WINGRIDDS®

User's Guide

Version: 3.1 01/01/2010

WINGRIDDS Table Of Contents

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WINGRIDDS FORWARD

Welcome to WINGRIDDS, the Microsoft Windows 32-bit version of the original Personal Computer based Gridded Interactive Display and Diagnostic System (PCGRIDDS). It is intended as a forecaster's tool for providing interactive access to high resolution meteorological information in support of domestic forecasting and international aviation using the Microsoft WINDOWS computer environment.

WINGRIDDS is a software tool that allows forecasters to perform a wide variety of diagnostic operations on gridded model data and observation data. The software runs on any 386-based or higher personal computer (PC) running Microsoft Windows 95 or newer. The gridded data are obtained from numerical weather prediction (NWP) models routinely run at the National Center for Environmental Prediction (NCEP) in Camp Springs, Maryland, other international meteorological forecast centers as well as local-run mesoscale models. The observation data is freely available from various university, collage and government web and FTP sites.

WINGRIDDS offers an amazing variety of commands to view and manipulate gridded data and observation data. Included with WINGRIDDS are a host of diagnostic functions to perform such operations as compute advection, divergence, take differences between fields, multiple a scalar field by a constant, etc. - the list is extensive. The WINGRIDDS user interface allows one to enter various combinations of command. Lengthy combinations of commands, or commands frequently used can be stored on disk for future use as a "command file". Command files have been written to compute such quantities as moisture convergence, 850 mb theta-E advection, Q-vectors, scalar frontogenesis, etc.

To realize and effectively use the full spectrum of WINGRIDDS commands - to go beyond simply displaying basic fields of temperature, wind, and moisture - requires a sound background in mathematics, especially elementary vector operations. Much of the background on vector operations can be found in any undergraduate calculus or dynamical meteorology textbooks. Good references would include the recent books by Holton (1992) or Bluestein (1992). Basically, if you understand the mathematical concepts of 1) partial differentiation, 2) gradient of a quantity, and 3) the scalar "dot" product and advection of a quantity, you'll be a long way to learning how to use WINGRIDDS effectively. Regardless, even without the mathematics, WINGRIDDS is still quite a useful diagnostic tool.

WINGRIDDS is also quite useful for displaying meteorological quantities in an isentropic coordinate framework. The area of isentropic analysis is enjoying quite a resurgence with the meteorological community. This resurgence is no doubt helped by availability of software, like WINGRIDDS, to view quantities isentropically. Moore (1993) contains a thorough review of isentropic analysis in the forecast process. Forecasters who use WINGRIDDS should try examining moisture and wind data in isentropic space.

What is this document?

This document is a reference manual that describes all commands available within WINGRIDDS. It will not teach you mathematics or dynamic meteorology. It will not teach you how to use WINGRIDDS to put a forecast together. What it does provide is documentation for each of the variety of WINGRIDDS commands that you may (someday) want to use. There are over 300 unique WINGRIDDS commands! Like any reference manual, you consult it when you have some question on what a particular command does and what input quantities the command requires, or what the output from the command is.

It's a good idea to skim through this manual, taking note of commands that interest you. Also, scan through the table of contents. Don't be afraid to try out new commands or experiment with computing various quantities - you won't break the system. Often, learning a new command sparks some interest in using it to answer some question you may have about the model data field.

WINGRIDDS is useful for local research studies. Once the model grids for a particular event are obtained, one can easily and readily review the model forecasts and perform sophisticated diagnoses of various fields.

Good luck and enjoy.

Jeff Krob

NESDIS
National Oceanic and Atmospheric Administration
Department of Commerce
United States of America

WINGRIDDS Home Page: http://winweather.org
PCGRIDDS32/WINGRIDDS User Support Forum:
http://www.weathergraphics.com/forum
WINGRIDDS Email Support: Jeffrey.A.Krob@noaa.gov
jkrob@comcast.net

Introduction

WINGRIDDS, a 32-bit Microsoft WINdows based GRidded Interactive Display and Diagnostic System, is a software package that allows the user to view meteorologically significant fields of gridded analysis and numerical weather prediction model output as well as observation data. The fields are displayed in either contour or vector format, whichever is appropriate for a particular field. Observation data can also be displayed in Surface or Upper-air Station plots. This package also allows the user to extract a variety of information from meteorological diagnostic parameters computed from the data fields.

The flexibility of WINGRIDDS allows the package to meet the needs of users with a wide range of skills and requirements. The novice can quickly learn to display a wide variety of predefined products using the WINGRIDDS Menu system. More advanced users can develop specialized products to meet their individual needs using the programmable WINGRIDDS Command language, including the creation of customized menu options to meet specific user needs.

This documentation guides users through installation and the basic concepts of operating WINGRIDDS through its menu system. It then proceeds with a discussion of topics useful for the more advanced user or system administrator. ONLINE HELP is available while using WINGRIDDS. All users should read the first four sections carefully:

A. Introduction
B. Installation of WINGRIDDS
C. Using WINGRIDDS

The remaining sections can be selected according to the user's needs and interests.

■ **Before Installation**

System Requirements and Preparation

-- Hardware Recommendations

- **AMD Athlon/Intel PENTIUM processor or greater running MS Windows 98 or greater.**
- **VGA graphics adapter** — Microsoft Windows compatible VGA or better color monitor.
- **16MB or greater memory** — This amount of memory is the minimum required to run WINGRIDDS on Windows 98. As with any Microsoft Windows installation, the more memory, the better.
- **Printer** — WINGRIDDS uses the default Windows printer.

-- System Setup

WINGRIDDS runs Microsoft Windows 98 or later. WINGRIDDS development no longer supports Windows 95. The system configuration necessary to run WINGRIDDS is described in this section.

Networks

- Installation — The WINGRIDDS software is designed for installation on a standalone PC.

- Data — The data displayed within WINGRIDDS may be located on a network drive. The complete path (drive and directory) to the data must be specified in the file, **USER\WINGMODE.DAT**. Refer to '*WINGRIDDS Configuration*' section additional information.

-- Memory Requirements

WINGRIDDS requires a minimum of 7MB of memory. The ingest programs that convert data from GRIB to WINGRIDDS format require about 3MB each of memory. Check the available memory for running programs.

Installation of WINGRIDDS

■ New Installation of WINGRIDDS

Before you start the installation, read and check the following information.

1. The WINGRIDDS software must be installed on a hard drive which is located on a standalone PC.

2. If necessary, the installation will create the following directories: **\WINGRIDDS**. If the directories already exist, it will write over any files in these directories. Before installation, save any important files in these directories and remove the directories.

■ Internet Access to WINGRIDDS Software and Documentation

■

WINGRIDDS Home Page: http://winweather.org

■

■

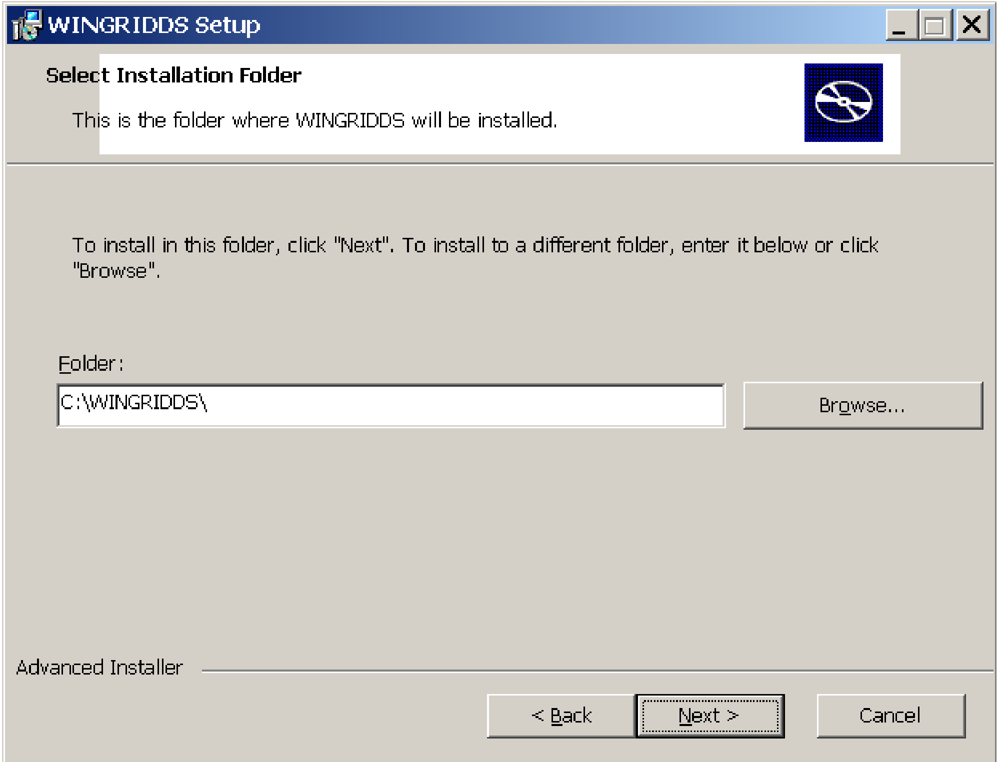
-- Install WINGRIDDS from your hard drive

Once the transfer of the WINGRIDDS files to your local system is complete, you can install WINGRIDDS from your hard drive.

1. Copy the WINGRIDDS installation file (WINGRIDDS.MSI) to a temporary directory of the hard drive you wish WINGRIDDS to execute from. If the file is not seen on your system as an executable file, you will have to download and install the latest Microsoft Installation client which is available from Microsoft or downloadable from the WINGRIDDS Home Page.

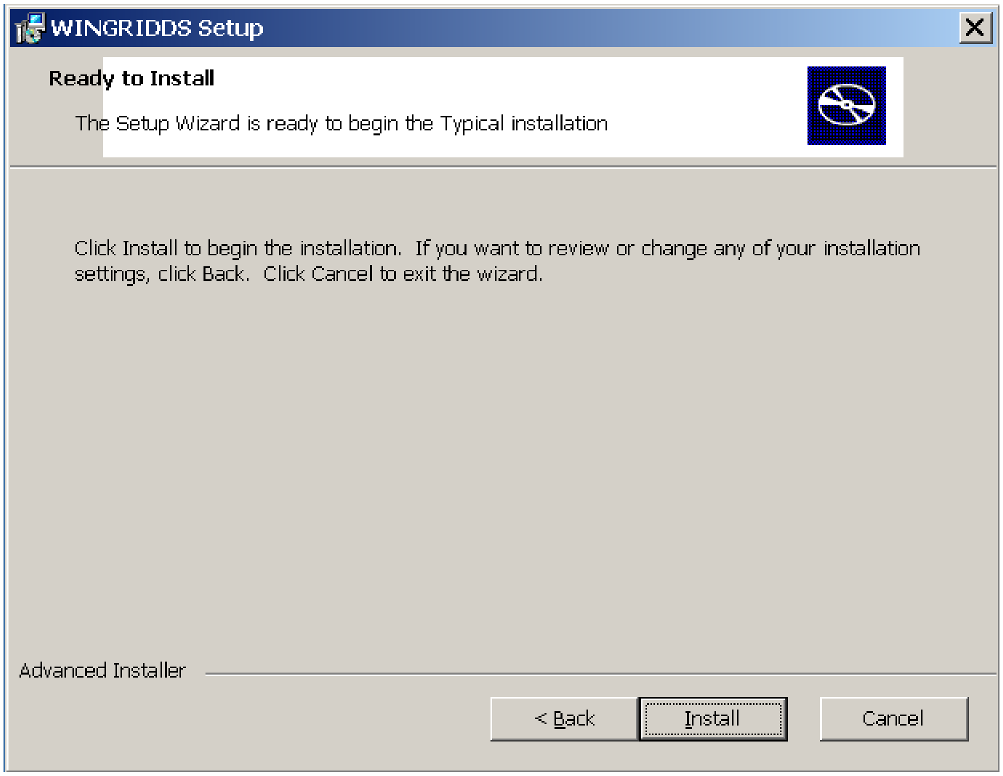
2. Execute the WINGRIDDS.MSI file and you will see the following:

3. Click on the 'Next' Button and follow the instructions.

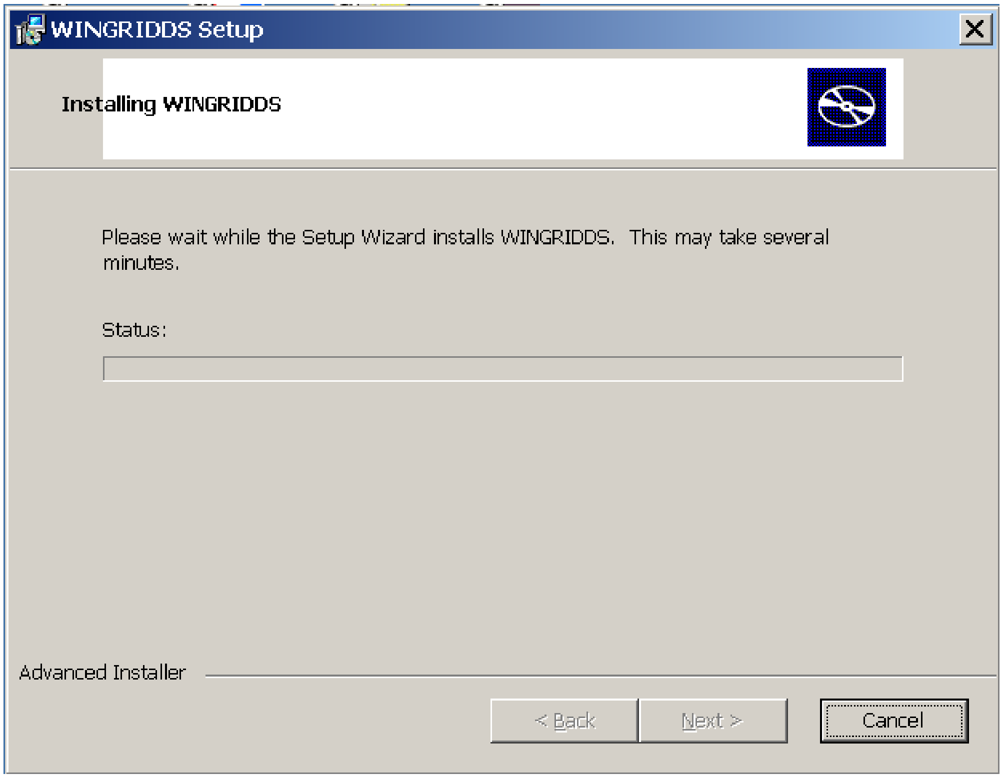


4. The Installation Utility will default to the C:\WINGRIDDS directory and that is the preferred location. However, if you wish to have WINGRIDDS run from another directory or drive, you may select it here.

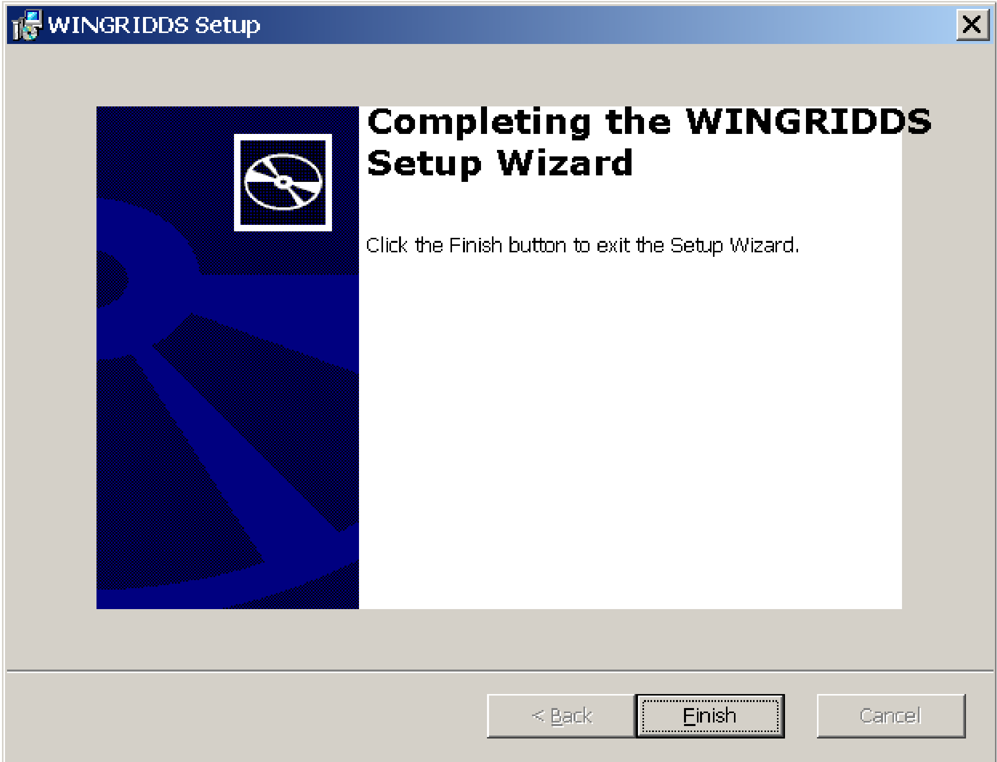
NOTE: If the directory used for data displayed by WINGRIDDS is not stored in the directory **\WINGRIDDS\GRIDDATA** directory, you MUST modify entry 2 in the file **USER\WINGMODE.DAT**. Refer to the section '*WINGRIDDS Configuration*' or the internal documentation in the file for additional information.



5. Click the 'Install' Button to begin the file copy process.



6. During the installation process, all files and directories will be created and copied. Also Program File and Desktop shortcuts to WINGRIDDS will be created.



7. At the successful end of the installation, click the 'Finnish' button. No system restart is required.

Removal of WINGRIDDS

In order to uninstall WINGRIDDS, go to "Settings>Control Panel>Add/Remove Programs" section of Windows. Once the program listing is complete, scroll down to the bottom of the page to where WINGRIDDS is listed (the program listing should be alphabetical). Once the WINGRIDDS list is found, click on the "Add/Remove" button to uninstall WINGRIDDS. Since there are no scattered DLL files, the uninstall process is clean and all files, directories and icons will be removed.

-- Directory Structure

Below is a diagram of the directory structure required to run WINGRIDDS. All directories must be present in order to run WINGRIDDS.

```
- WINGRIDDS ---+--ANIMATE
               +--DATA
               +--DOC------+--GRIB1
               |           +--GRIB2
               |
               +--GRIB-------+--NWS *
               |             +--MOS *
               |             +--USER
               |             +--WAFS * ---+--OCTANTI
               |                          +--OCTANTJ
               |                          +--OCTANTK
               |                          +--OCTANTL
               |                          +--OCTANTM
               |                          +--OCTANTN
               |                          +--OCTANTO
               |                          +--OCTANTP
               |
               +--GRIDDATA----OBS
               +--HELP
               +--MACROS
               +--MAPFIL
               +--OBS--------+--SURFACE---+--BUOY
               |             |            +--FRONT
               |             |            +--METAR
               |             |            +--SHIP
               |             |            +--SYN
               |             +--UPPER-AIR
               |
               +--PRTFIL
               +--USER
```

WINGRIDDS The main **WINGRIDDS** directory contains the temporary and status files written by WINGRIDDS and the program files used to run the WINGRIDDS system.

Your system administrator may modify the **.PCG** file to meet the needs of your environment. If an error occurs during the execution of WINGRIDDS, files, such as **WINGRIDDS.LOG**, **GRIB2PCG32.OUT, NGRB2PCG32.OUT** and **OBS2PCG.OUT** may provide information about the source of the problem.

ANIMATION The **ANIMATION** directory contains all of the files which are created and used every time an animation command is executed within WINGRIDDS.

DATA The **DATA** directory contains supporting data files used by WINGRIDDS to display items such as forms, messages, and maps. This directory does not contain gridded data files.

The contents of these files are crucial to the operation of WINGRIDDS and should be modified only by the system administrator.

DOC The **DOC** directory contains the WINGRIDDS User Guide as well as the html GRIB1 and GRIB2 documentation.

GRIB The **GRIB** directory contains files that control the selection and processing of GRIB data that is converted to WINGRIDDS format. Within it are located the sub-directories **NWS, WAFS, MOS** and **USER**. Under the **WAFS** directory are subdirectories for each WAFS Octant, I-P.

Files in this directory are crucial to the operation of the ingest process and should not be modified by any user.

NWS Non-WAFS GRIB data files that will be converted to WINGRIDDS format are stored in the **WINGRIDDS\GRIB\NWS** directory. This directory may be located in another location including shared drives if necessary. If relocated, it must be reflected in the WINGMODE.DAT file.

Files in this directory are provided by the GETGRIB utility (refer to '*Downloading GRIB data'* and '*Customizing the GRIB Download Process*') or by the user using other transfer methods separate from WINGRIDDS.

MOS Non-WAFS MOS GRIB data files that will be converted to WINGRIDDS format are stored in the **WINGRIDDS\GRIB\MOS** directory. This directory may be located in another location including shared drives if necessary. If relocated, it must be reflected in the WINGMODE.DAT file.

Files in this directory are provided by the GETGRIB utility (refer to '*Downloading GRIB data'* and '*Customizing the GRIB Download Process*') or by the user using other transfer methods separate from WINGRIDDS.

USER Contains all of the GRIB and Observation data Internet download scripts that control the data download process and the data files to create the Data Download Menus.

Files in this directory are used by the GETGRIB utility (refer to '*Downloading GRIB data'* and '*Customizing the GRIB Download Process*') .

These files can be modified by the system administrator to meet your requirements (refer to '*Customizing the Data Download Process*').

WAFS WAFS GRIB data files that will be converted to WINGRIDDS format are stored in the **WINGRIDDS\GRIB\WAFS\OCTANT*** directory where the '*' stands for the Octant letter it represents. The user should place all 'J' Octant GRIB files in the **WINGRIDDS\GRIB\WAFS\OCTANTJ** directory and so on. This directory may be located in another location including shared drives if necessary. If relocated, it must be reflected in the WINGMODE.DAT file.

Files in this directory are provided by the GETGRIB utility (refer to '*Downloading GRIB data'* and '*Customizing the GRIB Download Process*') or by the user using other transfer methods separate from WINGRIDDS.

GRIDDATA The **GRIDDATA** directory is the default directory where the gridded meteorological data are stored. This directory may be located in another location including shared drives if necessary. If relocated, it must be reflected in the WINGMODE.DAT file.

Gridded data files can be added or deleted.

OBS Contains all of the processed Surface and Upper-Air Observation data processed for a specific time. This text-based data is used to create the Station Plots and build the gridded data files. These text files are what should be edited to remove erroneous observations which are corrupting the gridded data.

HELP The **HELP** directory contains files used to supply **ONLINE HELP** for WINGRIDDS Command Macros.

WINGRIDDS is delivered with a default set of **HELP** files. If any customized macros are added to a *'Product List'* menu, it is strongly recommended that a corresponding **HELP** file should also be added to the **HELP** directory.

MACROS The **MACROS** directory contains the currently active command files (xxxx.CMD) used to display WINGRIDDS products, the text file for the '*Product Category*' menu (**CMDMENU.LST**), and the text files for the *'Product List'* menus (**CMDMENU.###**).

WINGRIDDS is delivered with a default set of macros. You are encouraged to develop customized command files and menus to meet the special requirements of your environment (refer to '*Defining Products*').

MAPFIL In order to display a map on the screen, WINGRIDDS must transform latitude/longitude based line segment coordinates (found, for example, in the file **WINGRIDDS\DATA\WORLD.MAP**) to the current map projection on the screen. This is a time consuming process. To increase the efficiency of WINGRIDDS, display maps can be saved. The **MAPFIL** directory contains the saved display maps (**QCONTMP.###**, **QCONLTLN.###**) and the list (**MAP.LST**) of and index (**MAP.IDX**) to the names of the saved display maps.

Your system administrator can save frequently accessed display maps by using the **SVMP** command. Files in this directory are controlled by WINGRIDDS and should not be modified by any user.

OBS The **OBS** directory contains the subdirectories which hold the raw observation files to be processed and converted by the OBS2PCG Observation Ingest utility.

SURFACE This directory contains the categorized subdirectories which contain the surface observations.

BUOY The **BUOY** directory contains the individual raw buoy observation messages.

FRONT The **FRONT** directory contains the individual ASUS Frontal Position observation messages.

METAR The **METAR** directory contains the individual raw SAO/METAR observation messages.

SHIP The **SHIP** directory contains the individual raw ship observation messages.

SYN The **SYN** directory contains the individual raw synoptic observation messages.

UPPERAIR The **UPPERAIR** directory contains the individual raw RAOB upper-air observation messages.

PRTFIL The **PRTFIL** directory contains files used for printing. Files with the extension **.SVG** contain products saved by the user for printing and restoring to the screen. The files, **!A.SVG** and **A.SVG**, are dummy files used by WINGRIDDS and should not be deleted. Files that begin with '**!**' are used for delayed printing and should be managed through WINGRIDDS. All other **.SVG** files may be deleted by the user when they are no longer needed.

USER The **USER** directory contains files that control defaults for and the appearance of product displays, menu displays, and printed output. Other files provide WINGRIDDS with information about your computing environment. These files can be modified to meet your requirements (refer to '*Customizing WINGRIDDS*').

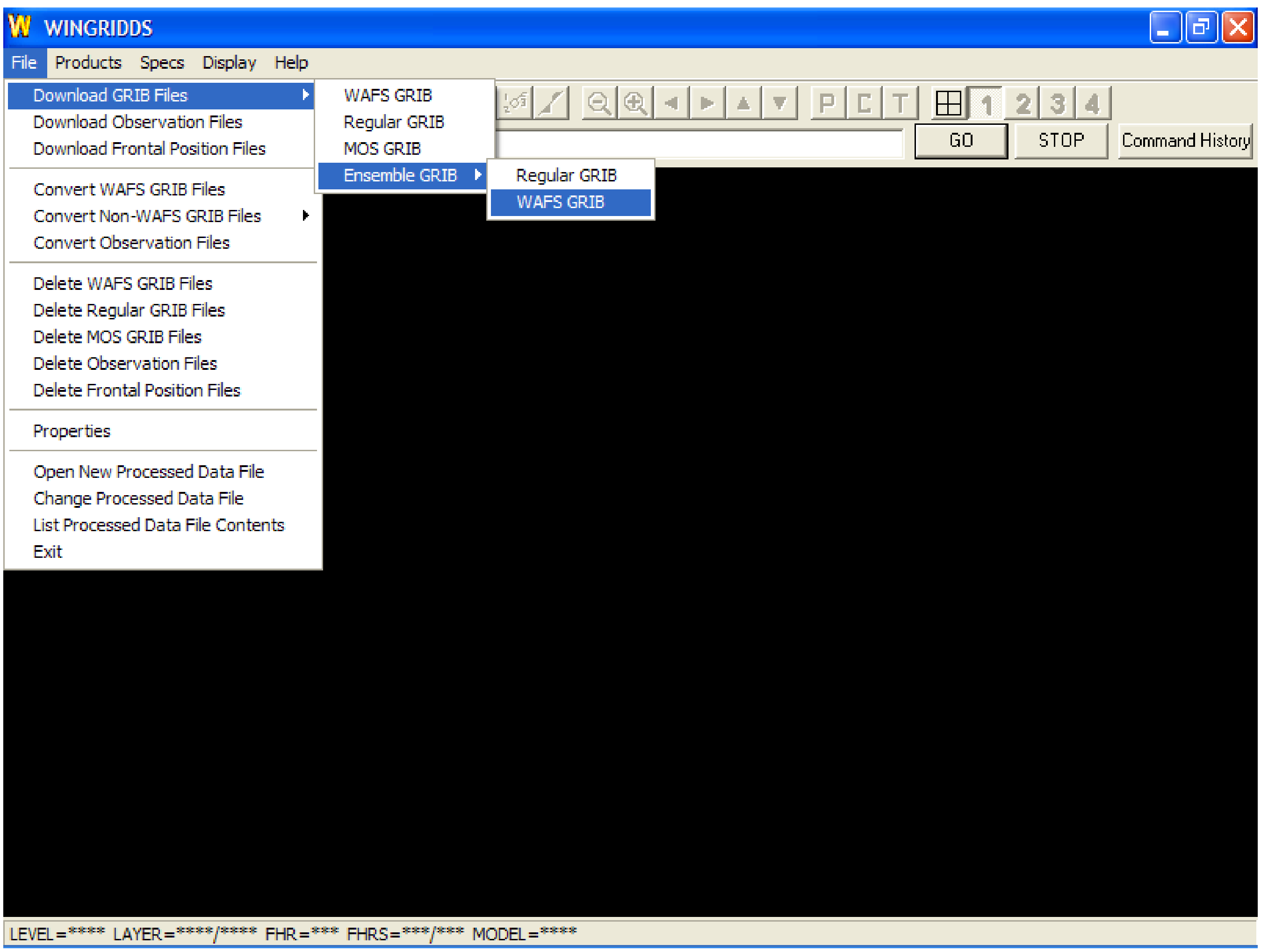
WINGRIDDS Applications

Downloading GRIB Data

WINGRIDDS works off of GRIB model data or Observation data and that data must be transferred into the WINGRIDDS system to be converted into PCG data format. This section will only cover GRIB data. WINGRIDDS uses the GETGRIB utility build the FTPDATA.BAT batch file using user configured data files within the WINGRIDDS/GRIB/USER directory and executes the URL2FILE utility to perform the actual transfer of downloading GRIB files via the Internet or local intranet. The GRIB transfer process can be performed from within WINGRIDDS while WINGRIDDS is executing or it can be done in an automated function during off hours through scheduled batch file execution using user created batch files and the Microsoft Windows Scheduling task. This process is covered in more detail below.

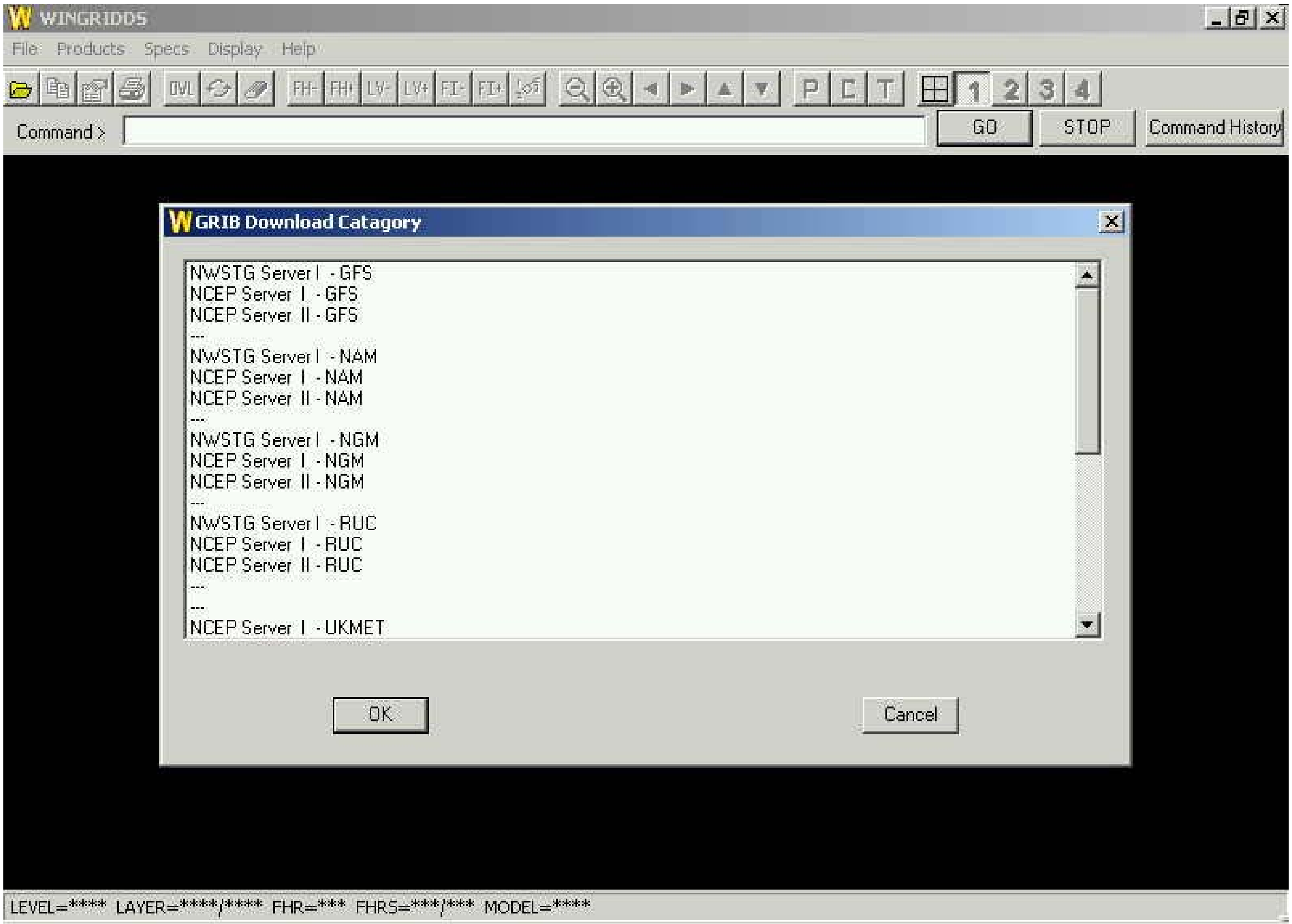
-- GRIB Download within WINGRIDDS

The first selection under the 'File' Menu, 'Download GRIB Files', leads to a sub-menu which has 'WAFS GRIB', 'Regular GRIB', 'MOS GRIB' and 'Ensemble GRIB'. The Ensemble GRIB selection has its own sub-menu which lists 'Regular GRIB' and 'WAFS GRIB' selections. See the figure below.



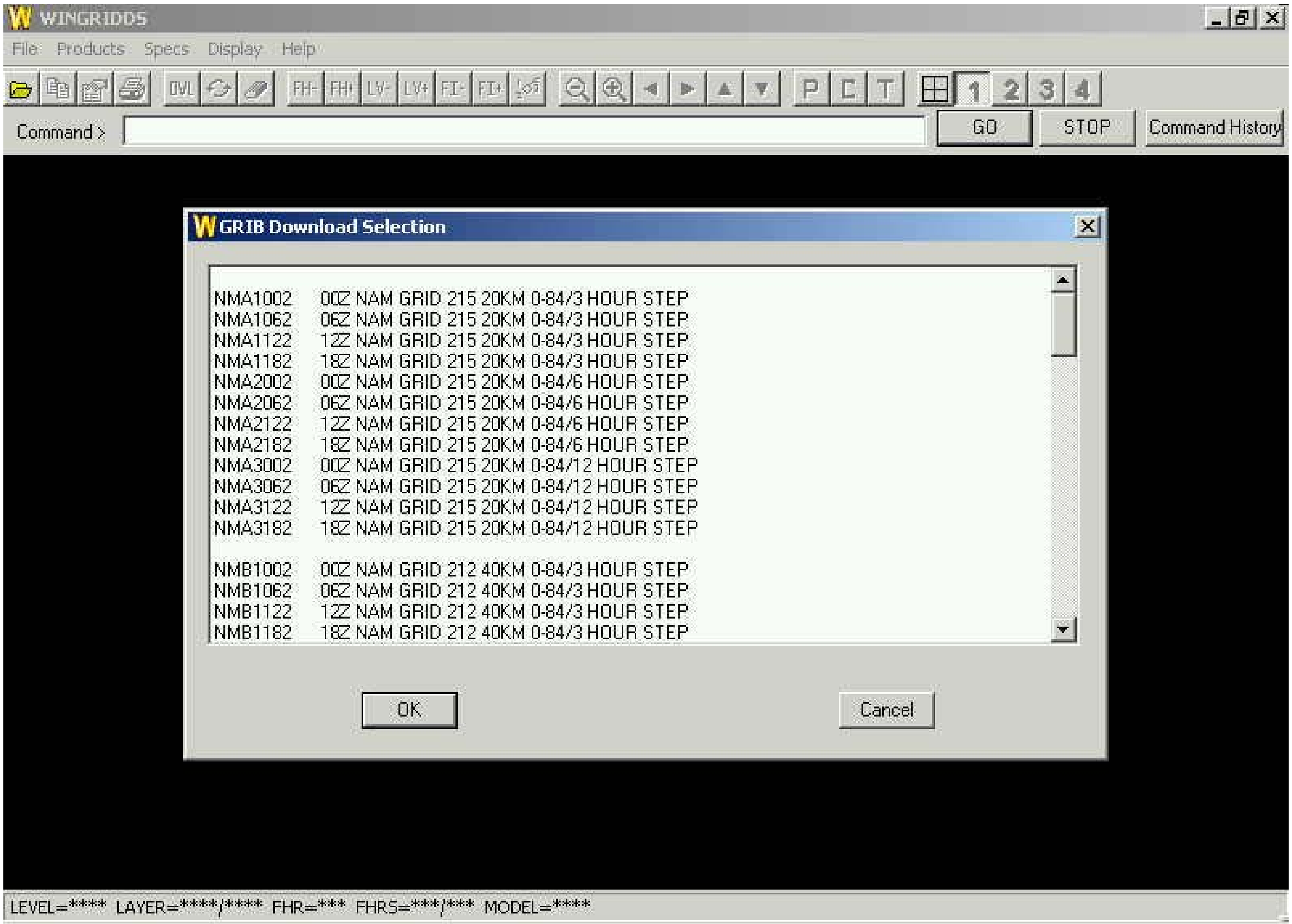
These selections are listed because each has its own separate directory destination under the GRIB directory. Any types of GRIB which do not fall under the category of WAFS, MOS or Ensemble should be listed under the 'Regular GRIB' listing.

Upon choosing a GRIB category, for example, 'Regular GRIB', brings up the GRIB Download Category:



This will display the contents of a file which is configurable by the user (refer to '*Customizing the GRIB Download Process*'). The user can double-click on a selection or single-click a selection to highlight and Click the 'OK' button.

Upon the selection by the user, the 'GRIB Download Selection' window is displayed. See the figure below.



The GRIB Download Selection windows lists the individual data file names and descriptions for doing a GRIB download job. These files are also configurable by the user (refer to '*Customizing the GRIB Download Process*'). The user can double-click on a selection or single-click a selection to highlight and Click the 'OK' button.

Upon this action, the GRIB download utility will begin and open a separate window to show the progress of the file download. If the user is running WINGRIDDS, that window can be iconized or placed in the background so WINGRIDDS operations can resume.

-- Automated GRIB Download Outside WINGRIDDS

The user can create batch files to execute the GETGRIB utility using the Microsoft Windows Scheduler to time when the batch file will run (refer to Microsoft Windows documentation for operation and configuration of the Scheduler). The commands for the batch file are as follows:

GETGRIB "user file".DAT

Where the "user file" is a '.DAT' file which holds the commands for downloading the specific GRIB files the user wants. This file name is the same as what is listed in the left column in the GRIB Download Selection window (refer to '*Customizing the GRIB Download Process*').

Ingesting GRIB Data

As the name implies, WINGRIDDS works off of GRIB format gridded model data. However, WINGRIDDS cannot work with the GRIB data directly. It must convert the GRIB data to WINGRIDDS rapid-access format before any data can be displayed. This process is referred to as ingesting GRIB data and this is where the GRIB ingest utilities are used. The use of these utilities will be covered in separate sections below.

NOTE – The GRIB ingest utilities within WINGRIDDS have the same names as in PCGRIDDS32 but they are not compatible or interchangeable.

The WINGRIDDS-format files created with these new GRIB ingest utilities are not compatible with the DOS versions. A new file version, PCG Version 2, has been created to allow for larger data sets as well as including the Grid Navigation information so the files MAPTYPE.DAT and GRIDTYPE.DAT are no longer needed in association with these new files. However, if you still wish to display the older, PCG Version 1 (DOS) versions of PCG files, due to the lack of grid navigation information embedded within the file, the MAPTYPE.DAT file from the DOS PCGRIDDS program which created those files will have to be copied to \WINGRIDDS\DATA directory so WINGRIDDS may obtain the grid navigation information and display the Version 1 files correctly.

The PCG Version 2 files have a different naming convention from PCG Version 1 files. The Version 1 files had a name format such as for WAFS: `WAF27APR.00Z` where:

WAF - WAFS grid
27 - Day of the month
APR - Month
00Z - Hour of Model run

or for NWS-type files: `JN089500.E48` where:

JN - Month
08 - Day of the month
95 - Year
00 - Hour of Model run
E48 - Three alphanumeric representation for grid projection from MAPTYPE.DAT file.

The PCG Version 2 files have a different, and much more descriptive naming convention. WAFS, NWS and NWS MOS files still have their differences. A WAFS file would have a name such as:
`MAR150312.AVN-JKLI`
where:

MAR - Month
15 - Day of month
03 - Year (last two digits)
12 - Hour of Model run
AVN - 3-letter Model name
JKLI - Octants included in GRIB ingest

Or for NWS-type files: `NOV070312.ETA211` where:

NOV - Month
07 - Day of the Month
03 - Year (last two digits)
12 - Hour of Model run
ETA - 3-letter Model name
211 - Grid Projection Number

Or for NWS MOS-type files: `NOV070312.ETAMOS211` where:

NOV - Month
07 - Day of the Month
03 - Year (last two digits)
12 - Hour of Model run
ETA - 3-letter Model name
MOS - Signifying MOS-type data
211 - Grid Projection Number

WINGRIDDS can also process Ensemble GRIB data. This results in a different data file name format to convey the information concerning the Ensemble model data. The NWS-type files will have a name format of the following:

The Date-Time-Group will be the same format as all PCG data files.

Following the center decimal; AAABCCCDDEEFFF

Where –

AAA = 3-letter Model name
B = 'E' for Ensemble-type data file
CCC = 'NEG' for Negative Perturbed Forecast
'POS' for Positive Perturbed Forecast
'MBR' for Ensemble Member ID
DD = '00-20' Ensemble member ID
EE = 'FU' Full Field
'SD' Standard Deviation
'WM' Weighted Mean

--- OR ---

If data is Ensemble Weighted Mean, CCCDDEE = ‘AVERAGE’
If data is Ensemble Standard Deviation, CCCDDEE = ‘STDEVAT’
If data is Ensemble Probability data, CCCDDEE ‘PROBLTY’

FFF = Grid Projection Number

The WAFS-type files will have a name format of the following:

The Date-Time-Group will be the same format as all PCG data files.

Following the center decimal; AAA’-‘BCCCDDEEFF

Where –

AAA = 3-letter Model name
B = ‘E’ for Ensemble-type data file
CCC = ‘NEG’ for Negative Perturbed Forecast
‘POS’ for Positive Perturbed Forecast
‘MBR’ for Ensemble Member ID
DD = ’00-20’ Ensemble member ID
EE = ‘FU’ Full Field
‘SD’ Standard Deviation
‘WM’ Weighted Mean

--- OR ---

If data is Ensemble Weighted Mean, CCCDDEE = ‘AVERAGE’
If data is Ensemble Standard Deviation, CCCDDEE = ‘STDEVAT’
If data is Ensemble Probability data, CCCDDEE ‘PROBLTY’

FF = Total number of Octants

-- Processing Ensemble Probability GRIB data
NGRB2PCG32 now has the ability to process Ensemble Probability GRIB data files. Ensemble probability GRIB file are completely different in the data they contain when compared to regular GRIB data. With regular GRIB data, the data area contains data points that reflect the value of the parameter they are associated with. For example, a GRIB message for Temperature data (TEMP) will contain data values of actual temperature measurements and so on with pressure, height, etc. However, for probability GRIB messages, the data area contains percentages of probability, ranging from 0% to 100%, of the likelihood a specific value of that parameter will occur. Those probabilities are in three possible groups:

1 = Probability of event below lower limit
2 = Probability of event above upper limit
3 = Probability of event between lower and upper limits

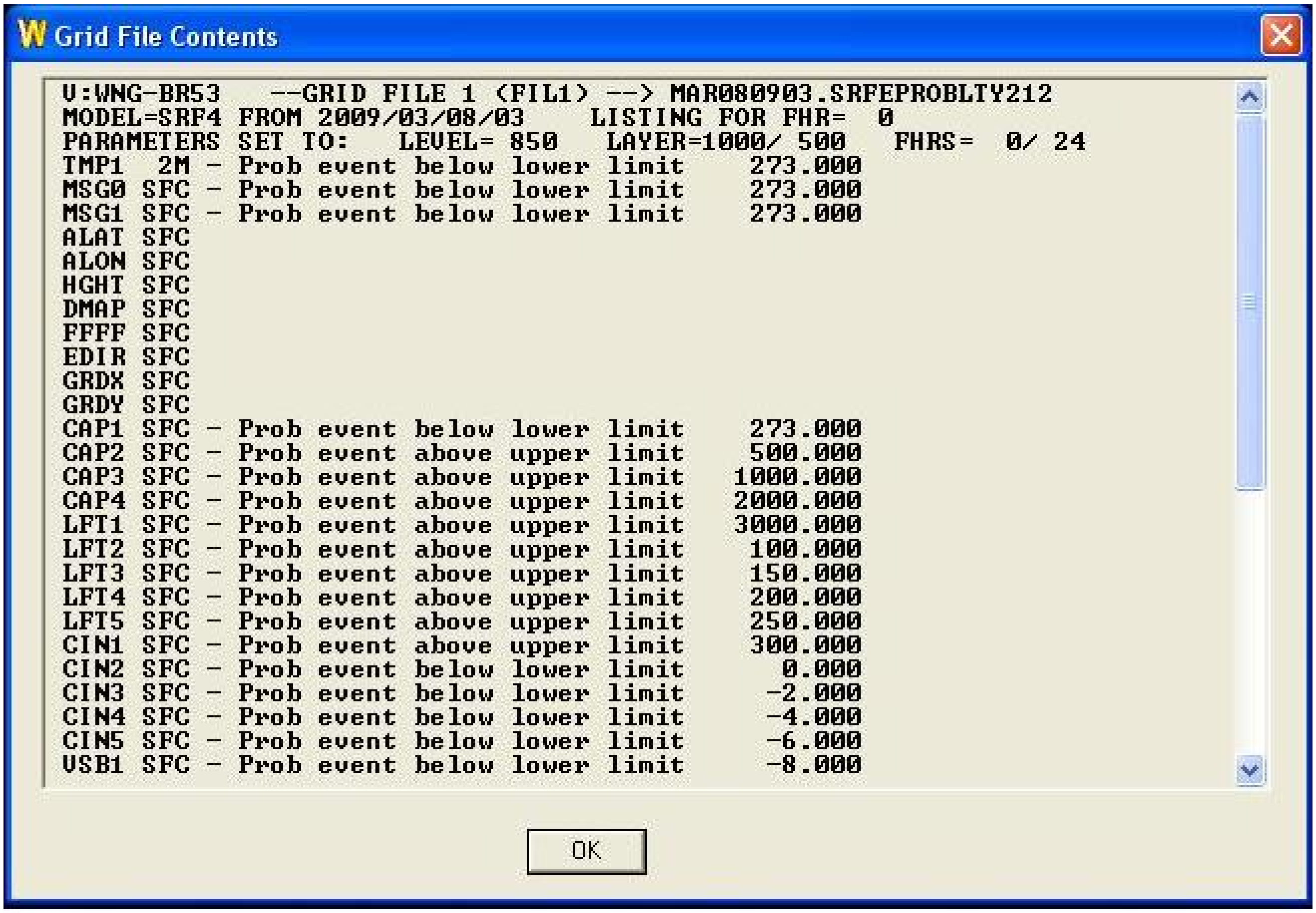
Associated with these messages are either one or two numbers which define the limit(s) of the parameter the GRIB message is associated with.

To accommodate the special processing requirements associated with ingesting Ensemble Probability GRIB data so it will work within the structure of the WINGRIDDS data model, NGRB2PCG32 uses a special GRIB2-to-Parameter decoding file. This file, GRIB2EnsProbParm.DAT, is used instead of the regular GRIB2Parm.DAT file. The file structure is the same ***HOWEVER*** the parameter names are limited to three (3) alphanumeric characters instead of 4 as in GRIB2Parm.DAT. See the example below:

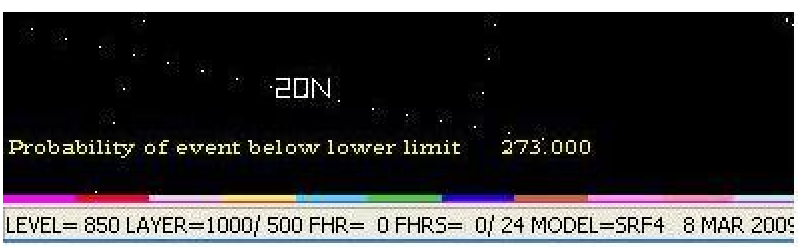
```
000 000 000 TMP              TEMPerature (deg K converted to deg C by WINGRIDDS)
000 001 008 TPC  0000  -3 Total PreCiPitation (m converted to cm in WINGRIDDS)
000 001 015 SNO              Large scale snow   kg m**-2
```

The 3 character limit is because within the probability GRIB files, there may be multiple parameters of the same name on the same surface in the same forecast hour but with different value thresholds. Therefore, what happens, is when NGRB2PCG32 comes across the first example of a specific parameter within a specific forecast hour, it adds a '**1**' to the end of the parameter name i.e. the first GRIB message of temperature (**TMP**) becomes **TMP1** and if it later comes across another GRIB message of temperature, that parameter name becomes **TMP2** and so on. If the number of similar parameters exceeds **9**, the extension will go from the letter '**A**' and continue incrementing till it gets to '**Z**' (TMPA, TMPB, - TMPZ). This process will occur for every unique parameter name, regardless of surface level, for that forecast hour. When the next forecast hour is processed, the extension cycle starts over at the number '**1**'.

Unfortunately, there is no way of telling the parameter limit values that are associated with the parameters by just the name alone. However, from within WINGRIDDS, when one looks at the Grid File Listing of an Ensemble Probability data file, the limit values for each parameter are show as in the figure below:



In addition, when an Ensemble Probability parameter is displayed on the screen, at the bottom-left corner of the screen, the limit values are shown there as well as in the figure below:



It is presumed that only one probability parameter will be displayed on the screen at one time.

-- Types of GRIB data

Several types of GRIB data are available to the WINGRIDDS user: WAFS (global data), NWS and NWS - MOS. Because the data are structured differently, the ingest procedures for the data types are different. The selected ingest procedure which is displayed in the title of the *'Ingest GRIB Data*' menu must match the data type that is ingested.

WAFS

Data for global grids (WAFS data) are subdivided into octets (I,J,K,L,M,N,O,P). This data must be preprocessed to create an inventory and list of model runs available for conversion from GRIB to WINGRIDDS format. Only one model run may be converted to WINGRIDDS format in a single ingest session. WAFS GRIB data is preprocessed and converted to WINGRIDDS format using the utility GRIB2PCG32.EXE. If any problems or errors occur while using GRIB2PCG32, please refer to the file GRIB2PCG32.OUT.

NWS

Data for the entire grid are stored together as a single group in NWS GRIB data files. No pre-processing of NWS GRIB data is necessary before the data are converted to WINGRIDDS format. Multiple model runs may be converted from GRIB to WINGRIDDS format in a single ingest session. The conversion utility is called NGRB2PCG32.EXE. If any problems or errors occur while using NGRB2PCG32, please refer to the file NGRB2PCG32.OUT.

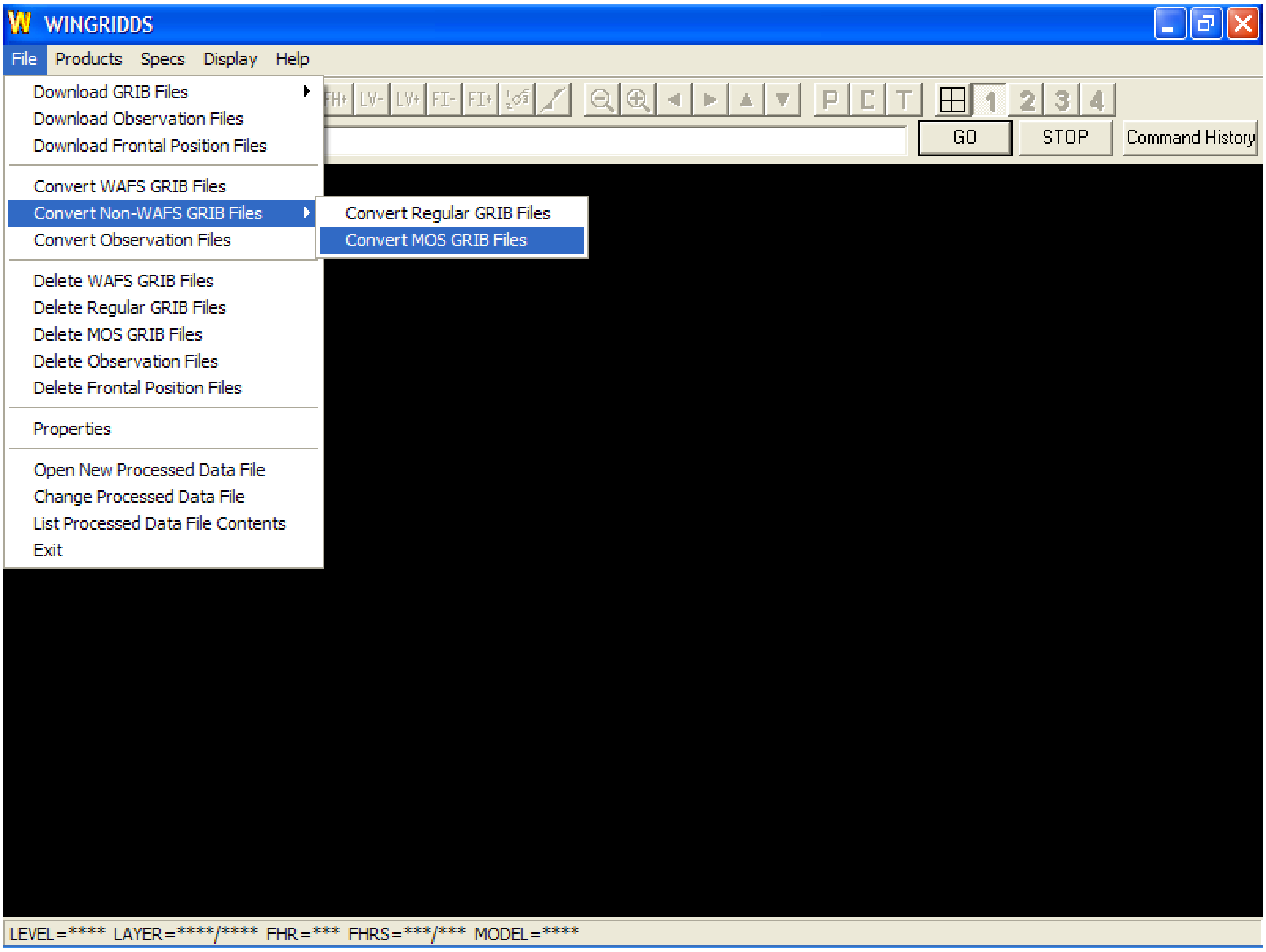
MOS

Data for the entire grid are stored together as a single group in MOS GRIB data files. No pre-processing of MOS GRIB data is necessary before the data are converted to WINGRIDDS format. However, the data parameters for a MOS file are different than a NWS file so a different ingest utility is required. Where the GRIBPARM.DAT file is used in the NWS ingest process, a new file, MOSGRIBPARM.DAT is required to process MOS GRIB files. Multiple model runs may be converted from GRIB to WINGRIDDS format in a single ingest session. The conversion utility is called NMOSGRB2PCG32.EXE. If any problems or errors occur while using NMOSGRB2PCG32, please refer to the file NMOSGRB2PCG32.OUT.

-- Selecting the method used to process GRIB data within WINGRIDDS

The procedure used to convert GRIB data to WINGRIDDS format differs for NWS, NWS-MOS and WAFS data. The selected procedure <u>MUST</u> match the type of GRIB data that you process.

To select the appropriate Ingest process within WINGRIDDS, under the 'File' Menu selection, select either the 'Convert WAFS GRIB Data' or 'Convert Non-WAFS GRIB Data', which ever is appropriate for your situation. 'Convert Non-WAFS GRIB Data' (see figure below) shows a sub-Menu which lists 'Convert Regular GRIB Data' and 'Convert MOS GRIB Data'. Because of the way Ensemble GRIB are processed, they are included with the Regular GRIB selection. When 'Regular GRIB' is selected, the utility NGRB2PCG32 is executed and when 'MOS GRIB' is selected, NMOSGRB2PCG32 is executed. Both of these utilities have debug message files created under their respective names with the ".OUT" extension. If any problems are encountered when running these utilities, please refer to the ".OUT" file to help show what the problem was.



-- Automated GRIB Ingest

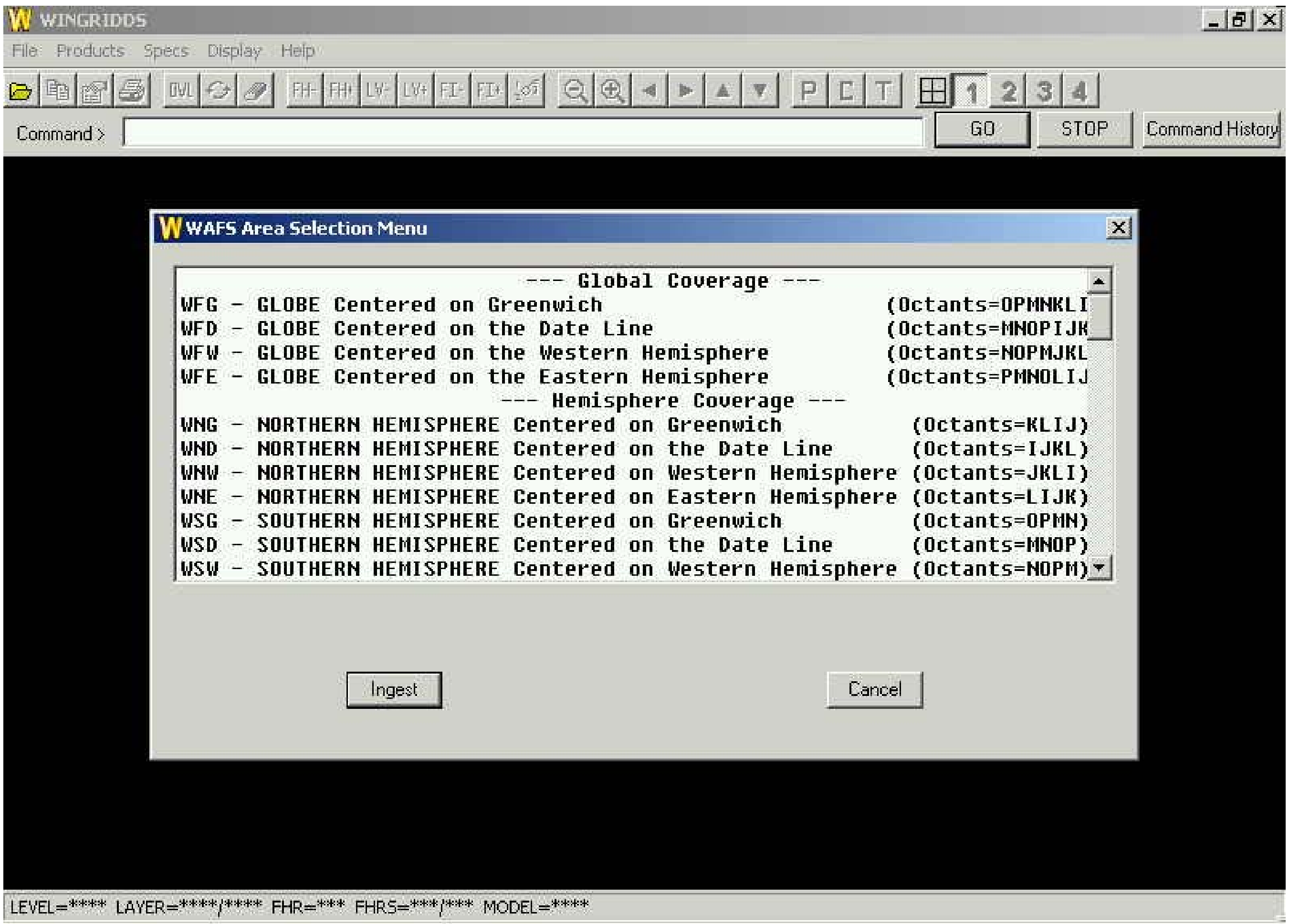
GRIB data can be ingested automatically when the GRIB Ingest utilities are called from within a batch file routine. For Regular and MOS GRIB files, the NGRB2PCG32 and NMOSGRB2PCG32 utilities can be executed directly without any command arguments. See the "WAFS GRIB Data Ingest" portion of this document for the automatic download instructions of this data.

WAFS GRIB Data Ingest

The following steps show you how to manually convert WAFS data encoded using a Gridded Binary format (GRIB) to WINGRIDDS format. WAFS GRIB data can be ingested in a manual mode or automatic mode. The following instructions show the steps for manual WAFS GRIB ingest. At the end of these instructions, the automatic method is explained.

-- Starting the manual ingest process

With the selection of 'Convert WAFS GRIB Data' from the 'File' Menu selection, the 'WAFS Area Selection Menu' is displayed (see figure below).



As in PCGRIDDS/PCGRIDDS32, the user must select which WAFS Octets they wish to ingest and select the orientation of the grid. The 3-letter groups in the left column refer to the 3-letter extension of the OCTETS.*** files in the WINGRIDDS/GRIB directory.   These files contain octet selection and grid orientation information. The GRIB2PCG32 WAFS GRIB Ingest utility uses this information when performing the WAFS GRIB ingest.

If you initially decide to convert part of your GRIB data to WINGRIDDS format, you may convert additional data at a later time.

As long as the new GRIB data you select covers the *same area* and was produced from the *same model run* as the initial data, the ingest program adds new variables to the existing file without reprocessing or overwriting the variables currently in the file.

If you select a *new area* but the GRIB data are from the *same model run*, then the ingest program produces a new file with the same name, but modifies the last letters of the extension to reflect the different octants. For example, if the initial WINGRIDDS file is MAR150312.AVN-JKLI, the next files may be named MAR150312.AVN-IJKL or MAR150312.AVN-LIJK.

If the GRIB data are from a *different model run*, then a new WINGRIDDS file is produced and named according to the model run. For example, if the last file produced is MAR150312.AVN-JKLI, then the first file from the next model run is named MAR160300.AVN-JKLI.

-- Select Area for Gridded Data Set

The surface of the earth is divided into eight areas (octants) identified by the labels I,J,K,L,M,N,O,P. You must specify the area that is covered by the gridded data set you are creating from the GRIB data. If you do not select a new area, then the area you selected for the last gridded data set is used. Only those GRIB data octants within the selected area are included in the WINGRIDDS data set.

The menu displayed on the screen lists the areas available for the conversion process. The required octants are listed for each entry. GRIB data for *all octants required by the selected area* must be placed in the **GRIB/WAFS/OCTANT*** directory where the "*****" denotes the Octant letter. If any required octants are missing for a field, GRIB data for that field will not be converted to PCG format.

The location of each octant is described below:

Octant	Latitude	Longitude
I	0-90N	30W- 60E
J	0-90N	60E-150E
K	0-90N	150E-120W
L	0-90N	120W- 30W
M	0-90S	30W- 60E
N	0-90S	60E-150E
O	0-90S	150E-120W
P	0-90S	120W- 30W

-- ECMWF WAFS GRIB Processing

GRIB2PCG32 now has the ability to process ECMWF WAFS grids. This is important because ECMWF WAFS grids do *not* conform to WMO WAFS area definitions, but they are similar and will be explained below.

ECMWF WAFS Grids –
The grid sections for the ECMWF WAFS grids are composed of 12 octant-like sections covering the globe but only 8 are used in GRIB2PCG32. Sections 1-4 cover the northern hemisphere, sections 9-12 cover the southern hemisphere and sections 5-7 cover a 70 degree belt around the equator (+/- 35 deg latitude). Sections 5-8 are not processed by GRIB2PCG32. Also, the grid section areas cover slightly different areas of the globe as shown below.

WMO WAFS Global Coverage of Grids
Octants of the Globe

90N	37 I	38 J	39 K	40 L
0 90S	41 M	42 N	43 O	44 P

330E 60E 150E 240E 330E

ECMWF WAFS Global Coverage of Grids
Octants of the Globe

90N	4 I	3 J	2 K	1 L
0 90S	12 M	11 N	10 O	9 P

0E 90E 180E 270E 360E

The graphics show there is a 30 degree west longitude offset between the WMO WAFS grids (on top) and the ECMWF WAFS grids (on bottom). The ECMWF graphic also shows the WMO octant letter ID's which the ECMWF data are mapped to. Therefore, the WMO octant letters which are selected to tell GRIB2PCG32 which grids to ingest & process are mapped to the ECMWF grid numbers.

Another difference between the WMO & ECMWF is the grid spacing. The WMO standard is a 1.25 deg grid spacing and the ECMWF has 2.5 deg grid spacing.

-- Convert WAFS GRIB Data to WINGRIDDS Format

After your GRIB data are stored in the **GRIB\WAFS/Octant*** directories, you are ready to preprocess the GRIB data to produce an inventory and list of model runs to be included in the gridded data set and convert your GRIB data to PCG format. The WAFS GRIB preprocessing used to be a separate utility in PCGRIDDS. In WINGRIDDS, that function has been incorporated within the GRIB2PCG32 ingest utility.

Use the following steps to proceed with the conversion process:

The use may double-click on any entry within the 'WAFS Area Selection Menu' area or single-click a selection to highlight and click the 'Ingest' button. GRIB data are preprocessed and inventoried before they are converted to PCG format. This procedure may require a significant amount of time if you are processing a large quantity of data. The Ingest process runs outside of the WINGRIDDS application so other WINGRIDDS tasks may be run at the same time. Once The GRIB Ingest process is complete, the window it was running in is closed. The data are now ready to be used in a WINGRIDDS session.

After the conversion is complete, the data files in PCG format are placed in the directory, **\WINGRIDDS\GRIDDATA,** and are available for display by WINGRIDDS (refer to '*Sample WINGRIDDS Applications Session*')**.**

Note: All GRIB files are left unchanged after the PCG file is created.

--Automated WAFS GRIB Data Ingest

The WAFS GRIB ingest process can be performed through a batch file for automatic execution. Within the batch file, GRIB2PCG32.EXE routine can be called from the command line with an Octets definition file listed in \WINGRIDDS\GRIB as a command argument. See the example below:

GRIB2PCG32 OCTETS.PL2

This command string will execute the GRIB2PCG32 utility and it will ingest octets P & L. The user can select which OCTETS.*** file to use according to their needs.

As with the automatic GRIB Download, the GRIB Ingest scheduling is done through the Microsoft Windows Scheduler (refer to Microsoft Windows documentation for operation and configuration of the Scheduler).

Downloading Observation Data

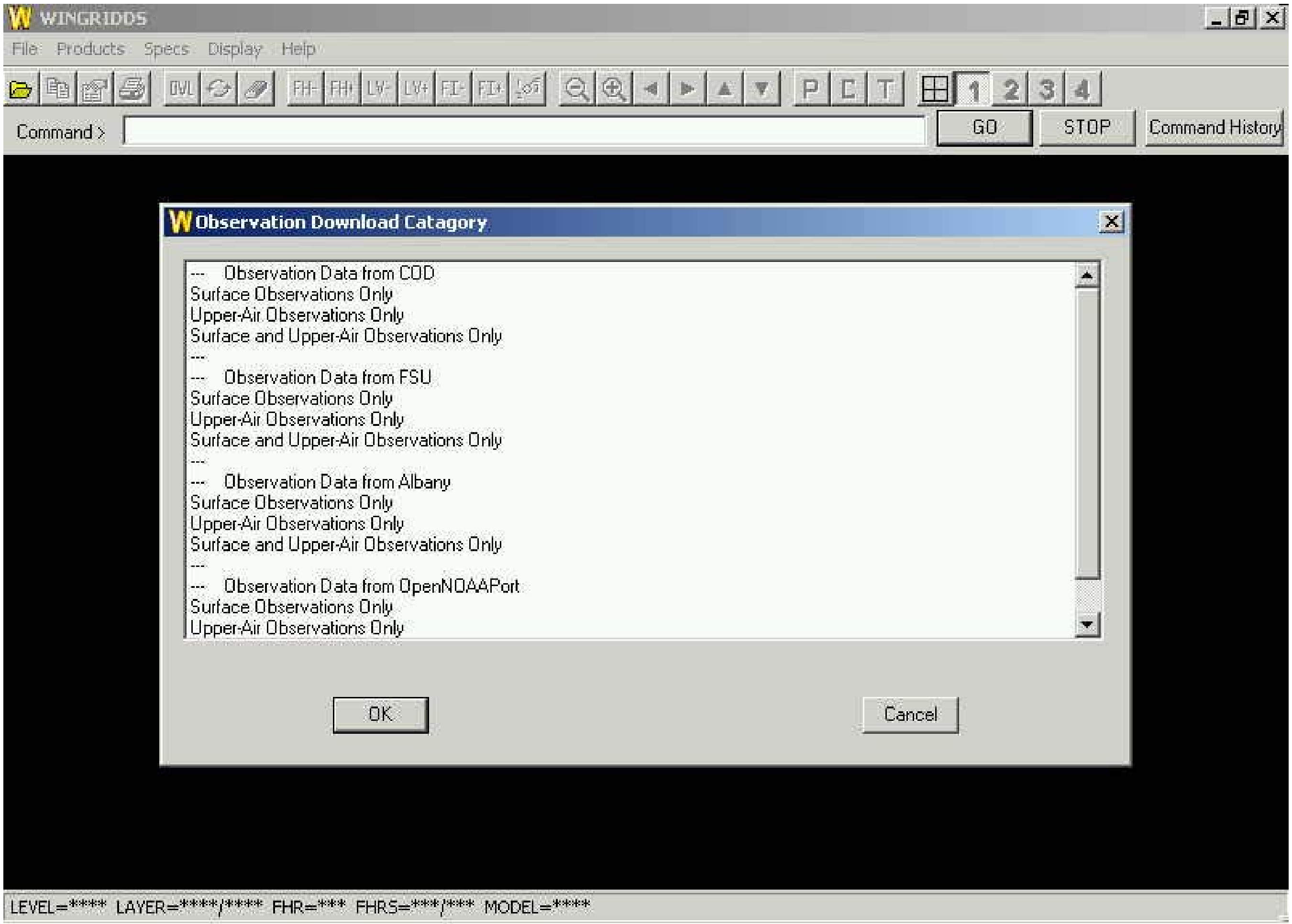
WINGRIDDS works off of GRIB model data or Observation data and that data must be transferred into the WINGRIDDS system to be converted into PCG data format. This section will only cover Observation data.

Observation data is categorized by Surface or Upper-Air data. Surface report types come in several different varieties such as METAR (or SAO), Synoptic, Buoy or Ship reports and Upper-Air reports are reported in RAOB format. All of these messages are in text format and are downloaded into their respective subdirectories in the OBS directory. Surface reports are usually available for every hour of the day but Upper-Air (RAOB) reports usually are only available at 00Z & 12Z. Therefore, it is possible to mix and match the Surface obs times with the Upper-Air obs times. This information is reflected in the corresponding file name created when observation data is ingested and converted with the OBS2PCG.EXE utility covered later.

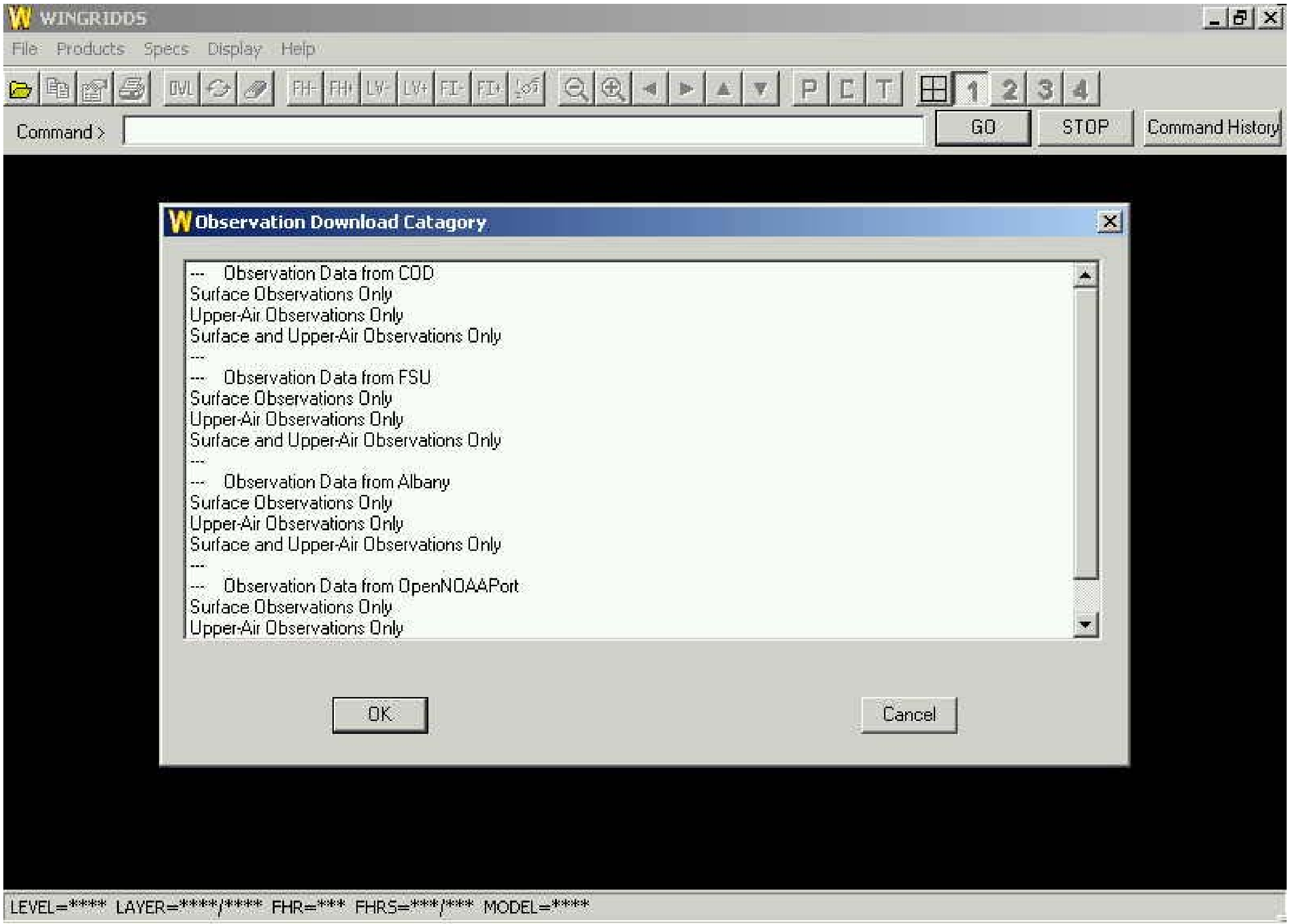
WINGRIDDS uses the GETGRIB utility build the FTPDATA.BAT batch file using user configured data files within the WINGRIDDS/GRIB/USER directory and executes the URL2FILE utility to perform the actual transfer of downloading Observation data files via the Internet or local intranet. The Observation data transfer process can be performed from within WINGRIDDS while WINGRIDDS is executing or it can be done in an automated function during off hours through scheduled batch file execution using user created batch files and the Microsoft Windows Scheduling task. This process is covered in more detail below.

-- Observation Data Download With in WINGRIDDS

Under the second selection of the 'File' Menu, select 'Download Observation Files'. See the figure below.

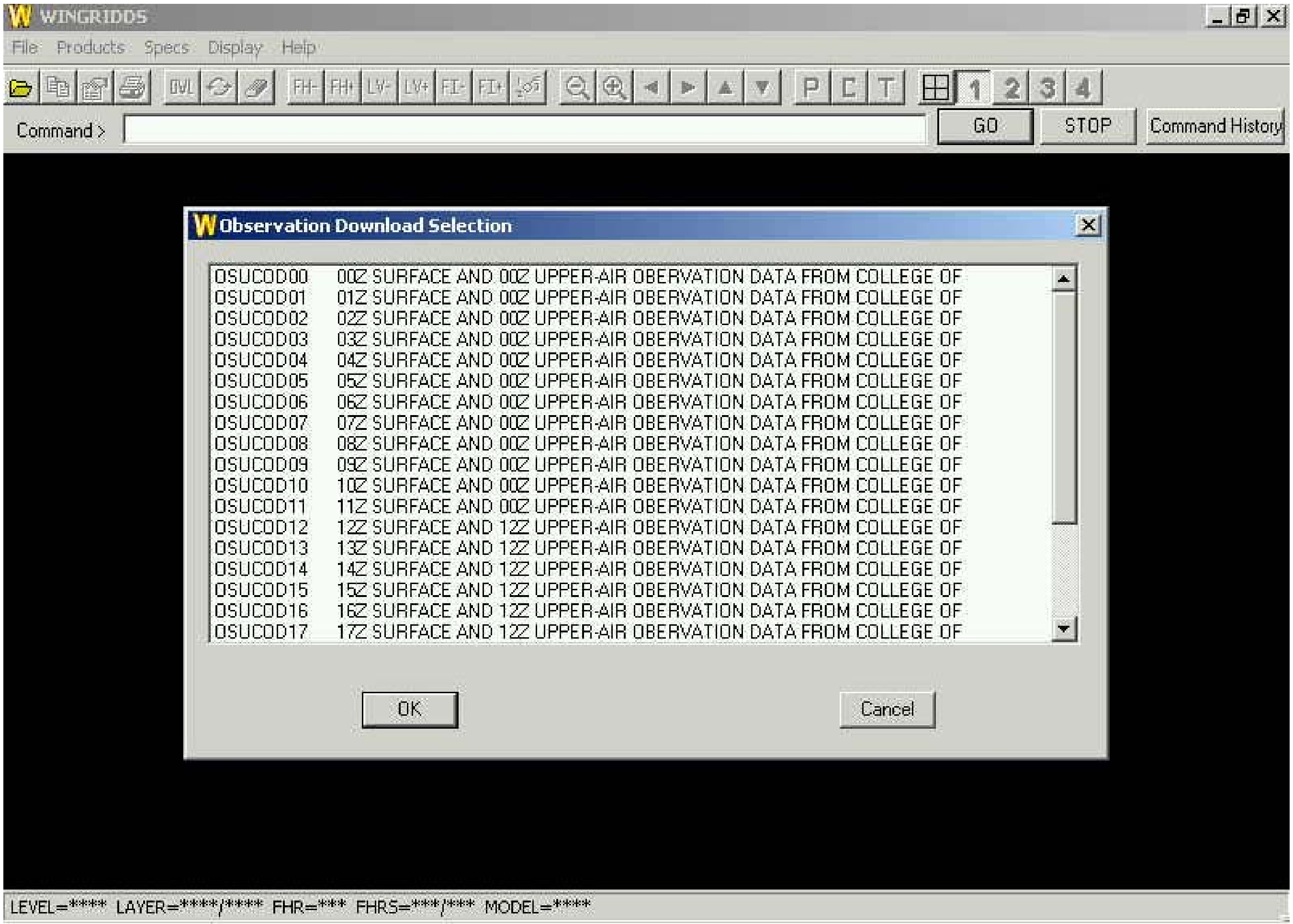


Upon choosing a 'Download Observation Files', brings up the GRIB Download Category:



This displays the contents of a file which is configurable by the user (refer to '*Customizing the Data Download Process*'). The user can double-click on a selection or single-click a selection to highlight and Click the 'OK' button.

Upon the selection by the user, the 'Observation Download Selection' window is displayed. See the figure below.



The Observation Download Selection windows lists the individual data file names and descriptions for doing a Surface and/or Upper-Air download job. These files are also configurable by the user (refer to '*Customizing the Data Download Process*'). The user can double-click on a selection or single-click a selection to highlight and Click the 'OK' button.

Upon this action, the Observation download utility will begin and open a separate window to show the progress of the file download. If the user is running WINGRIDDS, that window can be iconized or placed in the background so WINGRIDDS operations can resume.

-- Automated Observation Data Downloading

The user can create batch files to execute the GETGRIB utility using the Microsoft Windows Scheduler to time when the batch file will run (refer to Microsoft Windows documentation for operation and configuration of the Scheduler). The commands for the batch file are as follows:

GETGRIB "user file".DAT

Where the "user file" is a '.DAT' file which holds the commands for downloading the specific Surface and/or Upper-Air files the user wants. This file name is the same as what is listed in the left column in the Observation Download Selection window (refer to '*Customizing the Data Download Process*').

--Ingesting Observation Data

As the name implies, WINGRIDDS works off of gridded data. Therefore, WINGRIDDS cannot work with the textual observation data directly. It must convert the textual surface and upper-air observation data to WINGRIDDS rapid-access format before any data can be displayed. This process is referred to as ingesting Observation data and this is where the Observation ingest utility OBS2PCG.EXE is used. The use of this utility will be covered in a separate section below.

The WINGRIDDS-format files created with these new GRIB ingest utilities are not compatible with the DOS versions.

The PCG Version 2 observation-based files have a similar but different naming convention to the GRIB-based PCG data files. WAFS and regular Non-WAFS files still have their differences. A WAFS file would have a name such as:

Surface only: `MAR1503S12.OBS-JKLI`

MAR - Month
15 - Day of month
03 - Year (last two digits)
S - Surface Data
12 - Hour of Observation
OBS - Shows Observation-type Data
JKLI - Octants included in Observation ingest

Surface and Upper Air at different times: `MAR1503S16U12.OBS-JKLI`

MAR - Month
15 - Day of month
03 - Year (last two digits)
S - Surface Data
16 - Hour of Observation
U - Upper-Air Data
12 - Hour of Observation
OBS - Shows Observation-type Data
JKLI - Octants included in Observation ingest

Or for Regular Grid-type Surface only files: `NOV0703S06.OBS211`
where:

NOV - Month
07 - Day of the Month
03 - Year (last two digits)
S - Surface Data
06 - Hour of Observation
OBS - Shows Observation-type Data
211 - Grid Projection Number

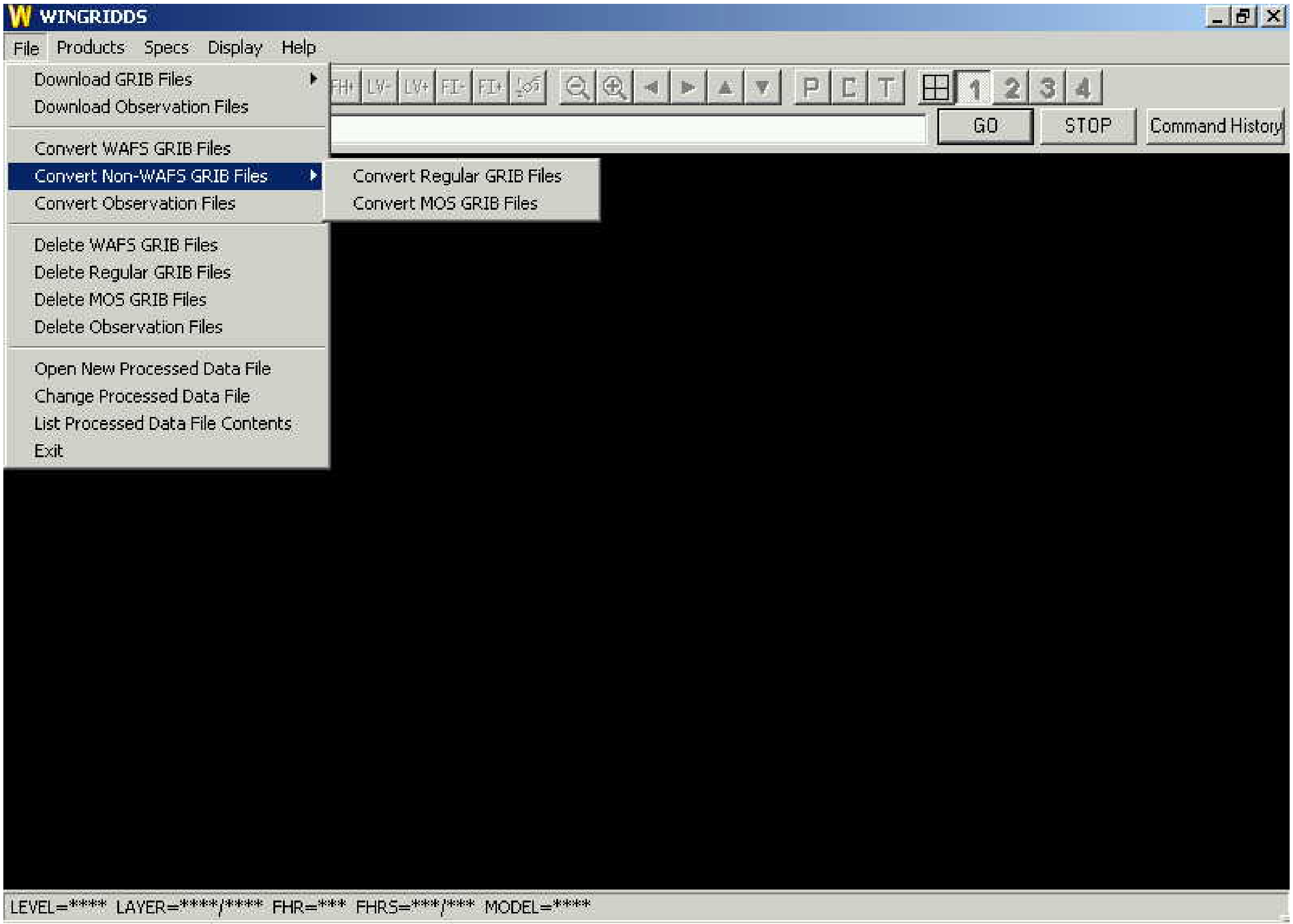
Or for Regular Grid-type Surface and Upper-Air files: `NOV0703S06U00.OBS211`
where:

NOV - Month
07 - Day of the Month
03 - Year (last two digits)
S - Surface Data
06 - Hour of Observation
U - Upper-Air Data
12 - Hour of Observation
OBS - Shows Observation-type Data
211 - Grid Projection Number

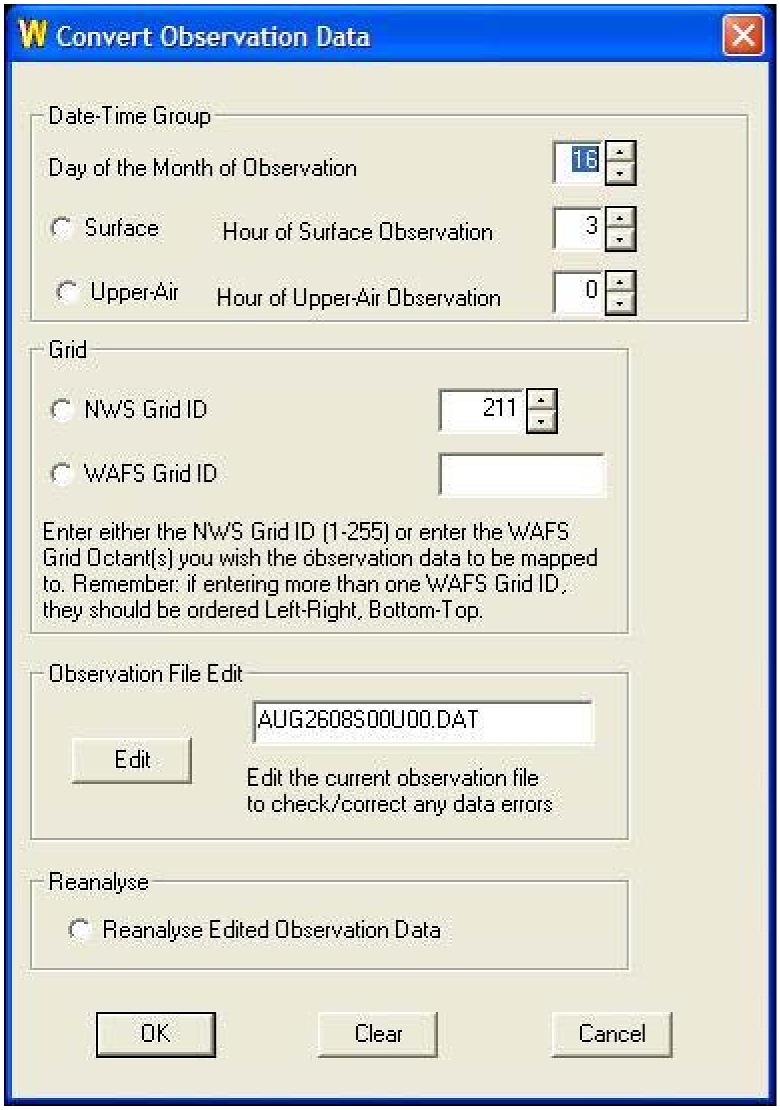
-- Selecting Options used to process Observation data within WINGRIDDS

The procedure used to convert Observation data to WINGRIDDS format differs from the GRIB conversion due to the nature of the data. The data is in ASCII text in a specific WMO (World Meteorological Organization) format which means there are specific Carriage-Returns and Line-Feeds inserted at the beginnings of every observation message which the ingest utility searches for to know the start of an individual observation.

To select the Observation Ingest process within WINGRIDDS, under the 'File' Menu selection, choose the 'Convert Observation Data' menu selection (see figure below).



Upon this selection, the 'Convert Observation Data' dialog is opened (see figure below).



If the data to be ingested is not current, the user must select the proper day of the month and observation time which is the same as the data which was downloaded. If only surface data or upper-air data is to be ingested, select only the proper category to be ingested. If both surface and upper-air data is to be processed, select both categories and the proper time selection for each data type.

-- NOTICE***

The Date-Time information within the observation messages only includes the day and hour of the observation. There is no month or year data. Therefore, it is possible for the WINGRIDDS operator to ingest data from May 21, but the current month may be July 21. The ingest utility will not be able to know any difference and as long as the observation times fall within the requested time, the PCD data file created will have the *current* year, month and day assigned to the file name.

-- Observation Grid Selection
The observation data must be mapped to a proper grid projection for the Barnes Analysis. The user must choose if the observation data will be mapped to a standard NWS-type grid or a WAFS-type grid(s). The NWS Grid ID will default to a preselected value which is set in the WINGMODE.DAT file.

For more information about changing the configuration of WINGRIDDS, see the **Customizing the WINGRIDDS System** section.
If the user wishes to use a NWS-type grid projection, the proper number from 1-255 should be entered in the window. All NWS grid ID descriptions are available in the GRIB1 documentation under the 'HELP' section.

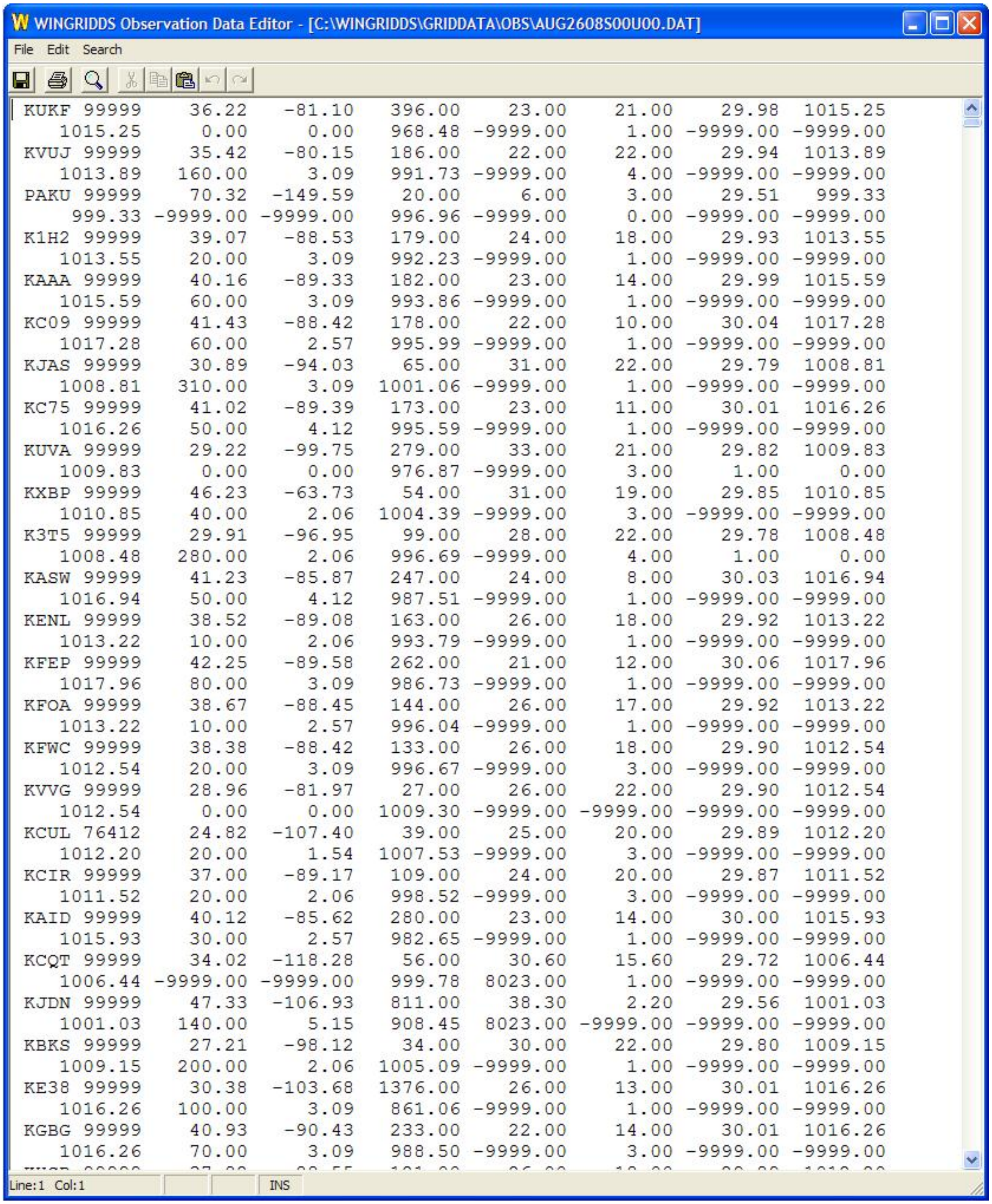
If the user wishes to use a WAFS-type grid projection, the user must enter the proper letter(s) which identify the WAFS grid octant(s) (IJKLMNOP).

NOTICE**** Remember, as with the GRIB WAFS ingest process, if needing more than one WAFS octant, the octant order *must* be ordered from Left to Right, Bottom to Top.

-- Observation Data File Editing
WINGRIDDS now has the ability to edit observation data files if data errors are found after initial processing is performed. If the user, while viewing observation data, saw spurious data contour 'bulls-eyes' in the analysis, this was an indication that there was a data parameter being misreported in the data from an observation station. The user would have to go outside WINGRIDDS, search for that specific data file and open it with a text editor to search for the reporting station which contained the bad data and either correct the data value or change it to a 'missing' value of -9999. Now, WINGRIDDS has its own text editor which will automatically open the current observation data file when executed. This editor is located within the 'Convert Observation Data' dialog.

When an observation data file is opened within WINGRIDDS and it is determined the contents need to be edited follow these simple steps:

1) On the WINGRIDDS Plan display, locate the geographic area where the spurious data bulls-eye is located and note the parameter which is displayed (TEMP, HGHT, etc.)
2) Type the command 'STID' to show the reporting stations and find the station IDs in the area of the bad data.
3) Open the 'Convert Observation Data' dialog and click the 'Edit' button to open the Observation Data Editor (see below).




```
 KUKF 99999    36.22    -81.10    396.00     23.00     21.00     29.98   1015.25
    1015.25     0.00      0.00    968.48  -9999.00      1.00  -9999.00  -9999.00
 KVUJ 99999    35.42    -80.15    186.00     22.00     22.00     29.94   1013.89
    1013.89   160.00      3.09    991.73  -9999.00      4.00  -9999.00  -9999.00
 PAKU 99999    70.32   -149.59     20.00      6.00      3.00     29.51    999.33
     999.33 -9999.00  -9999.00    996.96  -9999.00      0.00  -9999.00  -9999.00
 K1H2 99999    39.07    -88.53    179.00     24.00     18.00     29.93   1013.55
    1013.55    20.00      3.09    992.23  -9999.00      1.00  -9999.00  -9999.00
 KAAA 99999    40.16    -89.33    182.00     23.00     14.00     29.99   1015.59
    1015.59    60.00      3.09    993.86  -9999.00      1.00  -9999.00  -9999.00
 KC09 99999    41.43    -88.42    178.00     22.00     10.00     30.04   1017.28
    1017.28    60.00      2.57    995.99  -9999.00      1.00  -9999.00  -9999.00
 KJAS 99999    30.89    -94.03     65.00     31.00     22.00     29.79   1008.81
    1008.81   310.00      3.09   1001.06  -9999.00      1.00  -9999.00  -9999.00
 KC75 99999    41.02    -89.39    173.00     23.00     11.00     30.01   1016.26
    1016.26    50.00      4.12    995.59  -9999.00      1.00  -9999.00  -9999.00
 KUVA 99999    29.22    -99.75    279.00     33.00     21.00     29.82   1009.83
    1009.83     0.00      0.00    976.87  -9999.00      3.00      1.00      0.00
 KXBP 99999    46.23    -63.73     54.00     31.00     19.00     29.85   1010.85
    1010.85    40.00      2.06   1004.39  -9999.00      3.00  -9999.00  -9999.00
 K3T5 99999    29.91    -96.95     99.00     28.00     22.00     29.78   1008.48
    1008.48   280.00      2.06    996.69  -9999.00      4.00      1.00      0.00
 KASW 99999    41.23    -85.87    247.00     24.00      8.00     30.03   1016.94
    1016.94    50.00      4.12    987.51  -9999.00      1.00  -9999.00  -9999.00
 KENL 99999    38.52    -89.08    163.00     26.00     18.00     29.92   1013.22
    1013.22    10.00      2.06    993.79  -9999.00      1.00  -9999.00  -9999.00
 KFEP 99999    42.25    -89.58    262.00     21.00     12.00     30.06   1017.96
    1017.96    80.00      3.09    986.73  -9999.00      1.00  -9999.00  -9999.00
 KFOA 99999    38.67    -88.45    144.00     26.00     17.00     29.92   1013.22
    1013.22    10.00      2.57    996.04  -9999.00      1.00  -9999.00  -9999.00
 KFWC 99999    38.38    -88.42    133.00     26.00     18.00     29.90   1012.54
    1012.54    20.00      3.09    996.67  -9999.00      3.00  -9999.00  -9999.00
 KVVG 99999    28.96    -81.97     27.00     26.00     22.00     29.90   1012.54
    1012.54     0.00      0.00   1009.30  -9999.00  -9999.00  -9999.00  -9999.00
 KCUL 76412    24.82   -107.40     39.00     25.00     20.00     29.89   1012.20
    1012.20    20.00      1.54   1007.53  -9999.00      3.00  -9999.00  -9999.00
 KCIR 99999    37.00    -89.17    109.00     24.00     20.00     29.87   1011.52
    1011.52    20.00      2.06    998.52  -9999.00      3.00  -9999.00  -9999.00
 KAID 99999    40.12    -85.62    280.00     23.00     14.00     30.00   1015.93
    1015.93    30.00      2.57    982.65  -9999.00      1.00  -9999.00  -9999.00
 KCQT 99999    34.02   -118.28     56.00     30.60     15.60     29.72   1006.44
    1006.44 -9999.00  -9999.00    999.78   8023.00      1.00  -9999.00  -9999.00
 KJDN 99999    47.33   -106.93    811.00     38.30      2.20     29.56   1001.03
    1001.03   140.00      5.15    908.45   8023.00  -9999.00  -9999.00  -9999.00
 KBKS 99999    27.21    -98.12     34.00     30.00     22.00     29.80   1009.15
    1009.15   200.00      2.06   1005.09  -9999.00      1.00  -9999.00  -9999.00
 KE38 99999    30.38   -103.68   1376.00     26.00     13.00     30.01   1016.26
    1016.26   100.00      3.09    861.06  -9999.00      1.00  -9999.00  -9999.00
 KGBG 99999    40.93    -90.43    233.00     22.00     14.00     30.01   1016.26
    1016.26    70.00      3.09    988.50  -9999.00      3.00  -9999.00  -9999.00
```

4) Perform a search for the station ID. Refer to the WINGRIDDS documentation for the data layout of the observation data file.
5) Once the station is found and the data value is seen, either correct the data value or replace the value with the ‘missing’ value of -9999.
6) Save the file and, from within the ‘Convert Observation Data’ dialog, check the ‘Reanalyze’ button and reprocess the observation data with the corrected data value and the data bulls-eye should be gone.

-- Reanalyze Observation Data
There may be times when a previous observation data set would need to be reanalyzed. This would fall under the following two categories:

1) Correction of erroneous data – after processing a set of observation data, the user may find some erroneous observation data from a station which is causing the Barnes Analysis to create incorrect contour bulls-eyes in the analyzed data. This can be corrected when the user goes and edits the associated observation data file in the GRIB\OBS directory and, once the station is found, either enters the correct data or deletes the incorrect data parameter by replacing the bad value with -9999.00. This will be flagged as *missing* data and ignored when the data is scanned during the Reanalysis operation. Once the data file is corrected, select the proper Date-Time and the same grid selection and select 'Reanalyze' and the OBS2PCG process will reprocess the observation data in the corrected data file saving the data to the same file name as before, overwriting the previous processed data.

2) Mapping processed data to a different grid map – If the user wishes to have a previously processed observation data set mapped to a different grid projection, the whole data ingest process does not need to be repeated. Simply select the proper Date-Time for the data requested, the new grid selection and select 'Reanalyze' and the OBS2PCG process will skip parsing the raw obs data and utilize the observation which are already in the GRIB\OBS data file for the Date-Time selected.

-- Automated Observation Data Ingest

Observation data can be ingested automatically when the Observation Ingest utility OBS2PCG.EXE is called from within a batch file routine. See complete instruction on p.123.

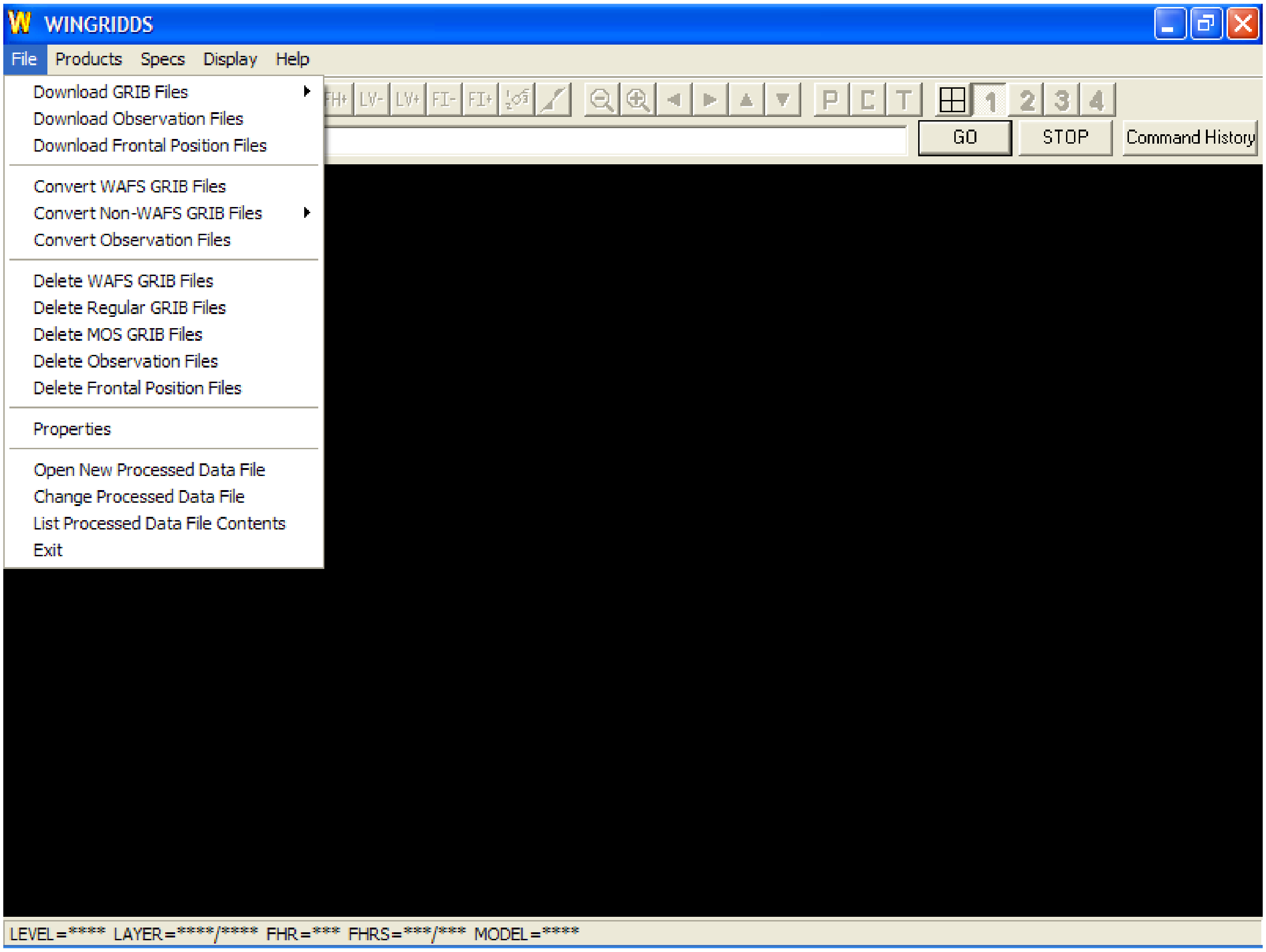
Downloading ASUS Frontal Data

WINGRIDDS can now download and display the ASUS Frontal position data files – both the regular and Hi-resolution versions. All of these messages are in text format and are downloaded into the SURFACE/FRONT directory. Frontal reports are usually available every 3 hours during the day.

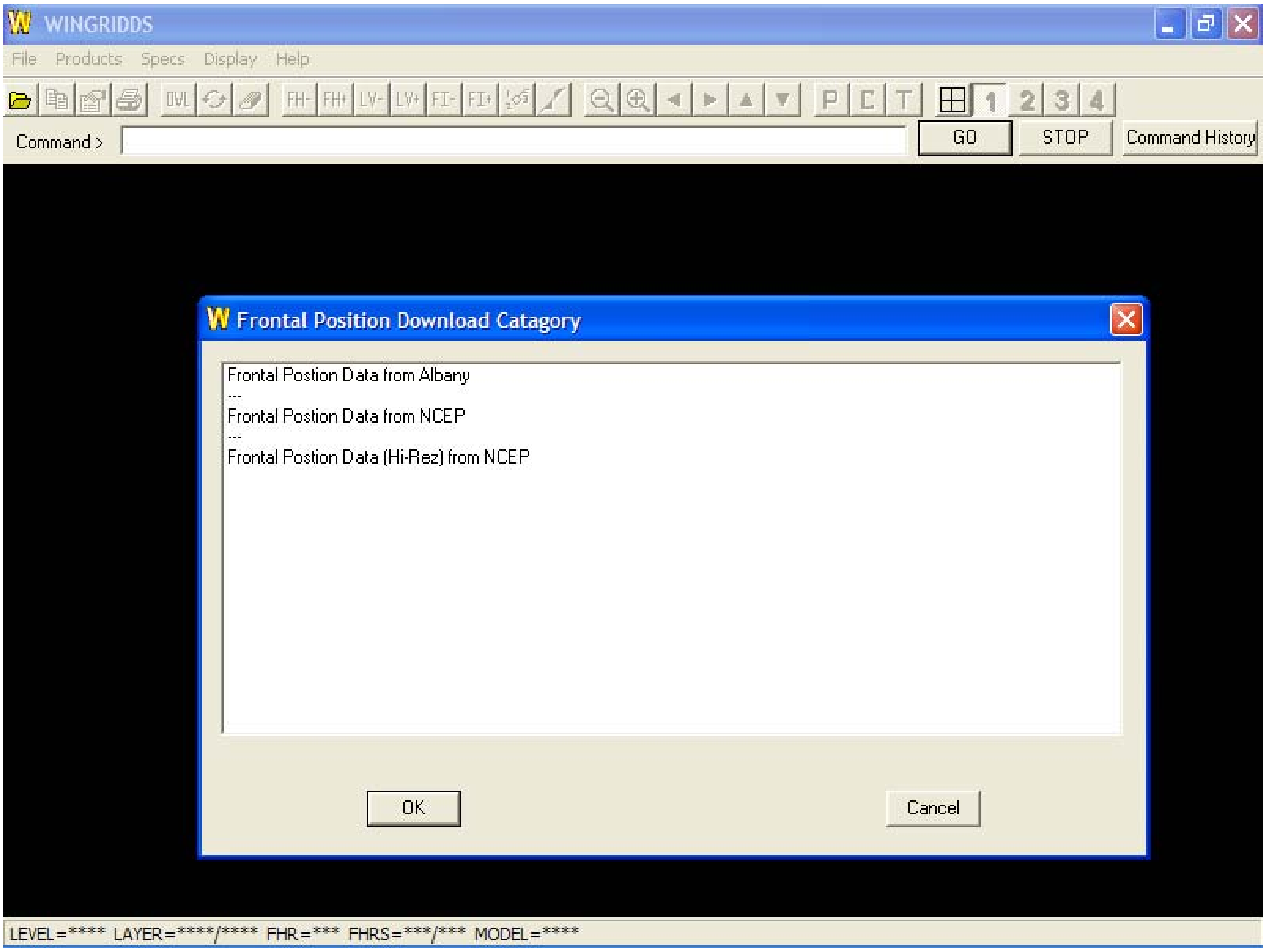
WINGRIDDS uses the GETGRIB utility build the FTPDATA.BAT batch file using user configured data files within the WINGRIDDS/GRIB/USER directory and executes the URL2FILE utility to perform the actual transfer of downloading ASUS Frontal Position data files via the Internet or local intranet. The ASUS Frontal Position data transfer process can be performed from within WINGRIDDS while WINGRIDDS is executing or it can be done in an automated function during off hours through scheduled batch file execution using user created batch files and the Microsoft Windows Scheduling task. This process is covered in more detail below.

-- ASUS Frontal Data Download With in WINGRIDDS

Under the third selection of the 'File' Menu, select 'Download Frontal Position Files'. See the figure below.

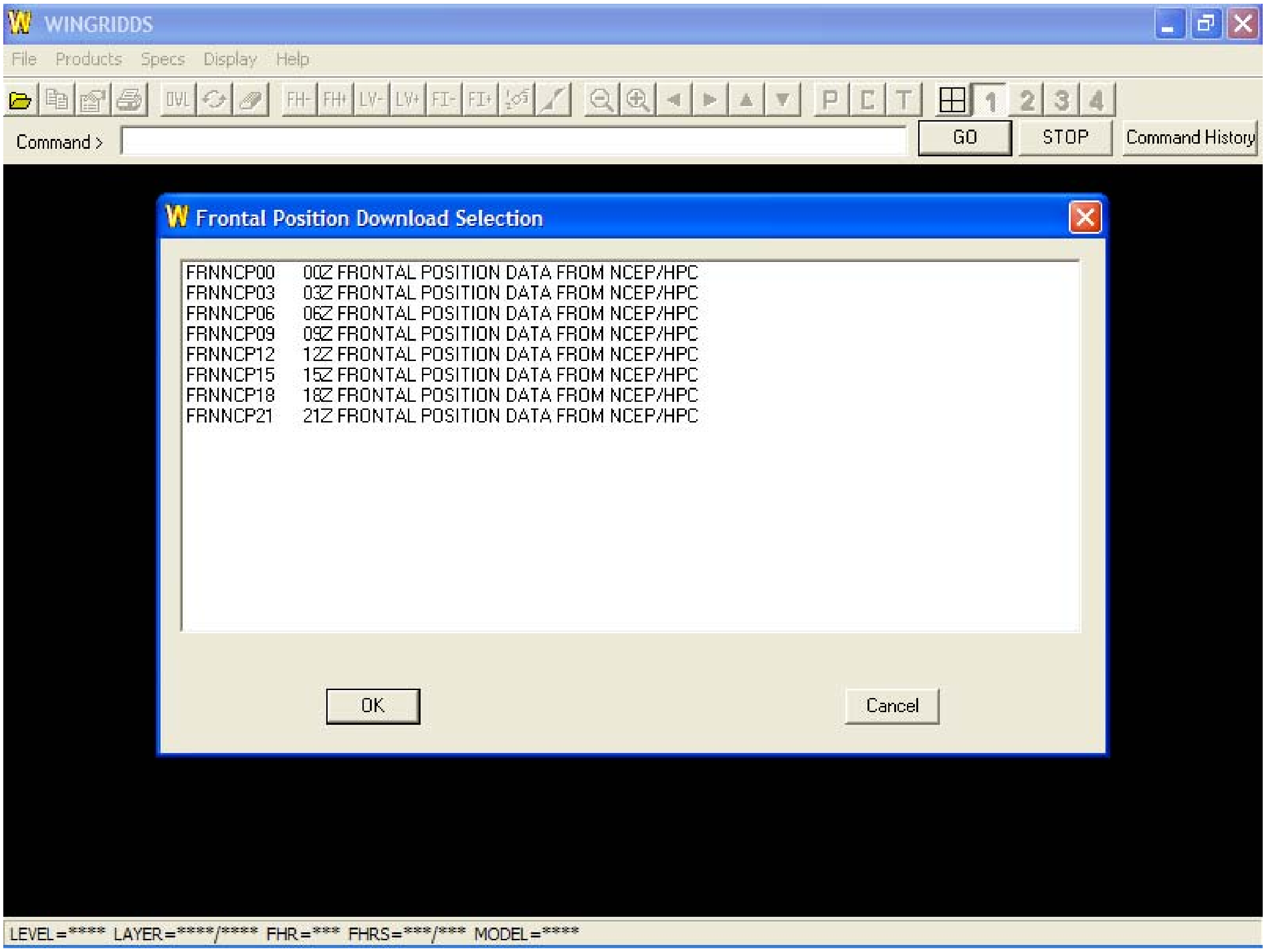


Upon choosing a ‘Download Frontal Files’, brings up the Frontal Position Download Category:



This displays the contents of a file which is configurable by the user (refer to ‘*Customizing the Data Download Process*’). The user can double-click on a selection or single-click a selection to highlight and Click the ‘OK’ button.

Upon the selection by the user, the ‘Frontal Position Download Selection’ window is displayed. See the figure below.



The Frontal Position Download Selection windows lists the individual data file names and descriptions for doing a Frontal Position download job. These files are also configurable by the user (refer to ‘*Customizing the Data Download Process*’). The user can double-click on a selection or single-click a selection to highlight and Click the ‘OK’ button.

Upon this action, the Frontal Position download utility will begin and open a separate window to show the progress of the file download. If the user is running WINGRIDDS, that window can be iconized or placed in the background so WINGRIDDS operations can resume.

-- Automated ASUS Frontal Position Data Downloading

The user can create batch files to execute the GETGRIB utility using the Microsoft Windows Scheduler to time when the batch file will run (refer to Microsoft Windows documentation for operation and configuration of the Scheduler). The commands for the batch file are as follows:

GETGRIB “user file”.DAT

Where the “user file” is a ‘.DAT’ file which holds the commands for downloading the specific Surface and/or Upper-Air files the user wants. This file name is the same as what is listed in the left column in the Frontal Position Download Selection window (refer to ‘*Customizing the Data Download Process*’).

Using WINGRIDDS

This section provides background information on WINGRIDDS. It should be noted, as in PCGRIDDS32, there is no longer a WAFS version and NWS version of WINGRIDDS as there were in PCGRIDDS. WINGRIDDS processes and displays WAFS as well as Regular grids interchangeably. Therefore, there is no need to switch back and forth as was the case in DOS PCGRIDDS.

-- **Modes of Operation**

In WINGRIDDS, there are two modes of operation.

User Mode In *User Mode* you perform tasks such as displaying products, retrieving data, and modifying parameters by ***selecting*** choices from *predefined* options or you display fields and the full variety of diagnostic calculations by ***entering*** WINGRIDDS commands directly from the keyboard in the Command Line.

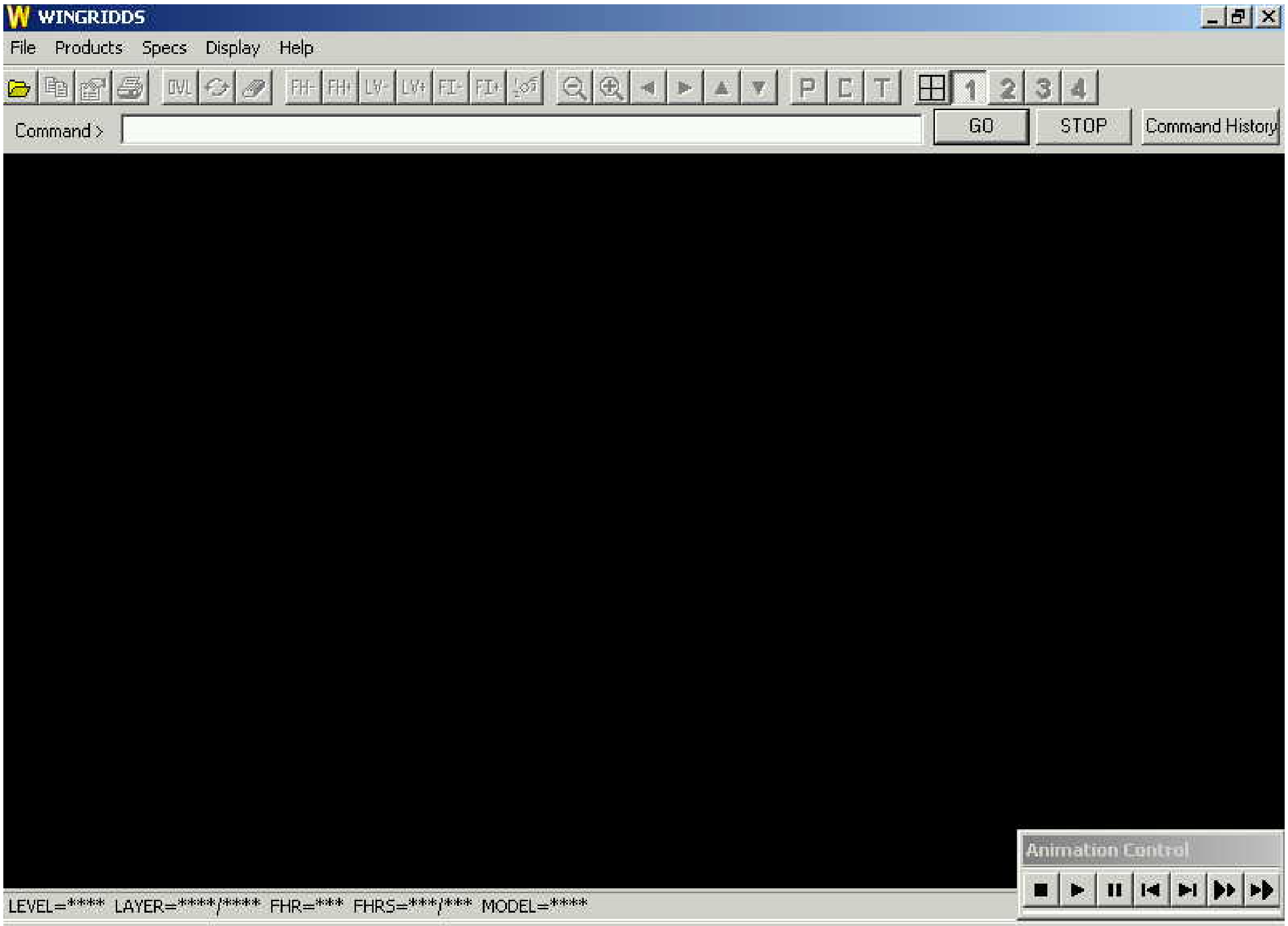
Automatic Mode In *Automatic Mode* you display fields and the full variety of diagnostic calculations by starting WINGRIDDS, loading up to 35 data files and executing a single command macro from a batch file. GRIB file downloading and Ingesting can also be performed.

During the execution of PCGRIDDS/PCGRIDDS32, you had to switch between the Menu mode and the Command Mode. In WINGRIDDS, Menu mode and Command mode have been blended into one operational environment. There is also a Tool Bar with frequently used buttons to ease the operation of WINGRIDDS. The WINGRIDDS Desktop will be explained below.

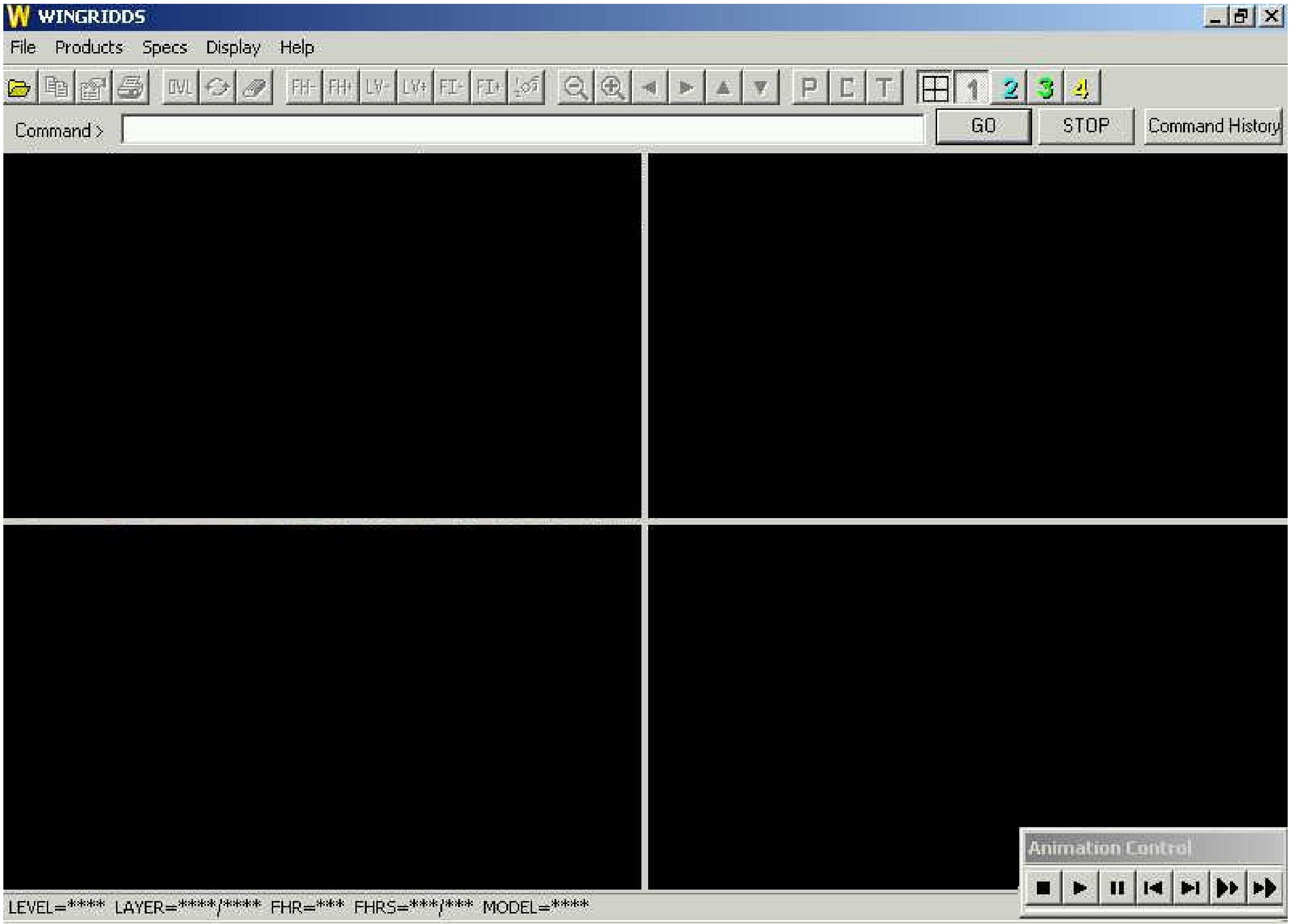
-- **WINGRIDDS Desktop**

The WINGRIDDS Desktop has (from top down) pull-down menus, a tool bar, command entry, display area and status bar.

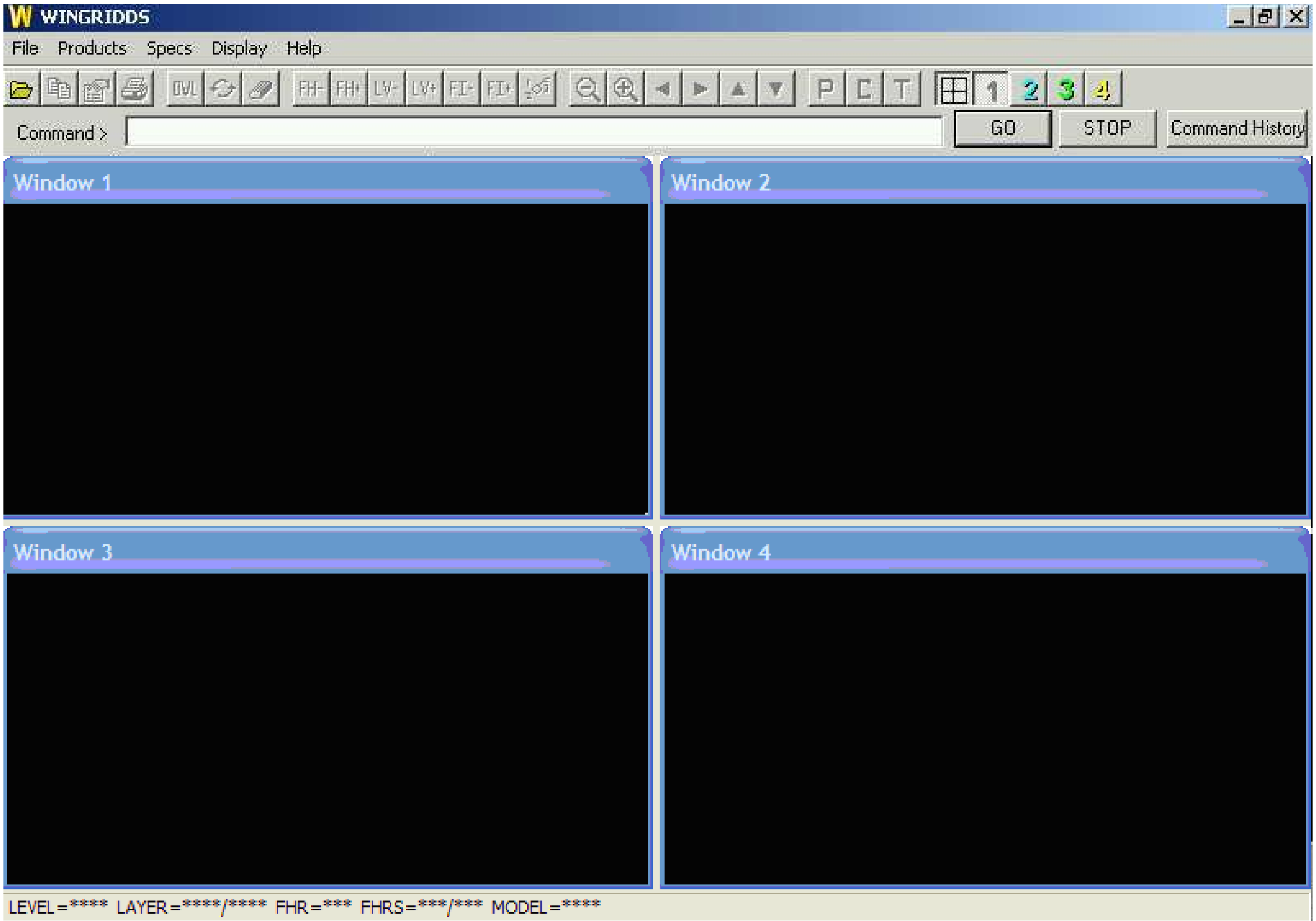
The Menus consist of the ‘File’ menu, ‘Products’ menu, ‘Specs’ menu, ‘Display’ menu, and ‘Help’ menu.



WINGRIDDS in Single Panel (1PNL) Mode



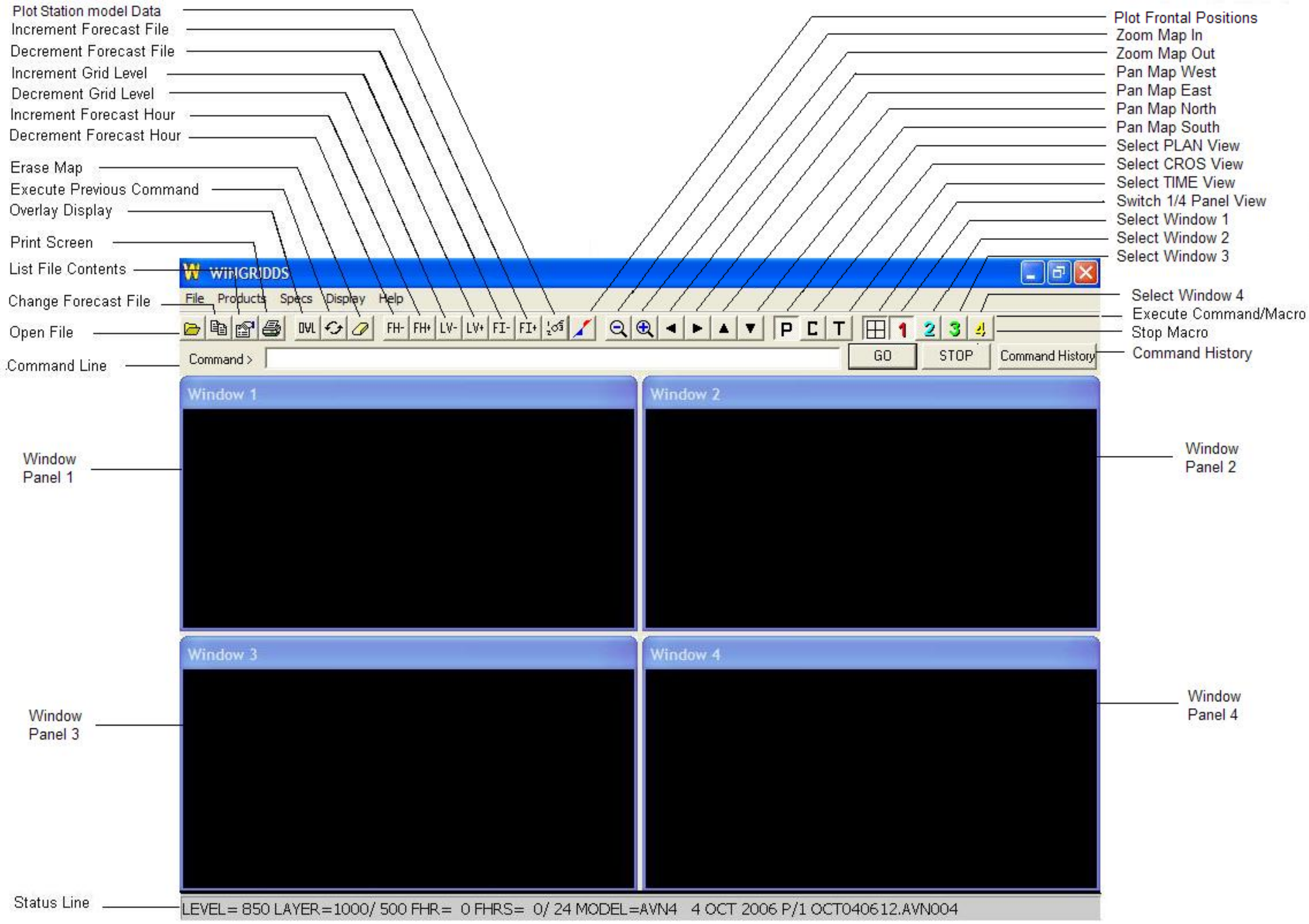
WINGRIDDS in 4 Panel (4PNL) Mode (without Window Banner)



WINGRIDDS in 4 Panel (4PNL) Mode (with Window Banner)

There are 5 menu options across the top.

File	Download and Ingest GRIB files, select, change, or list the contents of a forecast data file and Exit WINGRIDDS.
Products	Display predefined WINGRIDDS products.
Specs	Define the forecast hour and vertical level specifications.
Display	Change to or define one of the following display modes: Plan view (default), Cross-section, Time-section.
Help	Display Help files for WINGRIDDS Operations.



Command Line – Enter WINGRIDDS commands
Open File – Opens PCG Data files which have been through the GRIB Ingest Process
Change Forecast Files – Switches between multiple opened PCG Data files
List File Contents – Lists all GRIB parameters in the current PCG file for the active forecast time
Print Screen – Prints the contents of the display area to the default printer
Overlay Display – Overlays the next issued command with what is on the screen
Previous Command – Executes the previous command
Erase Map – Erases the display area & leaves a blank map
Decrement Forecast Hour – Decrement forecast hour by one step
Increment Forecast Hour – Increment forecast hour by one step
Decrement Grid Level – Steps Grid level farther from the surface (Lower in pressure)
Increment Grid Level - Steps Grid level closer to the surface (Higher in pressure)
Decrement Forecast File – Activates the previous loaded forecast file (if previously opened)
Increment Forecast File – Activates the next loaded forecast file (if previously opened)
Station Observation Data Plot – Plots the Observation data in Station Model format
Frontal Position Data Plot – Plots the ASUS Frontal position data if available at observation hour.
Map Zoom Out – Zooms the map display out for a wider view
Map Zoom In – Zooms the map display in for a narrower view
Pan Map West – Moves the map field of view toward the West
Pan Map East – Moves the map field of view toward the East
Pan Map North – Moves the map field of view toward the North
Pan Map South – Moves the map field of view toward the South

Choose PLAN Display – Switches to PLAN Display (default)
Choose CROSS Display – Switches to CROSS-Section Display (if configured)
Choose TIME Display – Switches to TIME-Section Display (if configured)
Switch Between 1Panel/4Panel Mode – Changes the display format between 1Panel & 4 Panel mode
Select Window 1 – Moves command focus to Window 1 in 4PNL mode (Default in 1PNL mode)
Select Window 2 – Moves command focus to Window 2 in 4PNL mode
Select Window 3 – Moves command focus to Window 3 in 4PNL mode
Select Window 4 – Moves command focus to Window 4 in 4PNL mode

GO – Executes Commands and Macros
STOP – Halts execution of Macro Loops
Command History – Redisplays recent commands in the command line
Status Line – Real time display of grid, time and file status

WINGRIDDS Tutorial

Sample Ingest Session for WAFS GRIB Data

The following steps show you how to convert WAFS data encoded using a GRIdded Binary format (GRIB) to WINGRIDDS format. The instructions assume you are using the sample WAFS data set provided with the program. After you have completed the example, read the documentation in detail to get a better understanding of the software and to answer your questions.

Start a session.

1. From the desktop, double-click the icon **WINGRIDDS**

2. Click: *File>Convert WAFS GRIB Data*
   Selects *File* choice #2 (Convert WAFS GRIB Data). Displays the '*WAFS Area Selection*' dialog and begins your ingest session.

Select area for gridded data set.

1. Use the **[Down arrow]** key or **[click-hold]** the mouse on the vertical scroll bar on the right of the window and drag up or down to scroll to position the highlight to an area you want to select.
   Data that fall with in the boundaries of the selected area are converted from GRIB to PCG format.

Convert WAFS GRIB data to WINGRIDDS PCG format.

1. Click: **Ingest** or press **Enter**
   Converts GRIB data for the selected model run to WINGRIDDS PCG format using the utility GRIB2PCG32 and places the data in the **WINGRIDDS\GRIDDATA** directory. This may require a significant amount of time if you are processing a large quantity of data. A window will show the progress of the GRIB2PCG32 utility. The window will close when the conversion process is completed. If any errors are encountered during the conversion process, the GRIB2PCG32.LOG file can be viewed for details. The data are now ready to be used in a WINGRIDDS session (refer to '*Sample WINGRIDDS Applications Session*').

Ingesting WAFS GRIB Data

You can receive gridded data from a variety of sources (e.g., satellite, phone lines). These data files are encoded using a GRIdded Binary communications format (GRIB). Before the data can be displayed and processed by WINGRIDDS, it must be converted to WINGRIDDS rapid-access PCG format. This process is referred to as ingesting GRIB data.

-- Types of GRIB data

Three types of GRIB data are available to the WINGRIDDS user: WAFS (global data) GRIB and NWS or Regular GRIB and MOS GRIB. Because the data are structured differently, the ingest procedures for the three data types are different. The selected ingest procedure which is displayed in the *'File'* menu must match the data type that is ingested

WAFS

Data for global grids (WAFS data) are subdivided into octets (I,J,K,L,M,N,O,P). This data must be preprocessed to create an inventory of data and list of model runs available for conversion from GRIB to WINGRIDDS PCG format. Only one model run may be converted to WINGRIDDS format in a single ingest session.

NWS/Regular and MOS

Data for the entire grid are stored together as a single group in NWS GRIB data files. No pre-processing of NWS GRIB data is necessary before the data are converted to WINGRIDDS PCG format. Multiple model runs may be converted from GRIB to WINGRIDDS PCG format in a single ingest session.

-- Delete GRIB Data

GRIB data from the previous forecast cycle **should be deleted** before you acquire GRIB data for a new forecast cycle. This will avoid mixing data from different model forecasts and speed up the conversion to WINGRIDDS PCG format because the programs that perform these conversions may process files for *ALL* the forecast model dates that are present.

To delete GRIB data, Click: File> Delete WAFS GRIB Files

Selects choice #4 (Delete WAFS GRIB Files) from the '*File*' menu.

You are asked to verify that you want to delete all the files in every **GRIB/WAFS/*** directory. Press **[Y]** to begin deleting files. Press **[N]** to stop the deletion process.

-- Converting WAFS Data from GRIB to WINGRIDDS PCG format

An important step must be taken to describe the area included in the WINGRIDDS data set before you begin the conversion. This is done when you Click: *File>Convert WAFS GRIB Data.* The '*WAFS Area Selection*' dialog is displayed for the user to select the geographical area which they desire to be included in the ingest process.

A summary of the conversion process and any errors is contained in the file **GRIB2PCG32.LOG**.

If you initially decide to convert part of your GRIB data to WINGRIDDS format, you may convert additional data at a later time.

As long as the new GRIB data you select covers the <u>*same area*</u> and was produced from the <u>*same model run*</u> as the initial data, the ingest program adds new variables to the existing file without reprocessing or overwriting the variables currently in the file.

If you select a <u>*new area*</u> but the GRIB data are from the <u>*same model run*</u>, then the ingest program produces a new file with the same name, but modifies the last letter of the extension to match the octants requested. For example, if the initial WINGRIDDS file covering Octant L is MAR150300.AVN-L and you wish to also cover the areas of Octants L & P, those files are named MAR150300.AVN-PL.

If the GRIB data are from a *__different model run__*, then a new PCGRIDDS file is produced and named according to the model run. For example, if the last file produced is MAR150300.AVN-L, then the first file from the next model run is named MAR150312.AVN-L.

-- Select Area for Gridded Data Set

The surface of the earth is divided into eight areas (octants) identified by the labels I,J,K,L,M,N,O,P. You must specify the area that is covered by the gridded data set you are creating from the GRIB data. If you do not select a new area, then the area you selected for the last gridded data set is used. Only those GRIB data octants within the selected area are included in the WINGRIDDS data set.

The menu displayed on the screen lists the areas available for the conversion process. The required octants are listed for each entry. GRIB data for *__all octants required by the selected area__* must be placed in the **GRIB/WAFS/OCTANT*** directory where the "*****" denotes the Octant letter. If any required octants are missing for a field, GRIB data for that field will not be converted to PCF format.

The location of each octant is described below:

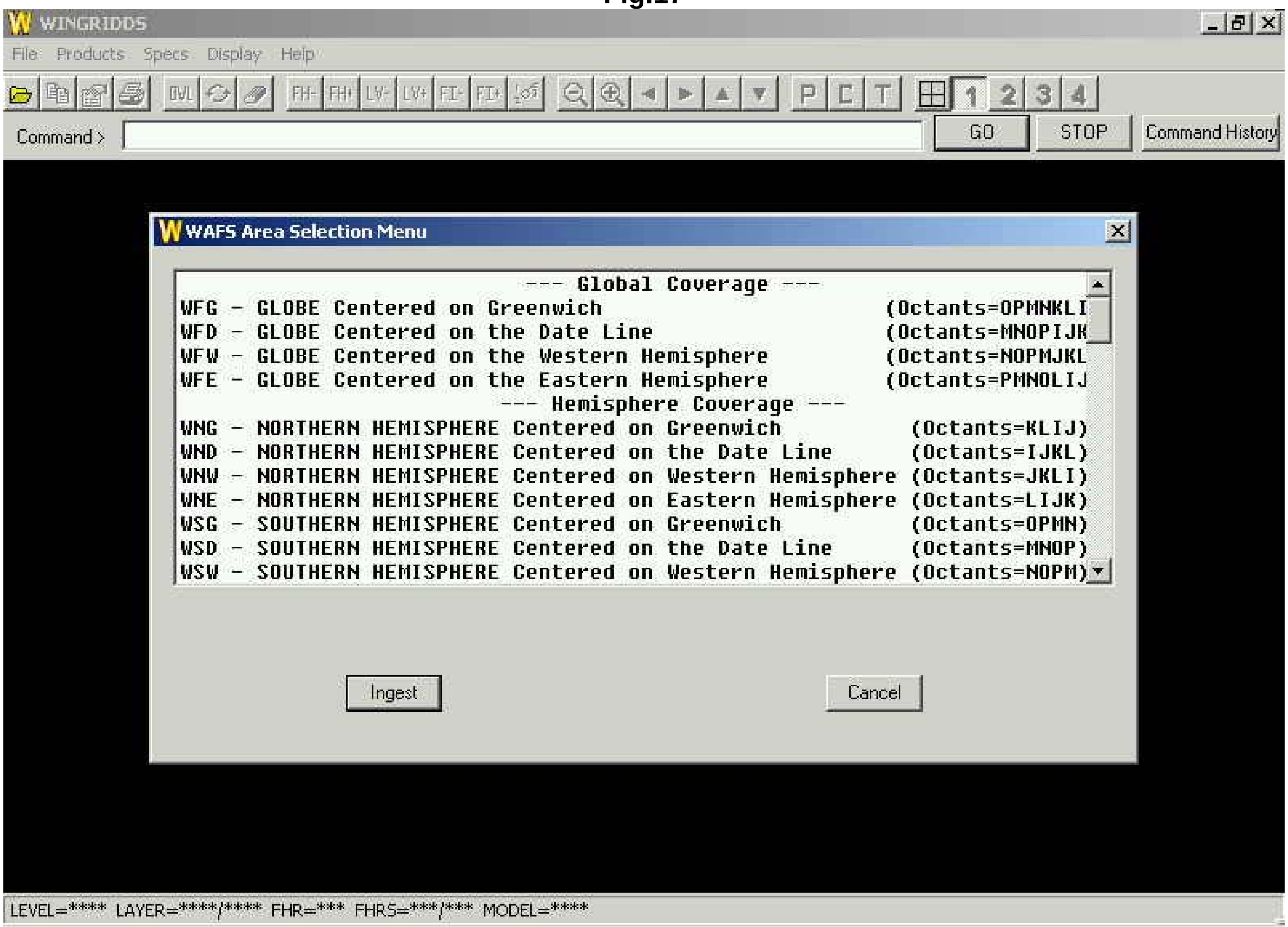
Octant	Latitude	Longitude
I	0-90N	30W- 60E
J	0-90N	60E-150E
K	0-90N	150E-120W
L	0-90N	120W- 30W
M	0-90S	30W- 60E
N	0-90S	60E-150E
O	0-90S	150E-120W
P	0-90S	120W- 30W

Use the following steps to select an area for the gridded data set:

1. Click: *File>Convert WAFS GRIB Data*
   Selects *File* choice #2 (Convert WAFS GRIB Data). Displays the '*WAFS Area Selection*' dialog and shows the available areas for selection. The menu is shown in Fig.17.

2. Select an area.
   To select an entry with the highlight
   Position the highlight to the desired choice and press **[Enter]** or click **[Ingest]**.

Fig.17



-- Convert GRIB Data to PCG Format

After your GRIB data are stored in the **GRIB\WAFS/Octant*** directories, you are ready to preprocess the GRIB data to produce an inventory and list of model runs to be included in the gridded data set and convert your GRIB data to PCG format. The WAFS GRIB preprocessing used to be a separate utility in PCGRIDDS. In WINGRIDDS, that function has been incorporated within the GRIB2PCG32 ingest utility.

Use the following steps to proceed with the conversion process:

1. Within the *WAFS Area Selection Menu,* press **[Enter]** or click **[Ingest]**
   The GRIB2PCG32 GRIB Conversion Utility is started and data are preprocessed and inventoried before they are converted to PCG format. This procedure may require a significant amount of time if you are processing a large quantity of data. When the GRIB2PCG32 utility is started, the *WAFS Area Selection Menu* disappears and a window opens to show the progress and status of GRIB2PCG32. Other WINGRIDDS tasks and operations may be performed during this process. The Window closes when the conversion process is completed. The data are now ready to be used in a WINGRIDDS session.

After the conversion is complete, the data files in PCG format are placed in the directory, **\WINGRIDDS\GRIDDATA,** and are available for display by WINGRIDDS (refer to '*Sample WINGRIDDS Applications Session*')**.**

Note: If not every octant has the same GRIB parameters, those parameters which are missing are skipped. All GRIB files are left unchanged after the WINGRIDDS file is created.

Sample Ingest Session for NWS/Regular GRIB Data

The following steps show you how to convert NWS/Regular data encoded using a GRIdded Binary format (GRIB) to WINGRIDDS PCG format. The instructions assume you are using the sample NWS data set provided. After you have completed the example, read the documentation in detail to get a better understanding of the software and to answer your questions.

Sample data set contents

The sample NWS data set contains:

NAM model fields (00 and12 hour forecast)

Start a session.

1. From the desktop, double-click the icon **WINGRIDDS**

2. Click: *File>Convert Non-WAFS GRIB Data>Convert Regular GRIB Data*

   Selects *File* choice #4 (Convert Non-WAFS GRIB Data) and Sub-Menu choice #1 (Convert Regular GRIB Data) which begins your ingest session. The utility NGRB2PCG32 Converts GRIB data to WINGRIDDS PCG format and places the data in the **WINGRIDDS\GRIDDATA** directory. This procedure may require a significant amount of time if you are processing a large quantity of data. A window opens to show the progress and any errors during the conversion process. While the conversion process is ongoing, other WINGRIDDS tasks and operations may be performed. This window closes when the conversion process is completed. The data are now ready to be used in a WINGRIDDS session (refer to '*Sample WINGRIDDS Applications Session*').

Delete existing GRIB data.
Use the following optional steps to delete NWS GRIB data files from previous forecasts, if desired, <u>before</u> you acquire new data:

To delete GRIB data, Click: File> Delete Regular GRIB Files
Selects choice #5 (Delete Regular GRIB Files) from the '*File*' menu.

2. Type: **Y**
Answers 'yes' when asked if you want to delete all the files in the **GRIB\NWS** directory. Type **N** if you want to exit this process without deleting files.

<u>Ingesting NWS GRIB Data</u>

You can receive gridded data from a variety of sources (e.g., satellite, phone lines, Internet). These data files are encoded using a GRIdded Binary <u>communications</u> format (GRIB). Before the data can be displayed and processed by WINGRIDDS, it must be converted to WINGRIDDS <u>rapid-access</u> PCG format. This process is referred to as ingesting GRIB data.

-- Types of GRIB data

Three types of GRIB data are available to the WINGRIDDS user: WAFS (global data) GRIB and NWS or Regular GRIB and MOS GRIB. Because the data are structured differently, the ingest procedures for the three data types are different. The selected ingest procedure which is displayed in the *'File'* menu must match the data type that is ingested

WAFS

Data for global grids (WAFS data) are subdivided into octets (I,J,K,L,M,N,O,P). This data must be preprocessed to create an inventory of data and list of model runs available for conversion from GRIB to WINGRIDDS PCG format. Only one model run may be converted to WINGRIDDS format in a single ingest session.

NWS/Regular and MOS

Data for the entire grid are stored together as a single group in NWS GRIB data files. No pre-processing of NWS GRIB data is necessary before the data are converted to WINGRIDDS PCG format. Multiple model runs may be converted from GRIB to WINGRIDDS PCG format in a single ingest session.

-- Selecting the method used to process GRIB data

The procedure used to convert GRIB data to PCG format differs for NWS and WAFS data. The selected procedure <u>MUST</u> match the type of GRIB data that you process. When ingesting and converting non-WAFS GRIB files to PCG files, the user must use the **Convert Non-WAFS GRIB Data** menu selections and vice-versa for **WAFS**.

A) As long as the new GRIB data you select covers the *same area* and was produced from the *same model run* as the initial data, the ingest program adds new variables to the existing file without reprocessing or overwriting the variables currently in the file.

B) If you select a *new area* but the GRIB data are from the *same model run*, then the ingest program produces a new file with the same name, but modifies the first character of the year field. For example, if the initial PCG file is JL030300.ETA211, the next files are named JL030300A.ETA211, JL030300B.ETA211 (up to a total of 10 files).

C) If the GRIB data are from a *different model run*, then a new PCGRIDDS file is produced and named according to the model run. For example, if the last file produced is JL030300.ETA211, then the first file from the next model run is named JL030312.ETA211.

-- Convert GRIB Data to PCG Format

After your GRIB data are stored in the **GRIB\NWS** directory, you are ready to convert your GRIB data to PCG format. Begin the conversion process by Clicking: *File>Convert Non-WAFS GRIB Data>Convert Regular GRIB Data* from the WINGRIDDS menu. This will start the NGRB2PCG32.EXE GRIB Conversion utility. After the conversion is complete, the data files in PCG format are placed in the directory, **\WINGRIDDS\GRIDDATA,** and are available for display by WINGRIDDS**.**

A summary of the conversion process and any errors encountered are contained in the file **NGRIB2PCG32.LOG**.

Note: All GRIB files are left unchanged after the PCG file is created.

Sample Ingest Session for Observation Data

The following steps show you how to convert Surface and/or Upper-Air data to WINGRIDDS PCG format. The instructions assume you are using the sample Observation data set provided. After you have completed the example, read the documentation in detail to get a better understanding of the software and to answer your questions.

Sample data set contents

The sample Observation data set contains:

00Z Surface and Upper-Air RAOB messages

Start a session.

1. From the desktop, double-click the icon **WINGRIDDS**

2. Click: *File>Convert Observation Files*

   Selects *File* choice #5 (Convert Observation Files) which begins your ingest session. The Convert Observation Data dialog will be shown. Once the selections have been made, selecting 'OK' will start the utility OBS2PCG32 which converts Observation data to WINGRIDDS PCG format and places the data in the **WINGRIDDS\GRIDDATA** directory and creates a text-based corresponding combined observation data file in the **WINGRIDDS\GRIDDATA\OBS** directory . This procedure may require a significant amount of time if you are processing a large quantity of data. A window opens to show the progress and any errors during the conversion process. While the conversion process is ongoing, other WINGRIDDS tasks and operations may be performed. This window closes when the conversion process is completed. The data are now ready to be used in a WINGRIDDS session (refer to '*Sample WINGRIDDS Applications Session*').

Delete existing OBS data.
Use the following optional steps to delete observation data files from previous ingests, if desired, before you acquire new data:

To delete Observation data, Click:
File> Delete Observation Files
Selects choice #9 (Delete Observation Files) from the '*File*' menu.

2. Click: **Y**
   Answers 'yes' when asked to acknowledge the successful deletion of the Observation data. If any deletions failed, they will create their own error dialog.

Ingesting Observation Data

You can receive Surface and/or Upper-Air observation data from a variety of sources (e.g., satellite, phone lines, Internet). These data files are text-based WMO formatted files. Before the data can be displayed and processed by WINGRIDDS, it must be scanned, filtered, a Barnes Analysis performed and then converted to WINGRIDDS rapid-access PCG format. This process is referred to as ingesting Observation data.

-- Types of Observation data

Two main categories of observation data are available to the WINGRIDDS user: Surface and Upper-Air (RAOB) observations. The Surface category can be subdivided into 4 categories: Buoy data, METAR or SAO data, Ship data and Synoptic data. Because the data are structured differently, the ingest procedures for the three data types are different. The selected ingest procedure which is displayed in the *'File'* menu must match the data type that is ingested

-- Convert Observation Data to PCG Format

After your Observation data are stored in the **OBS** directories, you are ready to convert your Observation data to PCG format. Before you begin, you must ensure the Date-Time selections match the data which was downloaded. You must also select the grid area to perform the Barnes Analysis on during the conversion. Once these selections have been made, you begin the conversion process by clicking the 'OK' button. This will start the OBS2PCG.EXE Observation Conversion utility. After the conversion is complete, the data file in PCG format is placed in the directory, **\WINGRIDDS\GRIDDATA,** and are available for display by WINGRIDDS**.** There will also be a corresponding combined observation text file stored in the **\WINGRIDDS\GRIDDATA\OBS** directory.

A summary of the conversion process and any errors encountered are contained in the file **OBS2PCG.LOG**.

Note: All Observation files are left unchanged after the PCG file is created.

For full details and full coverage of all Observation Ingest options, please refer to the **WINGRIDDS Observation Data Options** section.

Sample WINGRIDDS Applications Session

The following steps show you how to display a simple product using WINGRIDDS. After you have completed the example, read the documentation in detail to get a better understanding of the software and to answer your questions.

Start a session.

1. From the desktop, double-click the icon **WINGRIDDS**
   Begins your WINGRIDDS session.

Select forecast data file.

1. Click: **File>Open New Forecast File** or click: **Open New Forecast File** Button on Toolbar.
   A list of the available forecast data files is displayed on the screen. The first action you must take is to select a forecast data file.

2. Either Single-click a single file and click **Open** or you can double-click a single file and that file will open.
   Selects forecast data file and displays a map of the areal coverage.

Display a GRIB Parameter.

1. Click in the Command Line.

2. Enter: **HGHT**

   This should show a contour of the 850 mb Heights

3. Enter: **WIND**

   This should erase the Heights contour and display the WIND at 850 mb

4. Enter: **HGHT&WIND**

   This should show both the Heights & WIND at 850 mb

NOTE: All command requests are processed from right to left (a la Reverse Polish Notation). As such, the command **HGHT&WIND** will produce a Wind field first, followed by a Height field in a second color.

Define forecast hour.

1. Click: ***Specs***

   Selects the '*Specs*' dropdown menu. The highlight is positioned at the entry '*Forecast hour*' in the '*Specs*' menu.

2. Select the **Forecast Hour** menu

   The window used to define time parameters is displayed on the screen. A list of available forecast hours is displayed in the right side of the window.

3. Position the cursor to the field for forecast hour.

4. Type: **012**

   This clears the field by overwriting the old value. Enters a new value in the field.

5. Click: **[OK]**

   Sets the forecast hour used for the data displays to 12 hours and saves the value. Erases the form.

Define a display mode.

1. Click: ***Display*** menu

   Selects the '*Display*' entry. The checkmark is positioned at the entry '*Plan View*' in the '*Display*' menu to show the display is in Plan View Mode.

2. Click: ***Plan View***

   Selects the option to define a display mode. The window used to define the plan view mode is displayed on the screen.

3. Click: **Lookup** Button

   A list of predefined plan view definitions is displayed in a separate window.

4. Click-drag the scroll bal on the right side of the window to pan up/down to view the selection then click the area of your choice or use the **[down arrow]** key to move the highlight to the area of your choice.

5. Click: **OK**
   Erases the list of definitions. The definition values are entered into the form.

6. Click: **OK**
   Sets the plan view definition. A map showing the area you defined is displayed.

Display a product.

1. Click: ***Products*** menu
   Selects the '*Products*' entry.

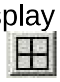
2. Drag your mouse across the Products Menu and the entries will highlight as you move your mouse.

3. Go down and click on the 'Build Your Own Maps' entry (10th entry down)

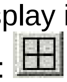
4. The 'Command window' will be displayed with the Command macros listed for that entry.

5. Single-Click:: **HGHT** then click **OK** or Double-click **HGHT**
   Selects the product and displays it on the screen. You should now see the 850 mb heights displayed on your screen.

Switch Between 1 Panel mode and 4 Panel mode.

1. If the display is in 1 Panel mode, to switch to 4 Panel mode either
   a) Click:  Button on the WINGRIDDS Tool Bar or
   b) Enter the command **4PNL** on the Command Line

   This will change the display mode from 1 Panel to 4 Panel mode.

   If the display is in 4 Panel mode, to switch to 1 Panel mode either
   a) Click:  Button on the WINGRIDDS Tool Bar or
   b) Enter the command **1PNL** on the Command Line

   This will change the display mode from 4 Panel to 1 Panel mode.

Once this is complete, you need to re-calculate the area displays.

2. Click: ***Display*** menu
   Selects the '*Display*' entry. The checkmark is positioned at the entry '*Plan View*' in the '*Display*' menu to show the display is in Plan View Mode.

3. Click: ***Plan View***
   Selects the option to define a display mode. The window used to define the plan view mode is displayed on the screen.

4. Click: **OK**
   Sets the plan view definition. A map showing the area you defined is displayed.

If CROSS or TIME section have previously been defined, they must be re-calculated as well. For the Cross Section:

5. Click: ***Display*** menu
   Selects the '*Display*' entry.

6. Click: ***Cross View***
   Selects the option to define a display mode. The window used to define the plan view mode is displayed on the screen.

7. Click: **OK**
   Recalculates the cross view definition. A map showing the area you defined is displayed.

For the Time Section:

8. Click: ***Display*** menu
   Selects the '*Display*' entry.

9. Click: ***Time View***
   Selects the option to define a display mode. The window used to define the plan view mode is displayed on the screen.

10. Click: **OK**
    Recalculates the time view definition. A map showing the area you defined is displayed.

Exit WINGRIDDS

1. Click: ***File> Exit*** menu
   Exits the WINGRIDDS program.

   or

2. Type: **X** at the Command Line
   Exits the WINGRIDDS program.

For more information or detailed instruction about WINGRIDDS operations, see the **WINGRIDDS Operations** section. For information about changing the configuration of WINGRIDDS, see the **Customizing the WINGRIDDS System** section.

WINGRIDDS Operations

The following discussions describe the operation of WINGRIDDS.

-- Starting WINGRIDDS

Use the following steps to initiate a WINGRIDDS session:

1. From the desktop, double-click the icon **WINGRIDDS**

   or

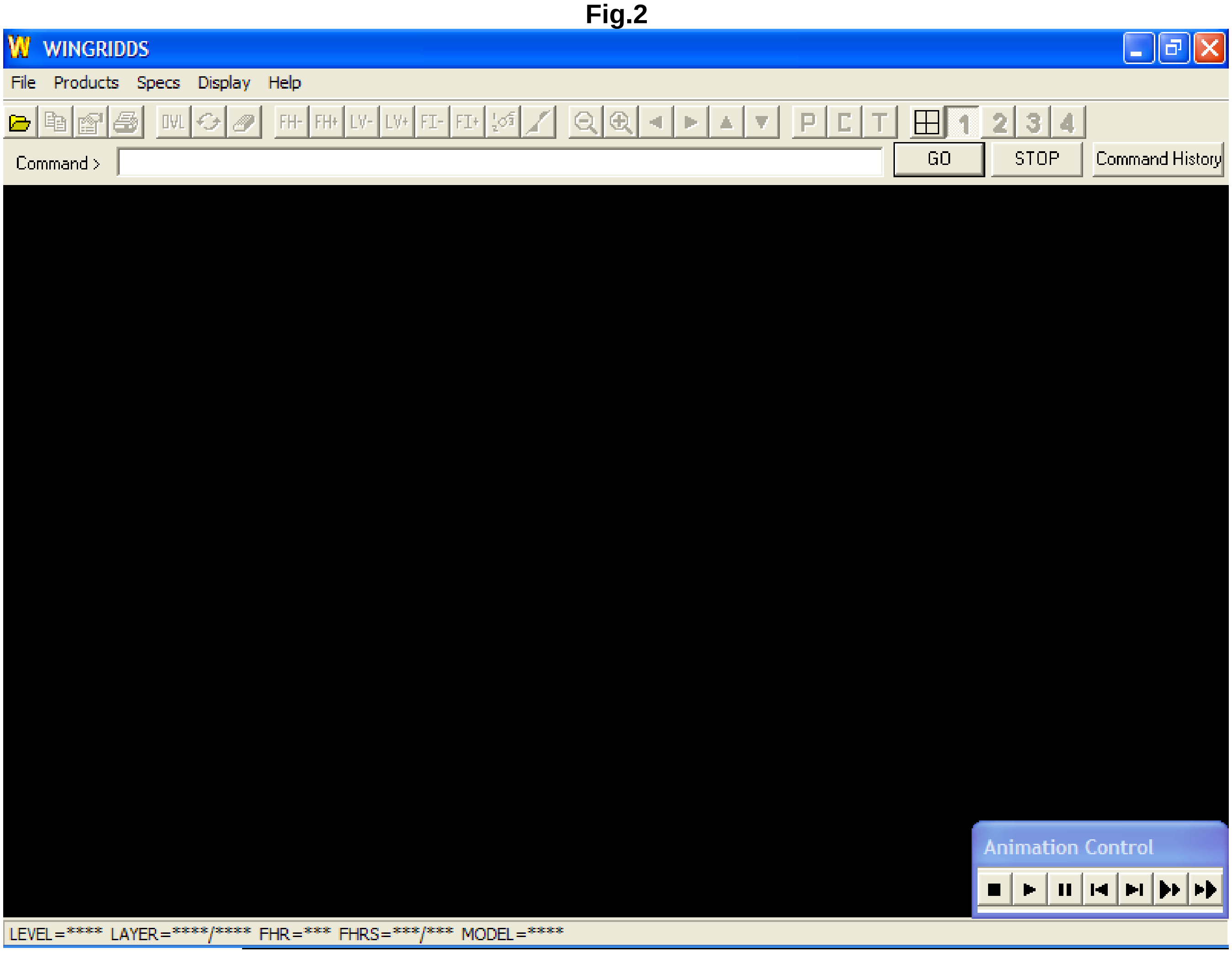
2. From the **'Start> Programs> WINGRIDDS'** menu, click **WINGRIDDS**

When you enter WINGRIDDS you may download data or ingest data but you can not perform any work on the data until a forecast file is opened.

-- Main Screen

The main screen for WINGRIDDS is displayed horizontally on line 2 (top) of the screen (Fig.2).

Fig.2



All Buttons except the **Open File** button are disabled and grayed out until a file is opened.

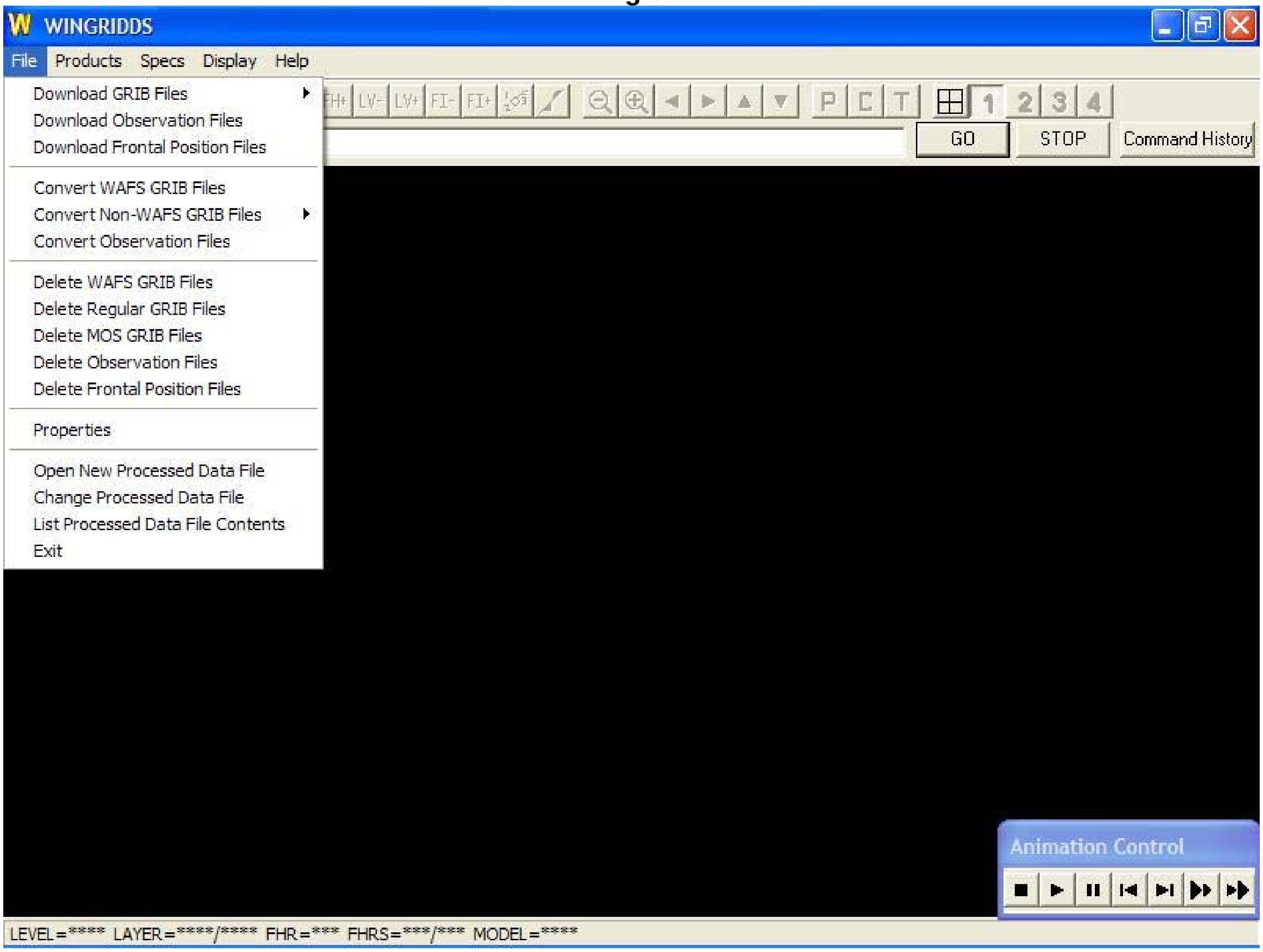
-- Grid Information

The grid information is displayed on the status line at the bottom of the screen. This line shows the current settings that are used for data selection. When you begin WINGRIDDS, these values are set to the default values found in **\WINGRIDDS\USER\INITGRID.SPC** (refer to '*Customizing WINGRIDDS*').

LEVEL	Pressure level, Isentropic level, Sigma level or Height level
LAYER	A grid layer consisting of 2 levels; used for level differences, etc.
FHR	Forecast hour
FHRS	Pair of forecast hours (Time range) used for time differences, etc.
MODEL	A 4 character forecast model identification name followed by the forecast model date
m/#	Current display mode (m) and grid data-thinning factor (#). The character 'm' can have one of three values: P (Plan view), T (Time-section), X (Cross-section). The character # can have a power of two value: 1, 2, 4, 8, A(16), B(32), etc.
Other	Once a forecast file is loaded, the date-time-group of the model run as well as the file name will be displayed.

-- File Menu

Fig.3



When you select '*File*' from the main menu, a 'pull-down' menu (Fig.3) with the following choices is displayed.

1. Download GRIB Files

This is where GRIB data files are downloaded through WINGRIDDS (refer to '*Downloading GRIB Data*')**.**

2. Download Observation Files

This is where Observation data files are downloaded through WINGRIDDS (refer to '*Downloading Observation Data*')**.**

3. Download Frontal Position Files

This is where ASUS Frontal Position data files are downloaded through WINGRIDDS (refer to '*Downloading ASUS Frontal Data*')**.**

4. Convert WAFS GRIB Data

This is where WAFS GRIB files are ingested and converted to PCG-format forecast files (refer to '*Ingest WAFS GRIB Data*')**.**

5. Convert Non-WAFS GRIB Data

This is where all other GRIB files are ingested and converted to PCG-format forecast files (refer to '*Ingest GRIB Data*')**.**

6. Convert Observation Data

This is where all Observation files are scanned and processed, Barnes Analysis applied and the data converted to PCG-format forecast files (refer to '*Convert Observation Data*')**.**

7. Delete WAFS GRIB Files

All WAFS GRIB files are deleted from the GRIB/WAFS/Octant* directories after they have been converted to PCG Format**.**

8. Delete Regular GRIB Files

All Regular GRIB files are deleted from the GRIB/NWS directory after they have been converted to PCG Format**.**

9. Delete MOS GRIB Files

All MOS GRIB files are deleted from the GRIB/MOS directory after they have been converted to PCG Format**.**

10. Delete Observation Files

All Surface and Upper-Air Observation data files are deleted from the OBS directory after they have been converted to PCG Format**.**

11. Delete Frontal Position Files

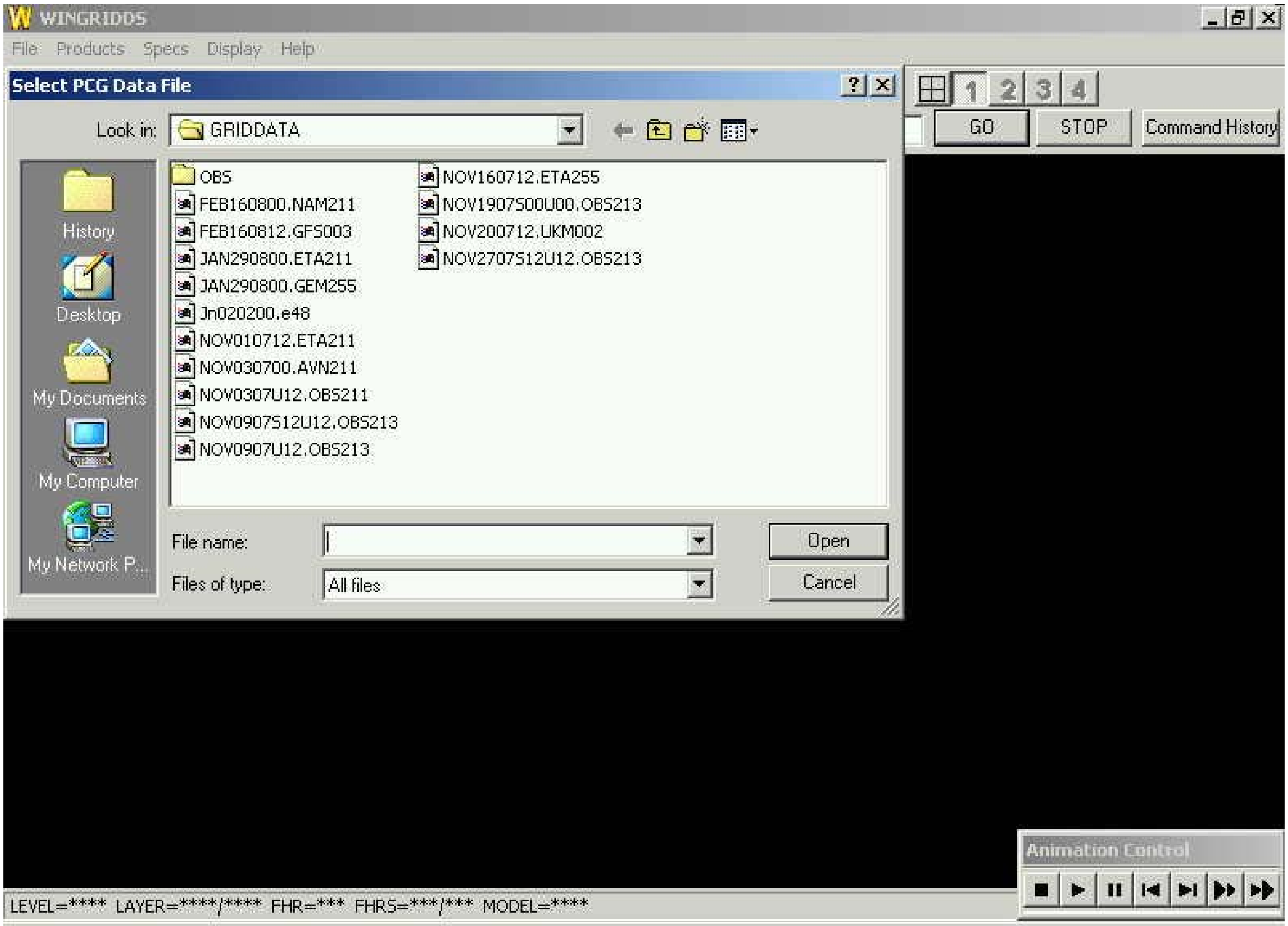
All ASUS Frontal Position data files are deleted from the FRONT directory.

12. Properties

Opens WINGRIDDS Properties Dialog to configure WINGRIDDS operations (refer to '*Customizing the WINGRIDDS System*').

13. Open New Processed Data File

This selects a new forecast data file from the list of files in the current gridded data directory. When you select this option, a list of available forecast data files is displayed on the screen.



To select a new forecast data file:

1. Double-click on the filename you wish to open, or…
   By default the files are listed in alphabetical order by name.

2. Single-click on the filename you wish to open and click "**Open"**

The current gridded data directory is specified in the file **\WINGRIDDS\USER\WINGMODE.DAT** (refer to '*Customizing WINGRIDDS*'). The default value for this directory is **\WINGRIDDS\GRIDDATA**.

Selecting a new forecast data file must be the first action you perform in WINGRIDDS before any WINGRIDDS commands can be accepted. No other actions (except Downloading or ingesting GRIB files or exiting) are allowed until you select a file. You can select only one file at a time. Each file you select is added to the list of up to 35 files available for access by WINGRIDDS. However, you can use only one file at a time. The last file you select will be the active forecast data file unless you change it with choice #5 (Change forecast file).

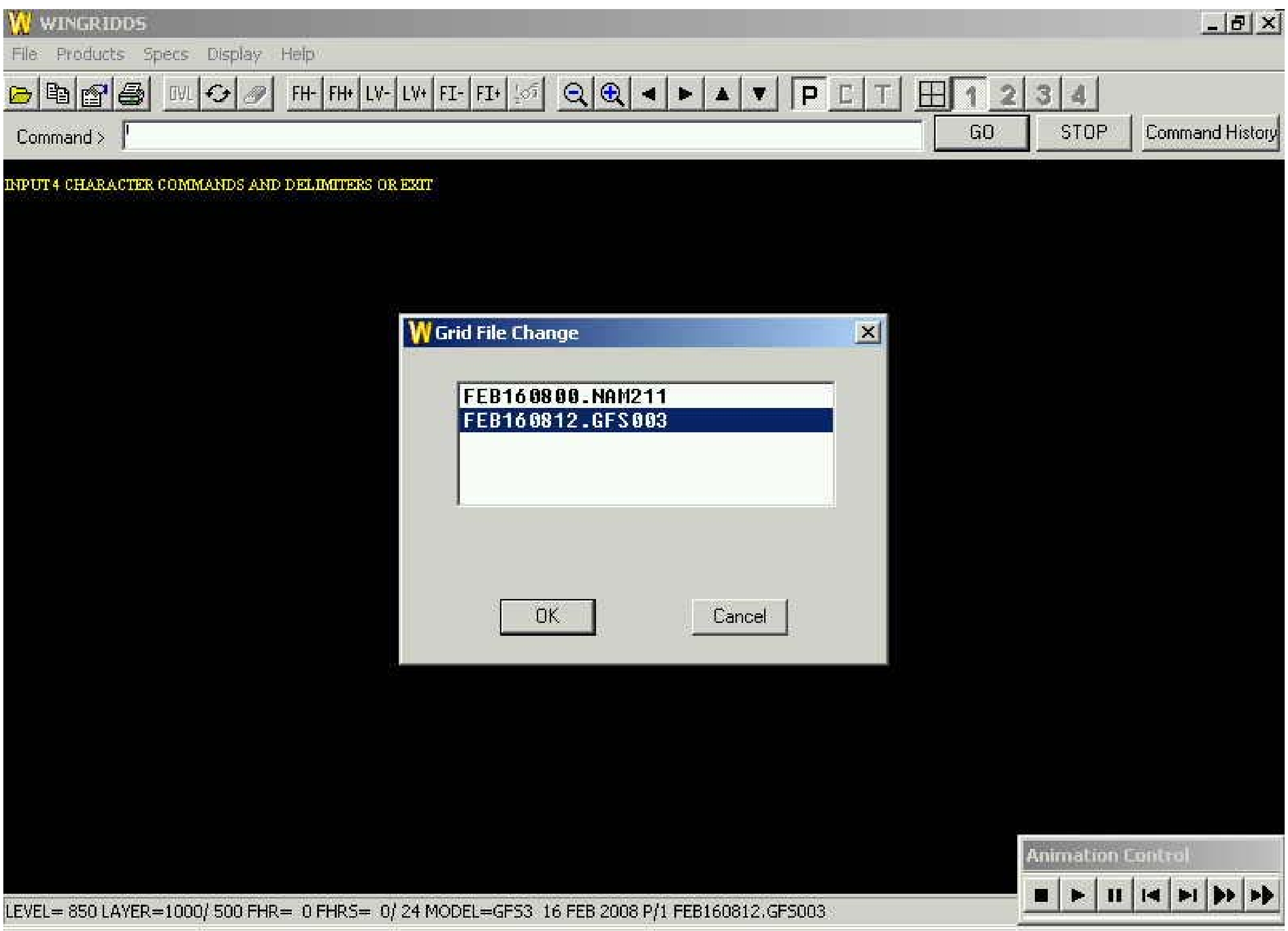
14. Change Processed Data file

Changes the active forecast data file to one of the files displayed in the list of previously selected forecast files (Fig.4). Files are added to this list each time you select a new forecast file (choice #4). Only one file may be active at a time. Data for products are obtained from the active file. When you select this option, a list of previously selected forecast data files is displayed on the screen. To change the active forecast data file:

1. Double-click on the filename you wish to open, or…
   The currently active processed data file is highlighted.

2. Single-click on the filename you wish to open and click "**Open"**
   Makes the file active.

(FIG 4)



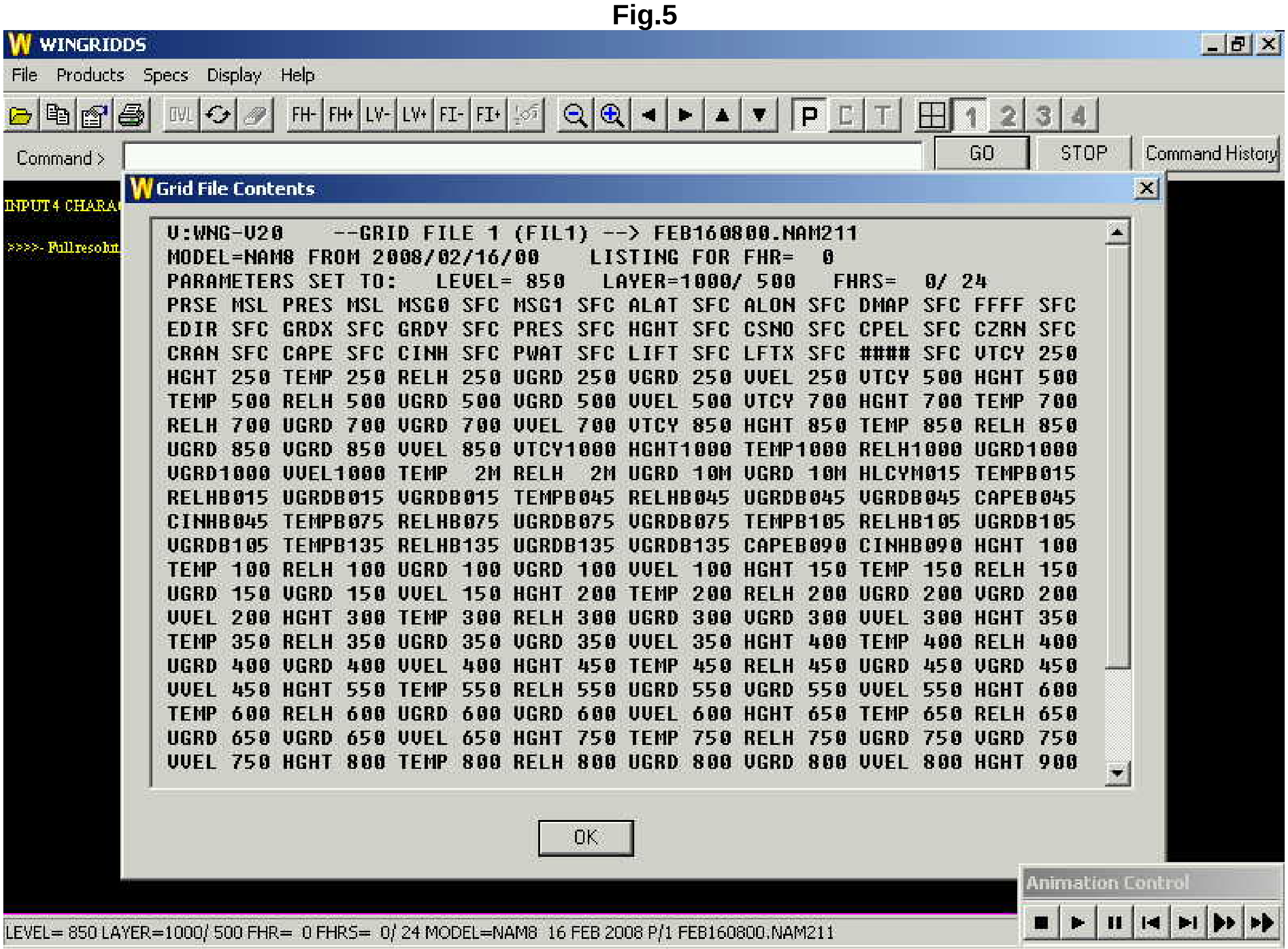
15. List Processed Data file contents

Lists the gridded data available in the active forecast data file at the currently selected forecast hour shown at the bottom of the screen (Fig.5).

The information displayed at the beginning of the listing includes: the filename (FEB160800.NAM211), the forecast model name (MODEL=NAM8), the model date (FROM 2008/02/16/00), the currently selected forecast hour (FHR=0), the level (LEVEL=850), the layer (LAYER=1000/ 500), and the time range (FHRS= 00/ 24)

Data fields are identified by a 4 character description followed by a 4 character level. For example, TEMP 250 corresponds to the TEMPerature grid at 250 hPa and PRESTROP corresponds to the PRESsure grid at the TROPopause.

Fig.5

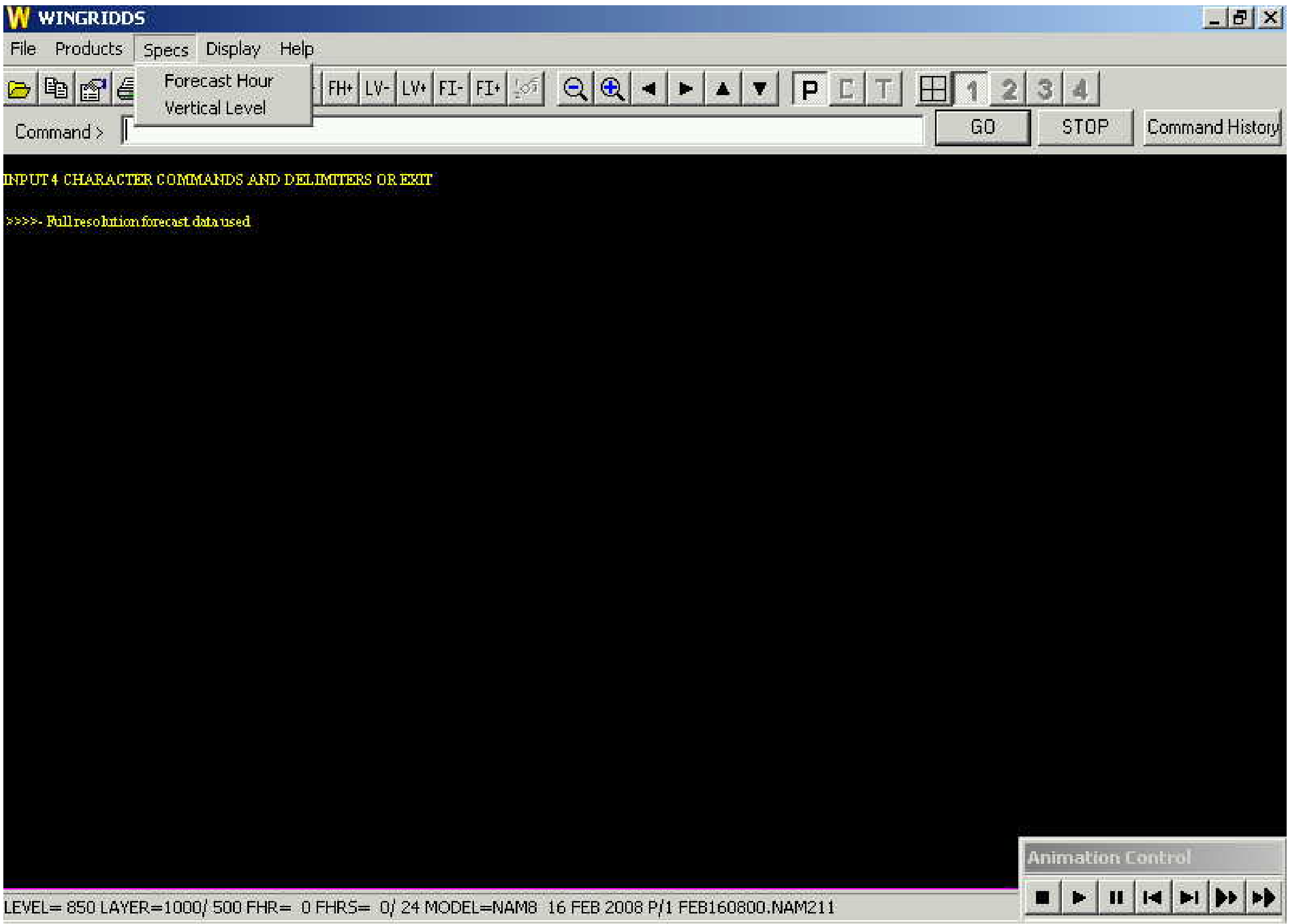


-- Specs Menu

The '*Specs*' option controls the setting of time and level specifications.

Note: The time parameters should be set before the level parameters so that all of the levels available for the currently selected forecast hour are displayed when you select the vertical levels.

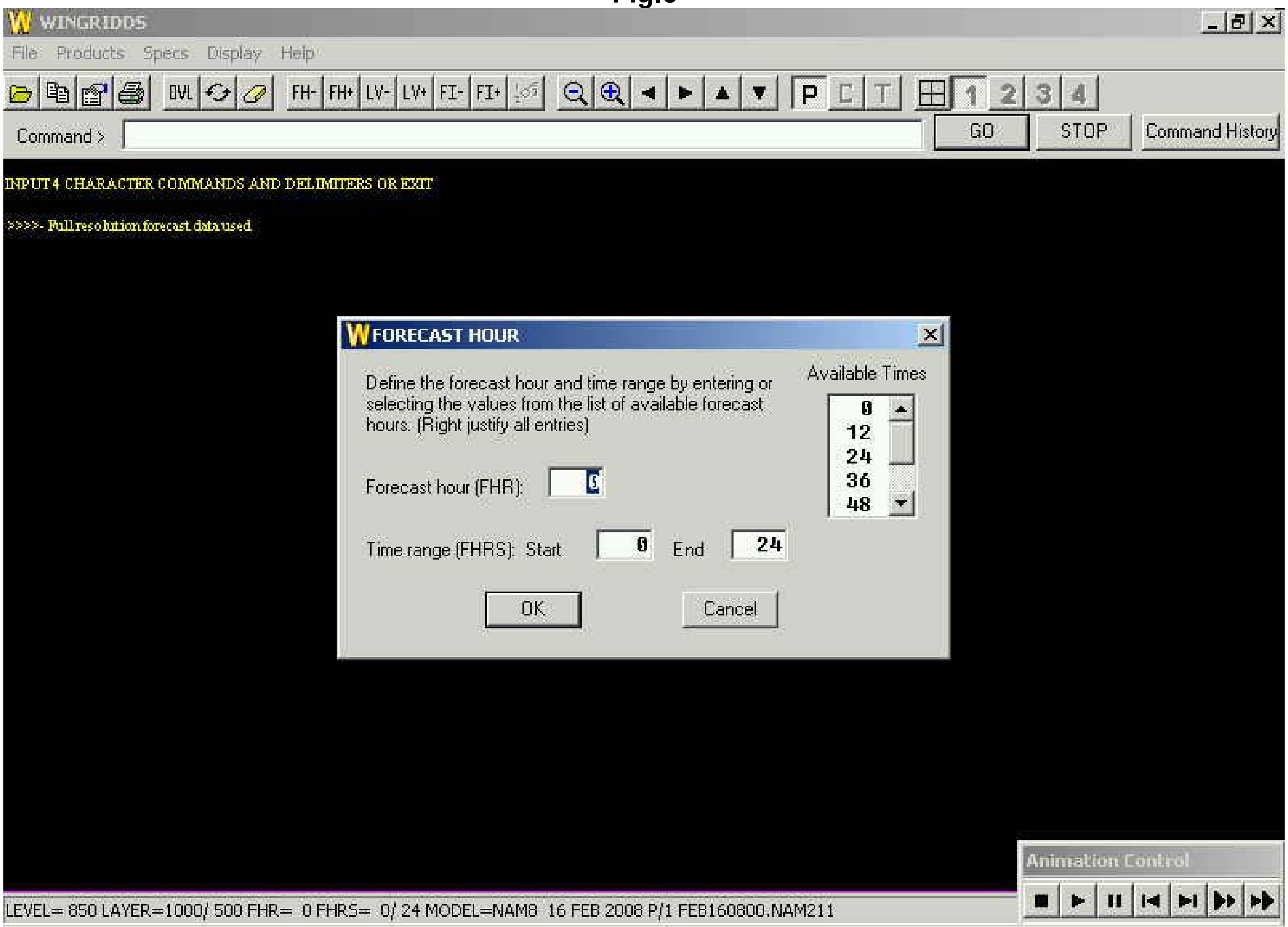
When you select '*Specs*' from the main menu, a 'pull-down' menu (Fig.6) with the choices, '*Forecast hour*' and '*Vertical level*', is displayed.



Forecast hour

When you choose this option, the current forecast hour and time range are displayed in a form (Fig.6) along with a list of the forecast times available in the currently active gridded data set.

Fig.6



You can modify the forecast time parameters by entering the integer times or selecting values from the list of available forecast hours.

To enter a value

1. Position the cursor to the desired field (Forecast hour, Time range start or end).

2. Type the number.

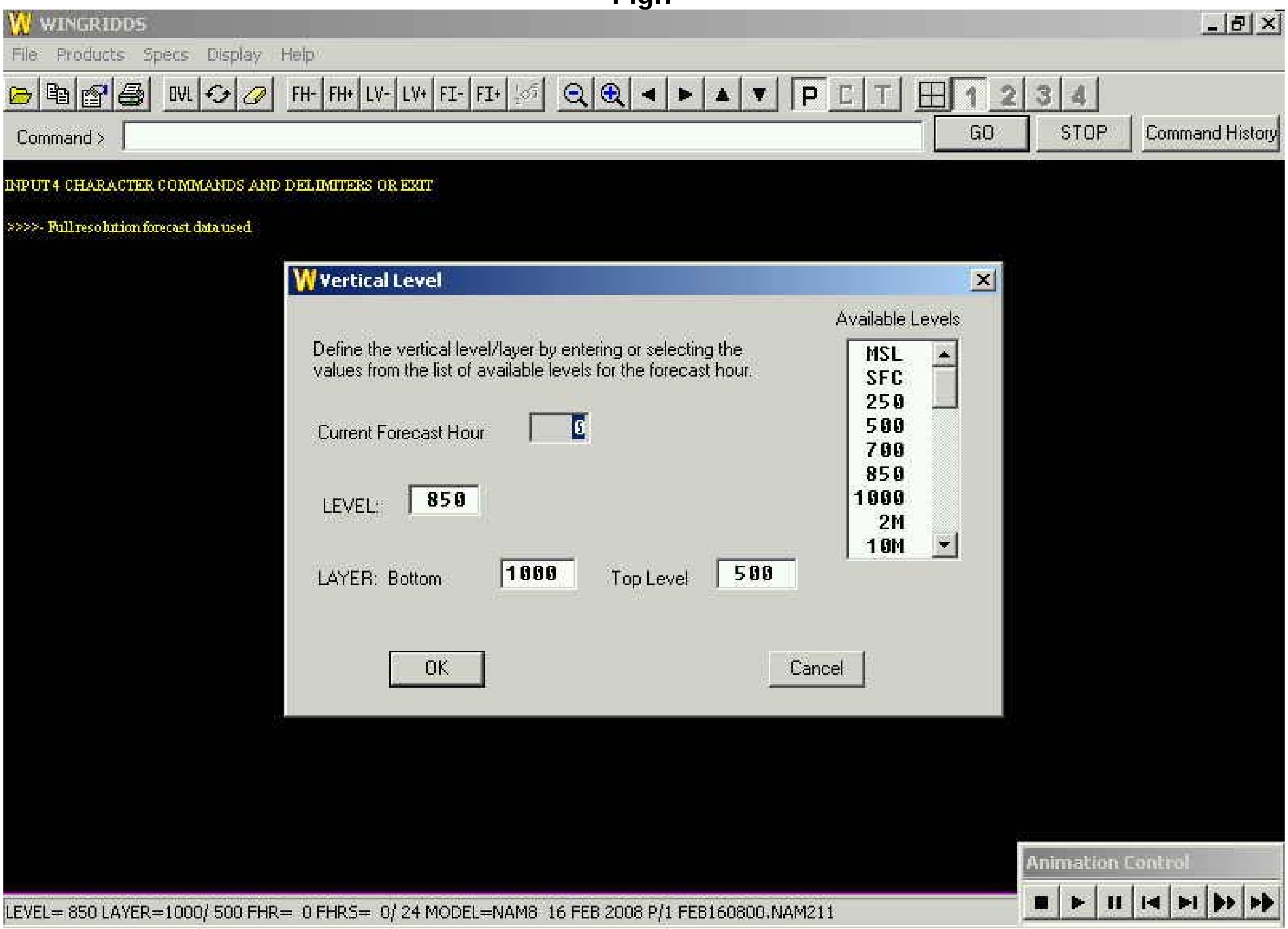
   The values in the ‘Available Times’ are not selectable. They are only there for reference.

After you have completed all of your revisions click **[OK]** to save the values you have set or click **[Cancel]** to cancel the operation.

Vertical level

With this option, the current level and layer values are displayed in a form (Fig.7) along with the *list of levels* which are available *at the currently specified forecast time* for the active gridded data set.

Fig.7



You can modify these parameters by entering values by referencing them from the list of levels displayed in the 'Available Levels' window. Since levels are listed only for the current forecast hour and may vary from one forecast time to another, you should select the time values (choice #1) before you select the levels.

-- Non-Pressure Levels

If the user wishes to enter Isentropic, Sigma or Height levels, those values are entered here as well. Isentropic range from I220-I500 degrees Kelvin. Sigma levels are preceded with the letter 'S'. Height ranges can be in Meters or Feet and must be in hundreds and preceded with the letter 'H'. For example, 'H100' would define the

10,000 ft/mtr level. The Feet/Meters selection is specified in the file **\WINGRIDDS\USER\WINGMODE.DAT** (refer to '*Customizing WINGRIDDS*').

To enter a value

1. Click the cursor in the desired field (LEVEL, LAYER: Bottom Level, Top Level).

2. Type the number. Ensure values are **LEFT** justified.

   The values in the ‘Available Levels’ are not selectable. They are only there for reference.

After you have completed all of your revisions click **[OK]** to save the values you have set
or click **[Cancel]** to cancel the operation.

-- Display Menu

The '*Display*' option controls the setting and definition of the display mode. When you select '*Display*' from the main menu, a 'pull-down' menu (Fig.8) appears on the screen with the following choices.

Plan view

Data are displayed over a horizontal area determined by a central latitude and longitude and a north/south distance in degrees.

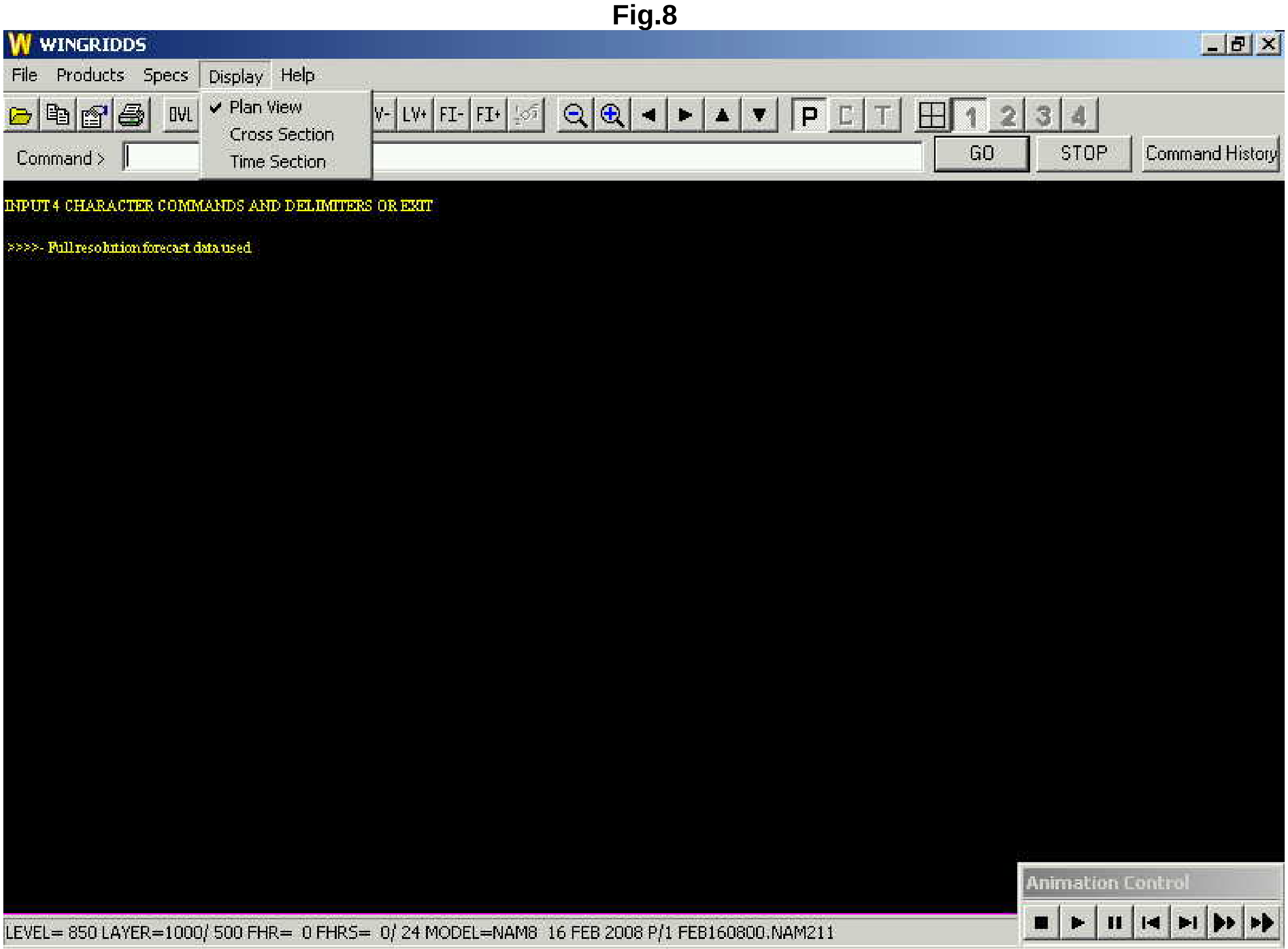
Cross-section

Data are displayed at multiple pressure levels along a vertical cross-section path which is defined between a left latitude and longitude point and a right latitude and longitude point.

Time-section

The vertical structure of data is displayed for a specified time period and multiple pressure levels at a particular point which is defined by a latitude and longitude.

Fig.8



Change the active display mode

The active display mode is identified with a check-mark next to the appropriate menu choice and the appropriate button on the Tool Bar is darkened. To change the active display mode, either click the file selection under the ‘Display’ menu or click the enabled Display Select button on the Tool Bar.

Note: A display mode must be defined before you can make it active.

Define the Plane View Mode

After clicking on the desired mode, the current latitude and longitude parameters that define the selected display mode are displayed in a form (Fig.9). You can use one of four methods to modify these parameters.

To enter a value (Fig.9)

1. Click in the desired field with the mouse to highlight the value.

2. Type the value of the desired latitude or longitude in degrees.
   Degrees may be expressed as a positive integer value or as a positive real value.

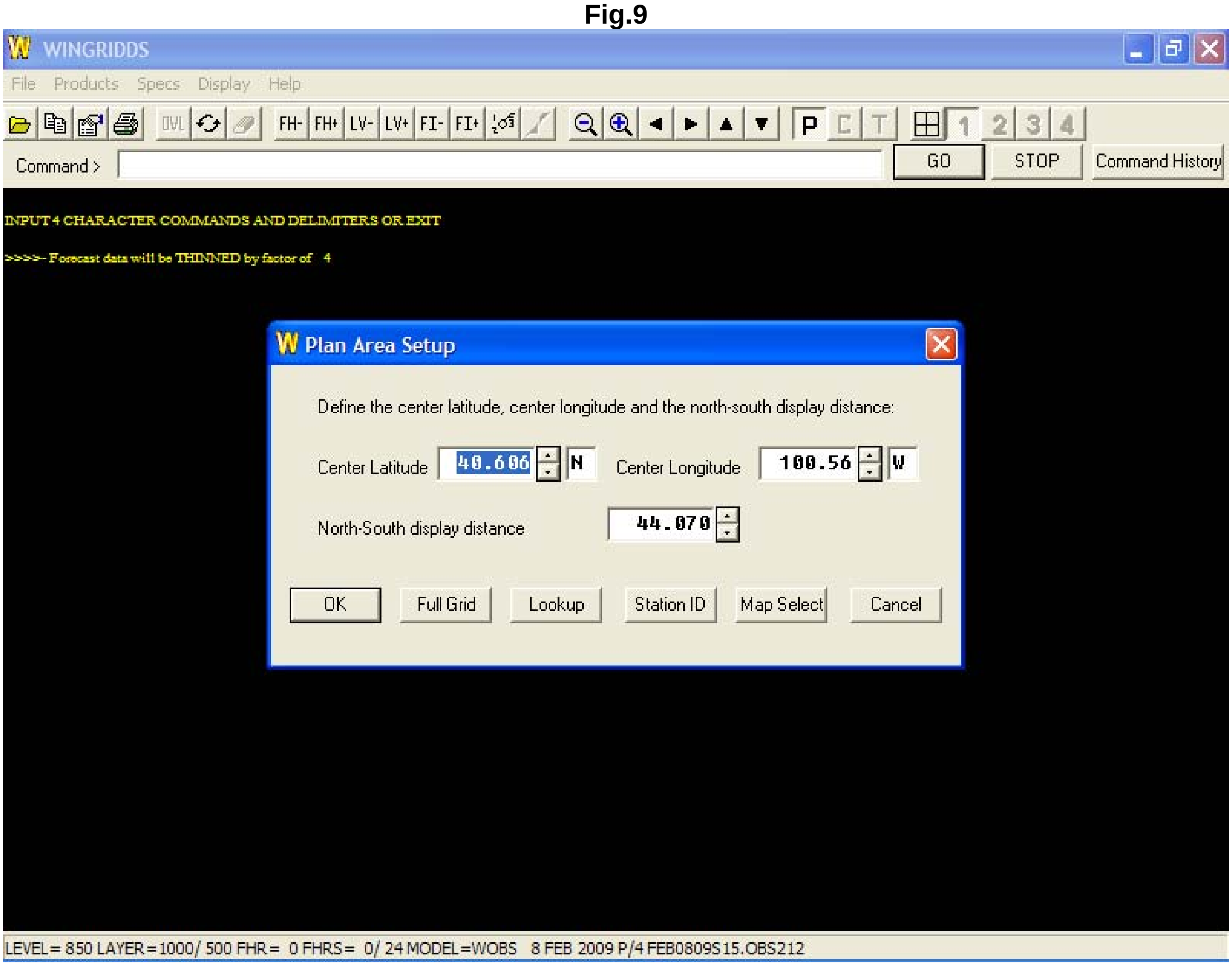
   OR

   Click on the up-down arrows to increment or decrement the value in the window.

3. When direction is required, type one of the following characters to indicate the appropriate hemisphere: **N**, **S**, **W**, **E**.

4. Press **[OK]**.
   Saves the values you set.

Fig.9



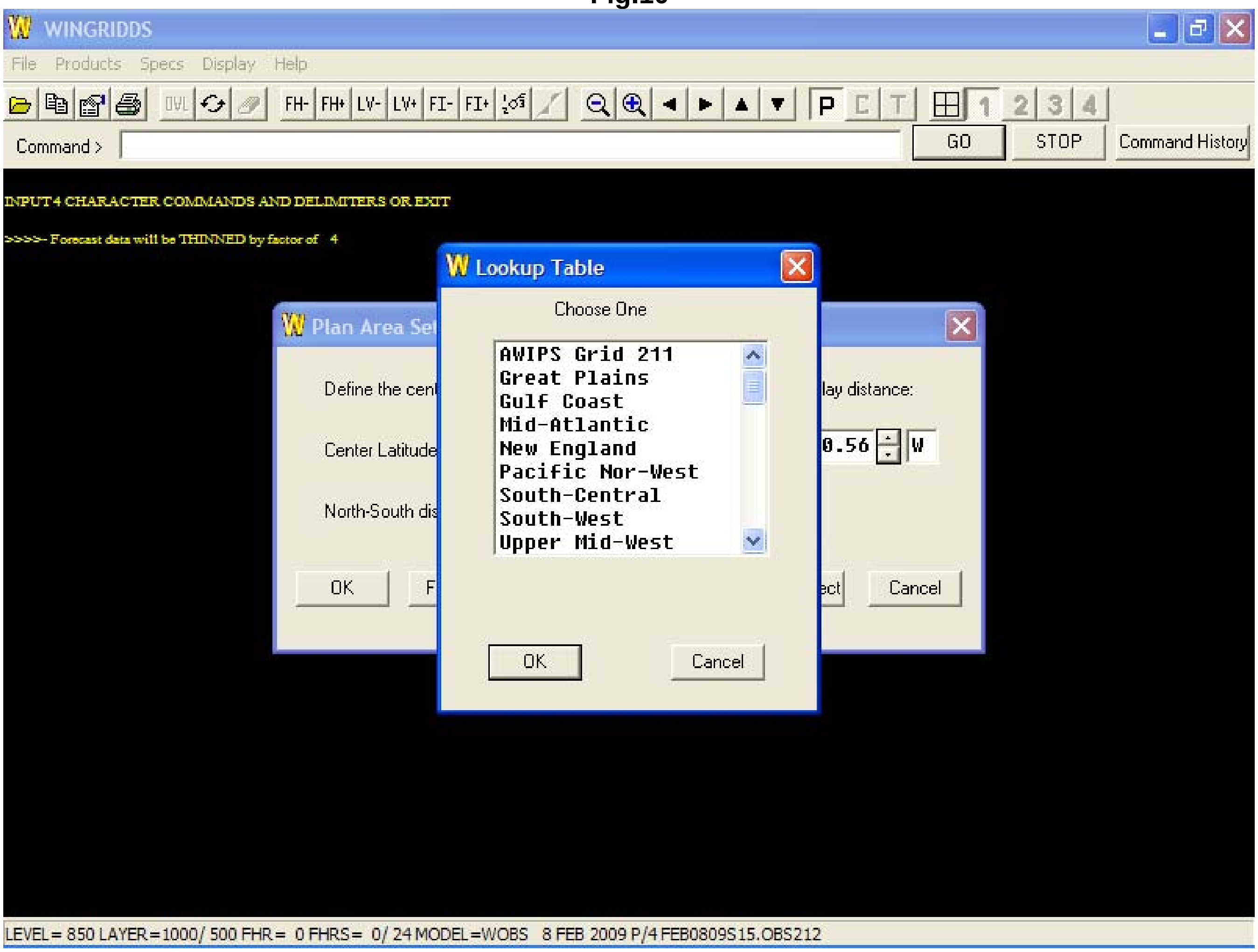
To select an entry from the lookup table (Fig.10)

1. Click **[Lookup]**.
   Activates the lookup menu. A list of display mode definitions is shown on the screen.

2. Double-click to select the entry immediately or single-click the entry.
   Remember the table may contain multiple pages.

3. Click **[OK]**.
   Saves the values you set.

Fig.10



To add entries into the Lookup Table refer to '*Customizing WINGRIDDS*'.

To select an entry from the station id list (Fig.11)

1. Click **[Station ID].**
   Activates selection by station identifier (id). A request for one or more station id's appears on the screen.

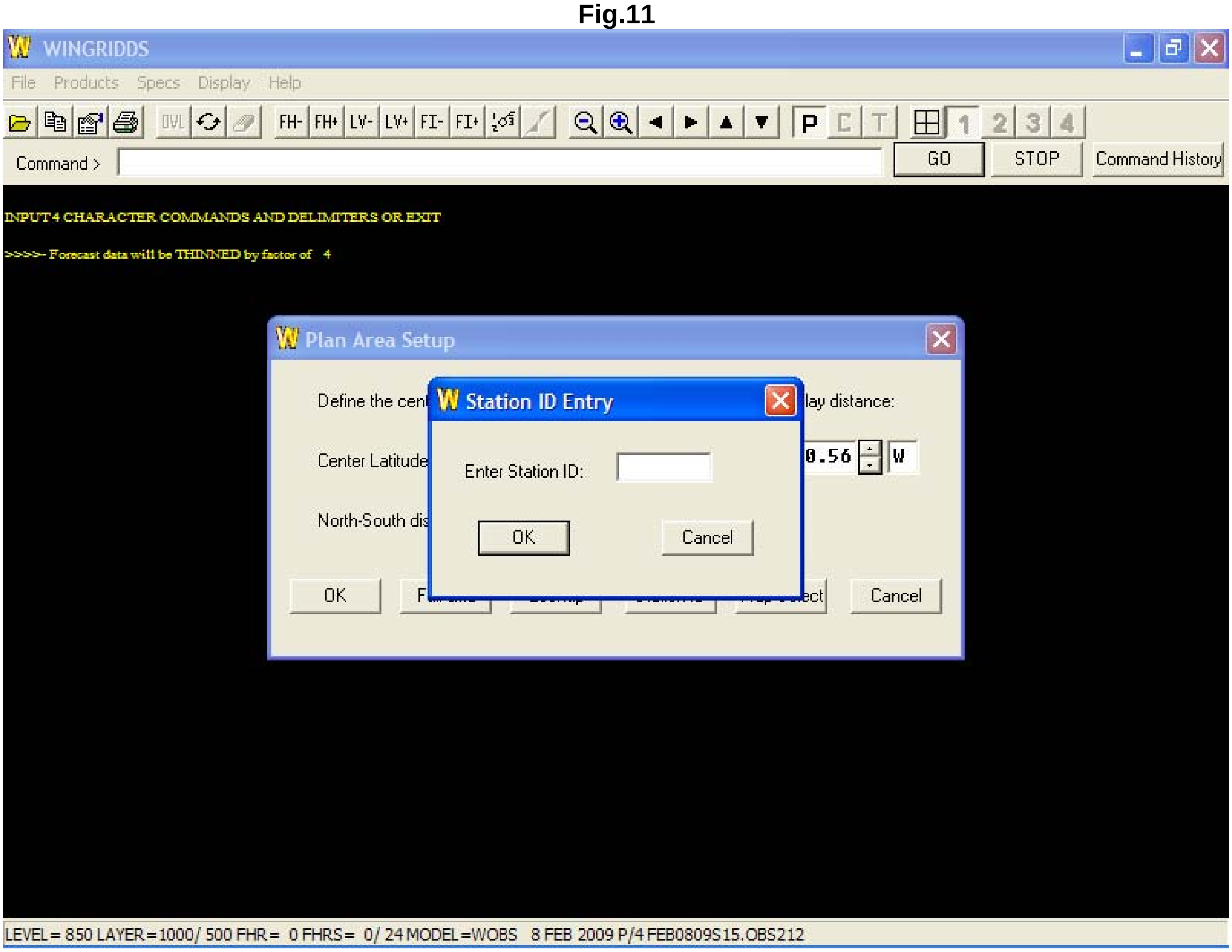
2. Type a 3 or 4 character station id in the field.

3. Click **[OK]**.
   Retrieves the parameters for the station id and enters them into the form.

4. **When** you are using the station id list to define a **plan view**, you **must** type in the N-S display distance manually if you want it changed from the current setting.

5. Click **[OK]**.
   Saves the values you set.

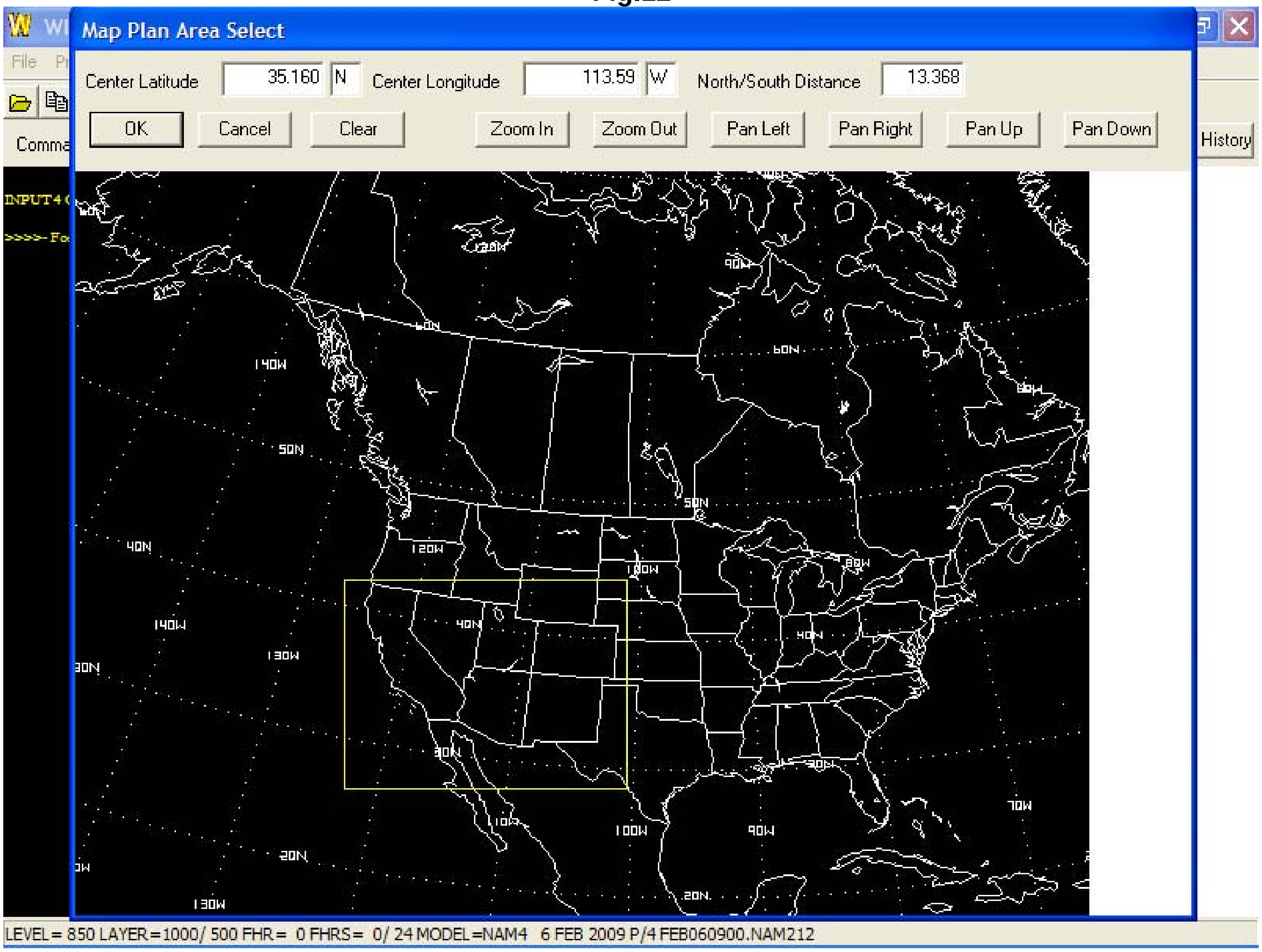
Fig.11



To select an entry from the Map Select (Fig.12)

1. Click **[Map Select]**.
   Activates the Map Plan Section Select Window. A list of display mode options are shown on the screen.

Fig.12



As the mouse is moved within the Map Select window, the '*Center Latitude'* and '*Center Longitude*' numbers will dynamically change to show the location of the mouse pointer. The '*Zoom*' and '*Pan*' buttons allow the user to change the geographic area shown in the window for more accurate area selection.

2. To create a Plan Area selection, click and hold the left mouse button. When you start to move the mouse, a rectangle will be drawn showing the Plan Area selection. Also, the '*Center Latitude'* and '*Center Longitude*' numbers will start showing the geographic center of the rectangle and the '*North/South Distance'* number will start to update the vertical distance of the rectangle (in degrees) as the mouse position is changed. When the mouse is moved to show the geographic area the user wants in the Plan Area, release the left mouse button and the Plan Area will be stored.

3. Click **[OK]** to save the Plan Area selection. The Selection Window will close.

   OR

4. Click **[CLEAR]** to undo the Plan Area selection and start again.

   OR

5. Click **[Cancel]** to close the Plan Area selection and clear any selection

For all three display modes, remember that you must click **[OK]** to save the values you have set. WINGRIDDS will define the new display mode and make it active. After this process is completed, a map is displayed on the screen showing the current plan view definition. The position of the cross-section line and the time-section point are indicated on the map if they are defined and lie within the map area.

Define the Cross Section Mode

After clicking on the desired mode**,** the current latitude and longitude parameters that define the selected display mode are displayed in a form (Fig.13). You can use one of four methods to modify these parameters.

To enter a value (Fig.13)

1. Click in the desired field with the mouse to highlight the value.

2. Type the value of the desired latitude or longitude in degrees.
   Degrees may be expressed as a positive integer value or as a positive real value.

   OR

   Click on the up-down arrows to increment or decrement the value in the window.

3. When direction is required, type one of the following characters to indicate the appropriate hemisphere: **N**, **S**, **W**, **E**.

The following entries are optional

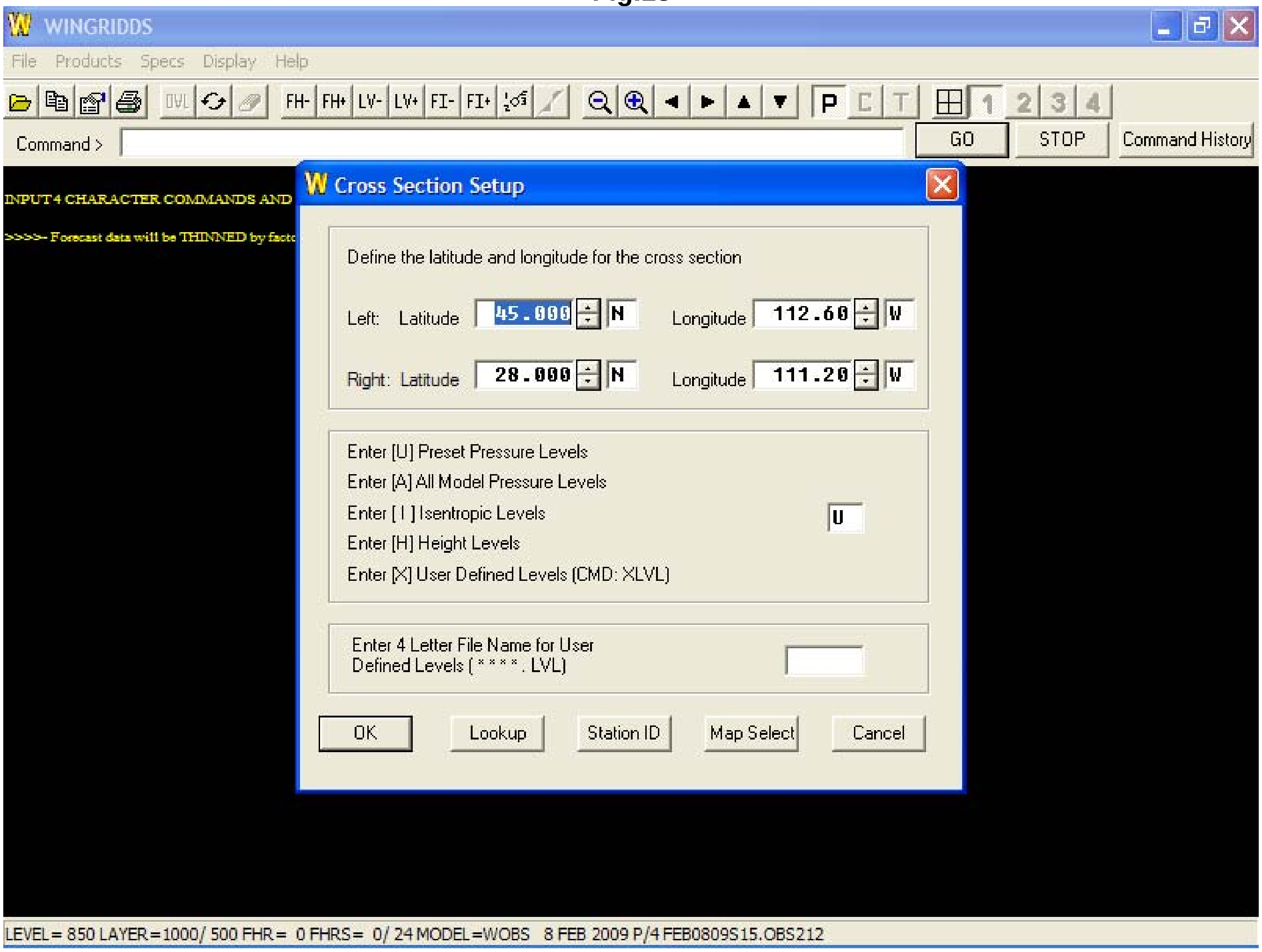
Accept default entries or-

4. Enter ‘U’ to display the Preset pressure levels listed the **INITGRID.SPC** file or enter ‘A’ to display all pressure levels in the current data file or enter ‘I’ to calculate data on Isentropic levels or enter ‘H’ to calculate data on height levels in feet or meters or enter ‘X’ to use a user defined file which is entered next.

5. Enter the 4-letter file name which contains the user defined pressure levels.

6. Click **[OK]**.
   Saves the values you set.

Fig.13


WINGRIDDS
File Products Specs Display Help
Command >
GO
STOP
Command History
INPUT 4 CHARACTER COMMANDS AND
>>>>- Forecast data will be THINNED by facto
Cross Section Setup
Define the latitude and longitude for the cross section
Left: Latitude 45.000 N Longitude 112.60 W
Right: Latitude 28.000 N Longitude 111.20 W
Enter [U] Preset Pressure Levels
Enter [A] All Model Pressure Levels
Enter [I] Isentropic Levels
Enter [H] Height Levels
Enter [X] User Defined Levels (CMD: XLVL)
U
Enter 4 Letter File Name for User Defined Levels (* * * * . LVL)
OK
Lookup
Station ID
Map Select
Cancel
LEVEL= 850 LAYER=1000/ 500 FHR= 0 FHRS= 0/ 24 MODEL=WOBS 8 FEB 2009 P/4 FEB0809S15.OBS212

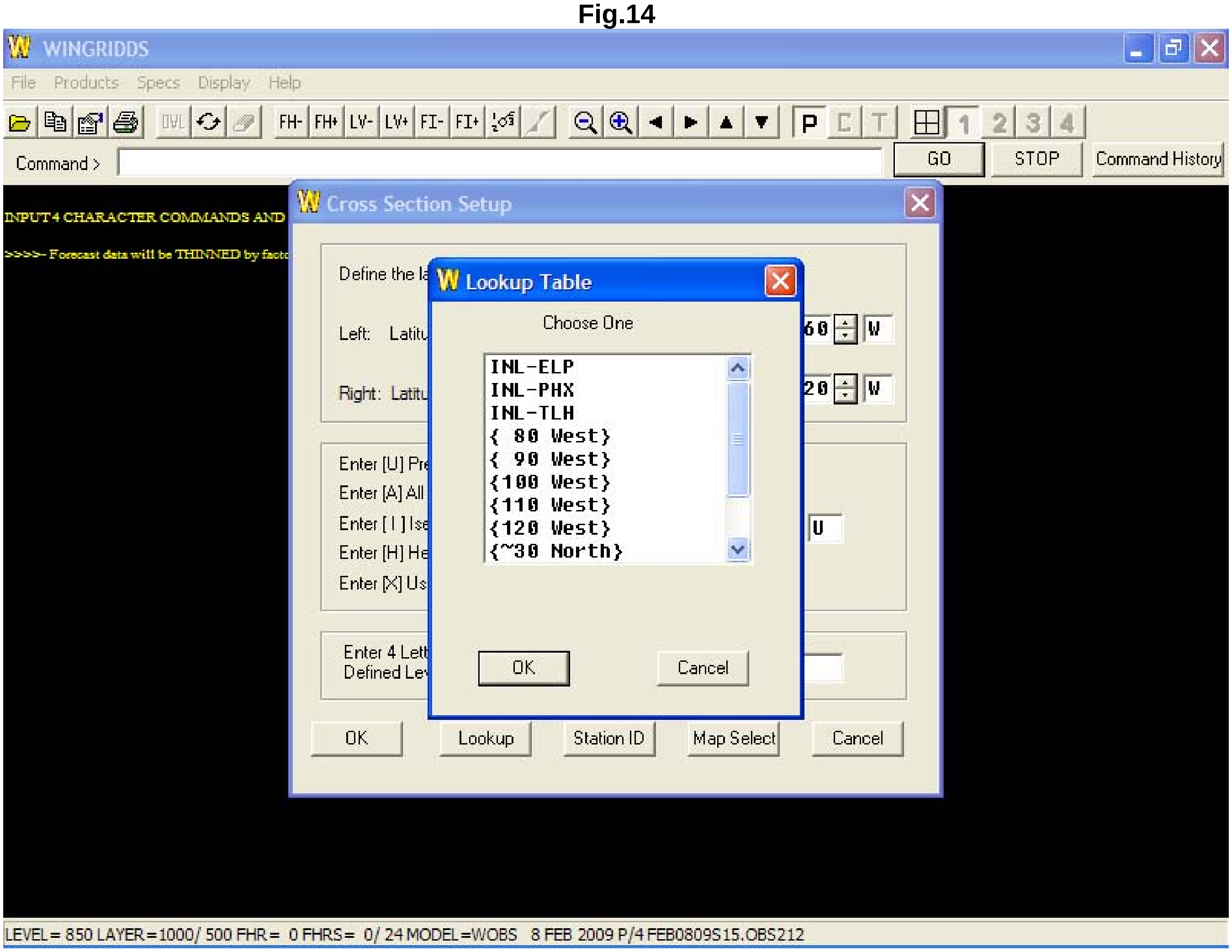
To select an entry from the Lookup table (Fig.14)

1. Click **[Lookup]**.
   Activates the lookup menu. A list of display mode definitions is shown on the screen.

2. Double-click to select the entry immediately or single-click the entry.
   Remember the table may contain multiple pages.

3. Click **[OK]**.
   Saves the values you set.

Fig.14



To add entries into the Lookup Table refer to '*Customizing WINGRIDDS*'.

To select an entry from the Station ID list (Fig.15)

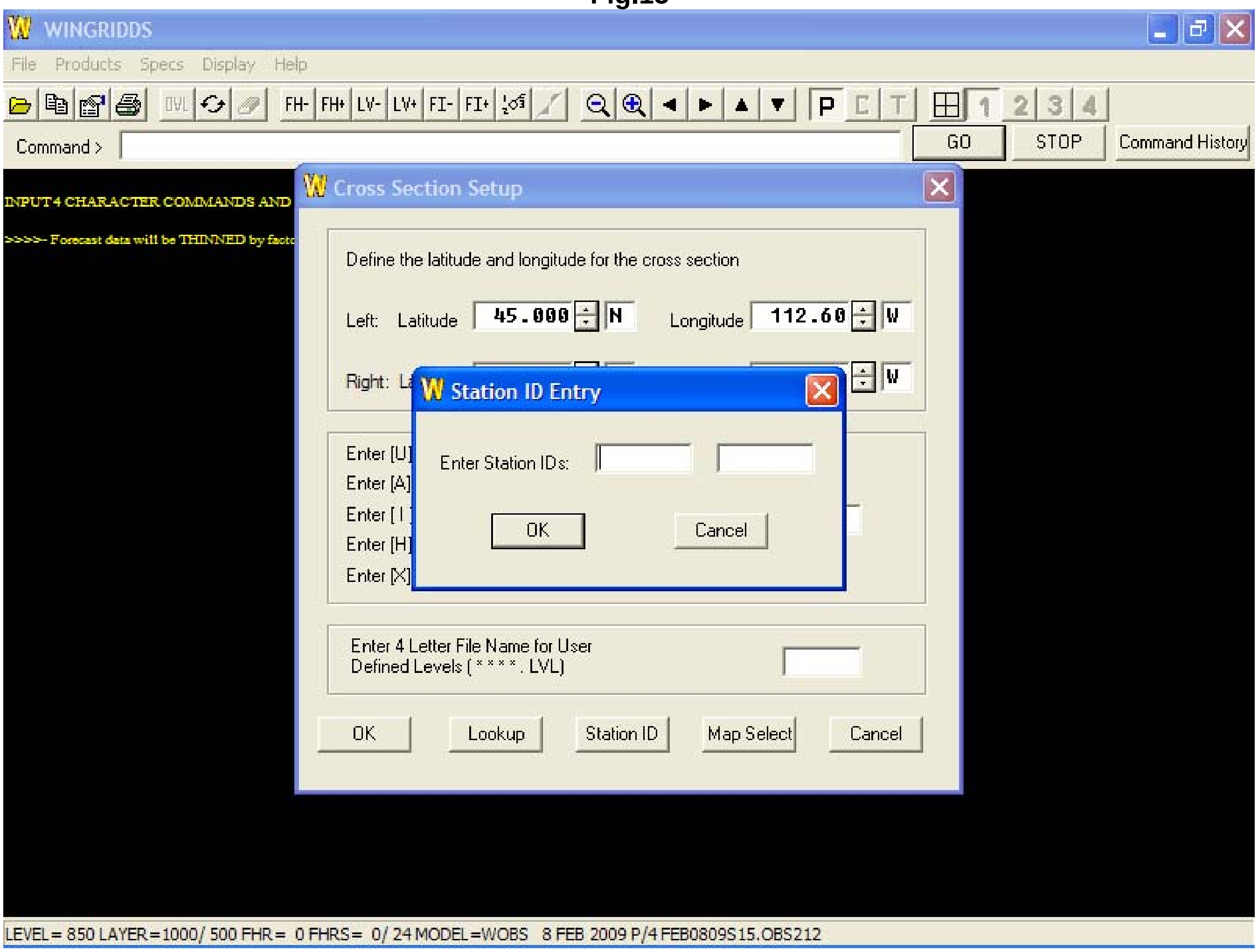
1. Click **[Station ID].**
   Activates selection by station identifier (id). A request for one or more station id's appears on the screen.

2. Type a 3 or 4 character station id in the field.
   If there is a second field, position the cursor to the next field using the **[Tab]** key and type a second station id.

3. Click **[OK]**.
   Retrieves the parameters for the station id and enters them into the form.

4. Click **[OK]**.
   Saves the values you set.

Fig.15

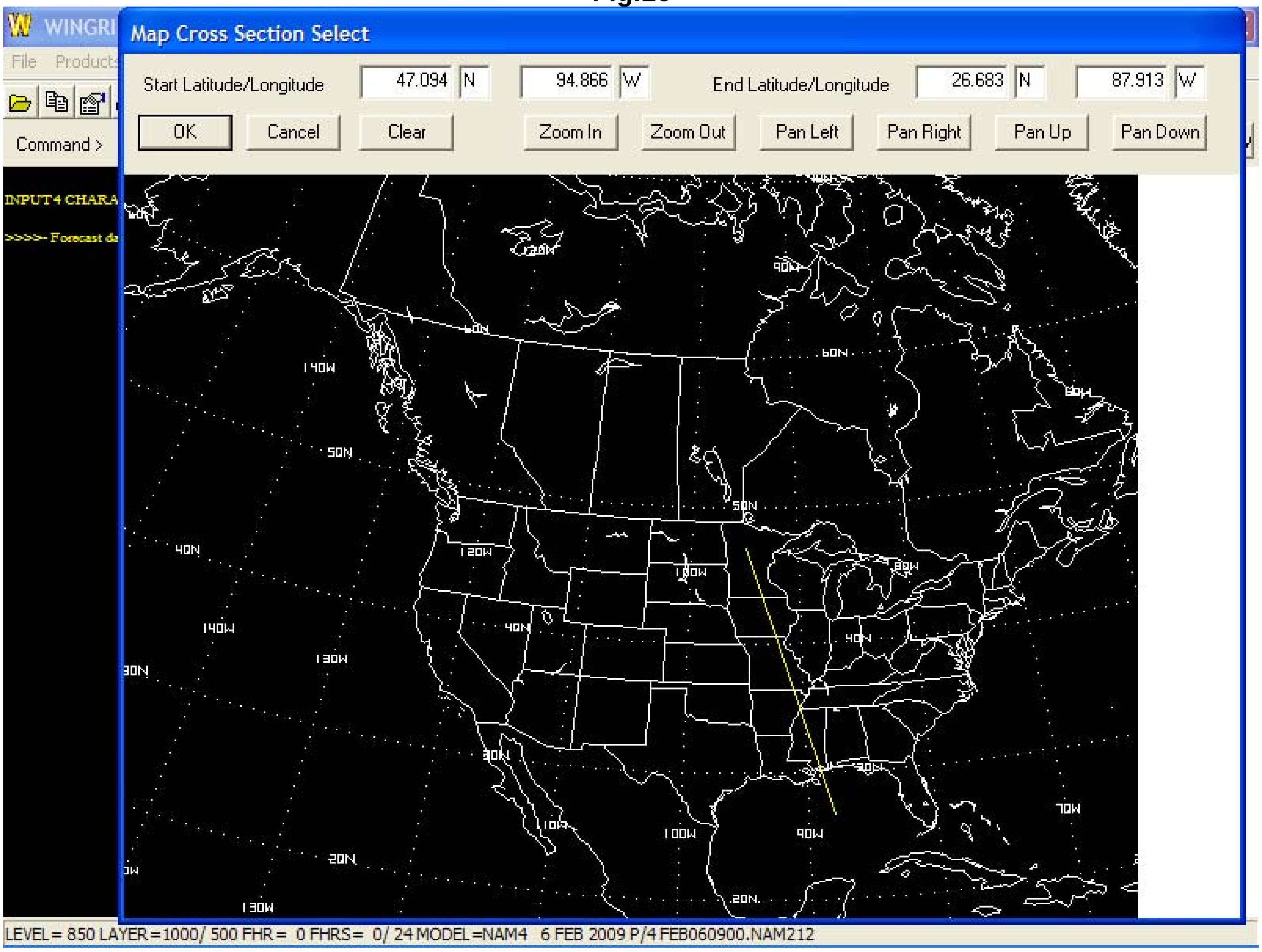


To select an entry from the Map Select (Fig.16)

1. Click **[Map Select]**.

   Activates the Map Cross Section Select Window. A list of display mode options are shown on the screen.

Fig.16



As the mouse is moved within the Map Select window, the '*Start Latitude/Longitude*' numbers will dynamically change to show the location of the mouse pointer. The '*Zoom*' and '*Pan*' buttons allow the user to change the geographic area shown in the window for more accurate area selection.

2. To create a Cross-Section selection, click and hold the left mouse button. When you start to move the mouse, a line will be drawn showing the Cross-Section selection. Also, the '*Start Latitude/Longitude*' numbers will be frozen at the first click-point. Now, the '*End Latitude/Longitude*' numbers will start to update the mouse position. When the mouse is moved to the geographic area the user wants the Cross-Section to end, release the left mouse button and the Cross-Section line will be stored.

3. Click **[OK]** to save the Cross-Section selection. The Selection Window will close.

   OR

4. Click **[CLEAR]** to undo the Cross-Section selection and start again.

   OR

5. Click **[Cancel]** to close the Cross-Section selection and clear any selection.

Note: You can define cross-section lines and time-section points that fall outside the plan view display area but within the area covered by the currently active gridded data set. However, they are not displayed on the plan view map.

If both ends of the cross-section line or the time-section point fall outside the area covered by the currently active gridded data set, then the definition points for that display mode are canceled and you are returned to the plan view display mode.

Define the Time Section Mode

After clicking on the desired mode**,** the current latitude and longitude parameters that define the selected display mode are displayed in a form (Fig.17). You can use one of four methods to modify these parameters.

To enter a value (Fig.17)

1. Click in the desired field with the mouse to highlight the value.

2. Type the value of the desired latitude or longitude in degrees.
   Degrees may be expressed as a positive integer value or as a positive real value.

   OR

   Click on the up-down arrows to increment or decrement the value in the window.

3. When direction is required, type one of the following characters to indicate the appropriate hemisphere: **N**, **S**, **W**, **E**.

The following entries are optional

Accept default entries or-

4. Enter ‘U’ to display the Preset pressure levels listed the **INITGRID.SPC** file or enter ‘A’ to display all pressure levels in the current data file or enter ‘I’ to calculate data on Isentropic levels or enter ‘H’ to calculate data on height levels in feet or meters or enter ‘X’ to use a user defined file which is entered next.

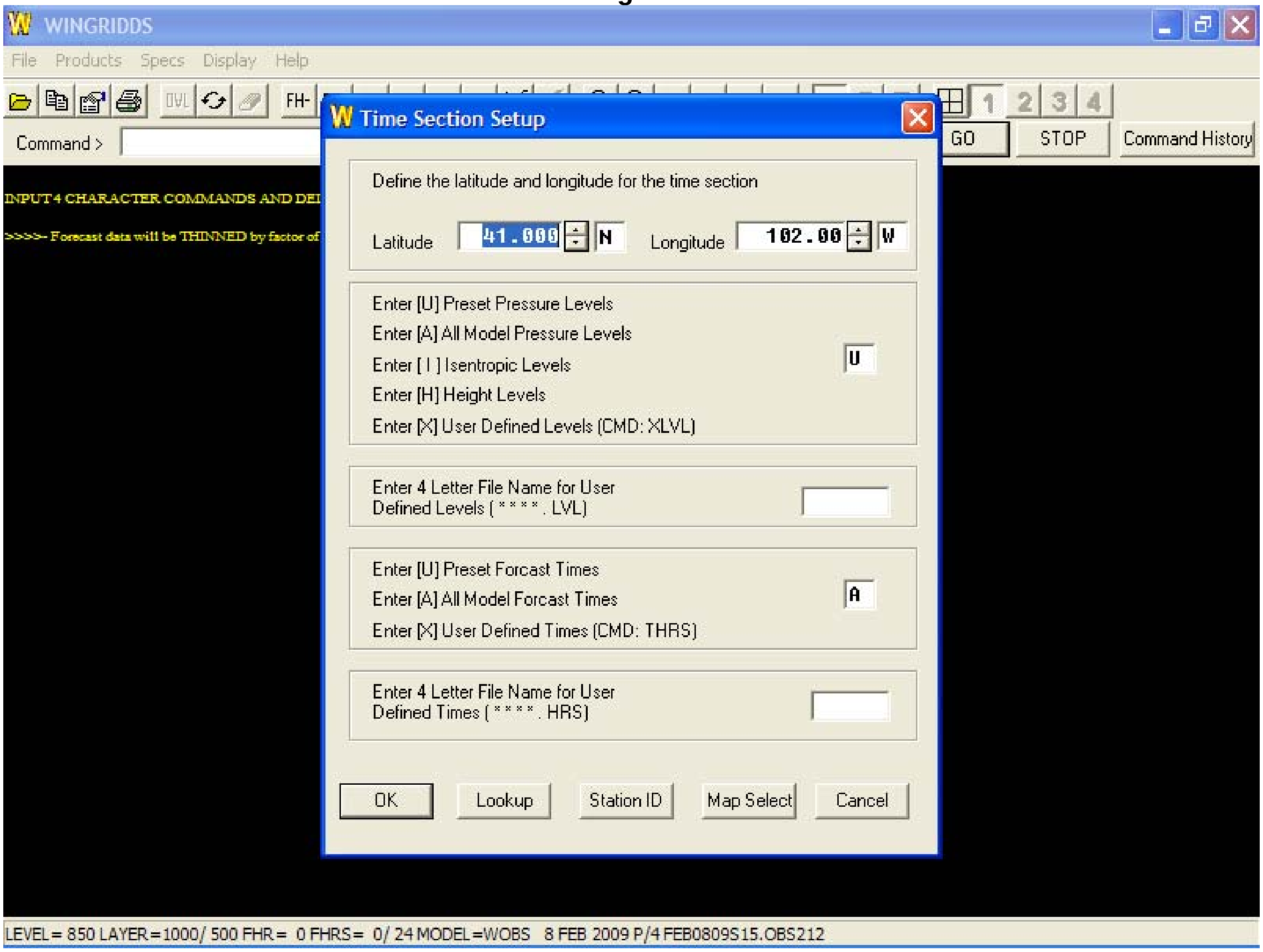
5. Enter the 4-letter file name which contains the user defined pressure levels.

6. Enter ‘U’ to display the Preset forecast hours listed the **INITGRID.SPC** file or enter ‘A’ to display all forecast hours in the current data file or enter ‘X’ to use a user defined file which is entered next.

7. Enter the 4-letter file name which contains the user defined forecast hours.

8. Click **[OK]**.
   Saves the values you set.

Fig.17


WINGRIDDS
File Products Specs Display Help
Command >
GO
STOP
Command History
INPUT 4 CHARACTER COMMANDS AND DEI
>>>>- Forecast data will be THINNED by factor of
Time Section Setup
Define the latitude and longitude for the time section
Latitude 41.000 N Longitude 102.00 W
Enter [U] Preset Pressure Levels
Enter [A] All Model Pressure Levels
Enter [I] Isentropic Levels
Enter [H] Height Levels
Enter [X] User Defined Levels (CMD: XLVL)
U
Enter 4 Letter File Name for User Defined Levels (* * * * . LVL)
Enter [U] Preset Forcast Times
Enter [A] All Model Forcast Times
Enter [X] User Defined Times (CMD: THRS)
A
Enter 4 Letter File Name for User Defined Times (* * * * . HRS)
OK
Lookup
Station ID
Map Select
Cancel
LEVEL= 850 LAYER=1000/ 500 FHR= 0 FHRS= 0/ 24 MODEL=WOBS 8 FEB 2009 P/4 FEB0809S15.OBS212

To select an entry from the lookup table (Fig.18)

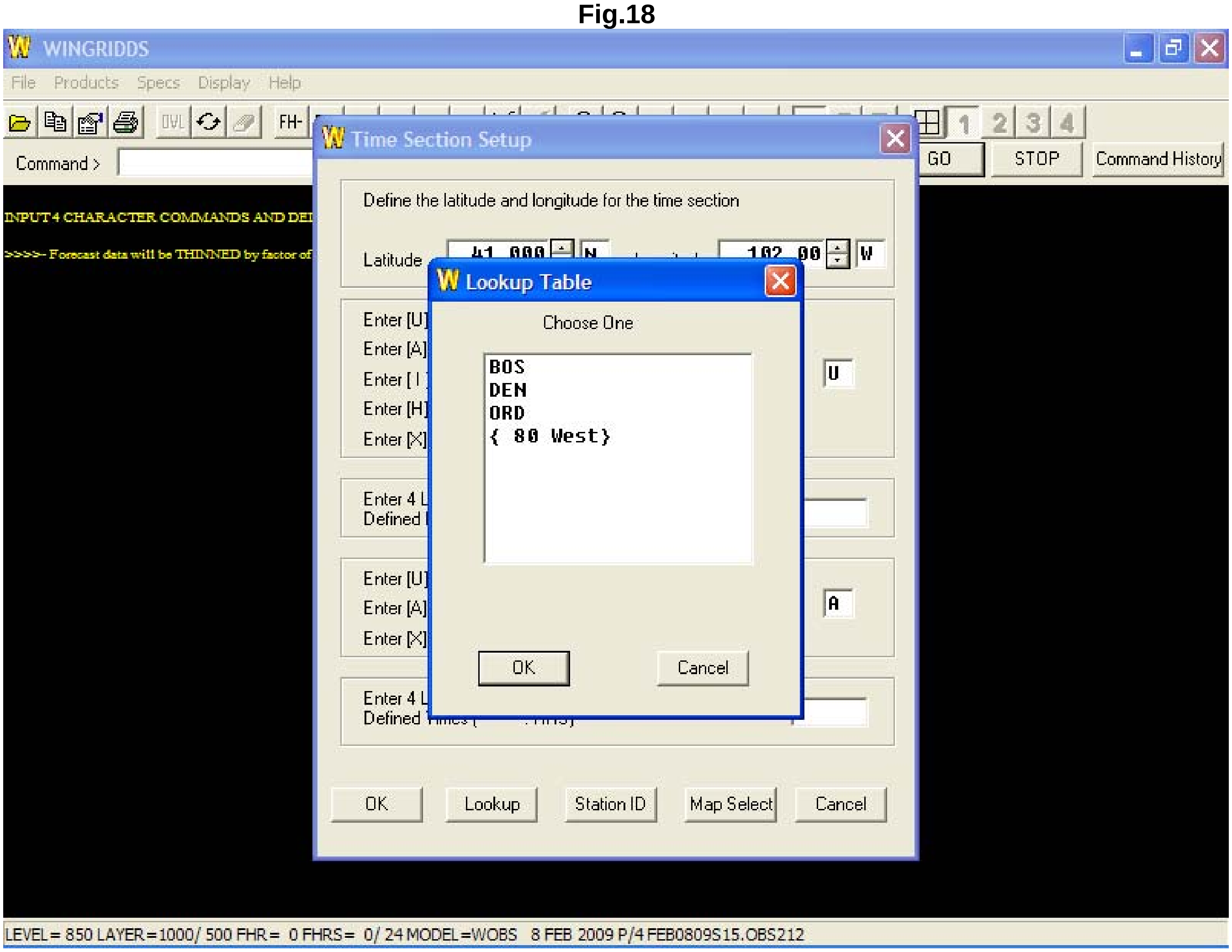
1. Click **[Lookup]**.
   Activates the lookup menu. A list of display mode definitions is shown on the screen.

2. Double-click to select the entry immediately or single-click the entry.
   Remember the table may contain multiple pages.

3. Click **[OK]**.
   Saves the values you set.

4. Click **[OK]**.
   Saves the values you set.

Fig.18



To add entries into the Lookup Table refer to '*Customizing WINGRIDDS*'.

To select an entry from the station id list (Fig.19)

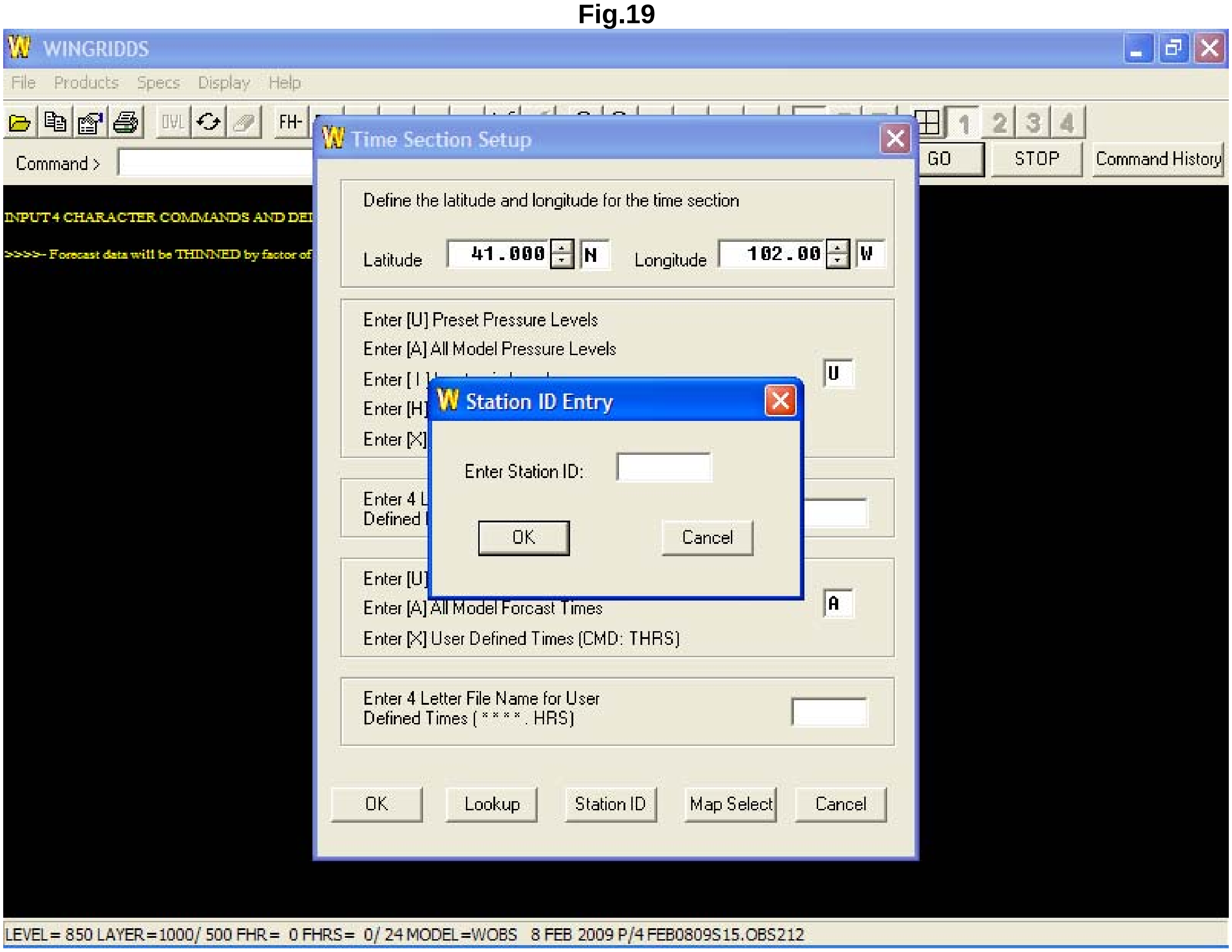
1. Click **[Station ID].**
   Activates selection by station identifier (id). A request for one or more station id's appears on the screen.

2. Type a 3 or 4 character station id in the field.

3. Click **[OK]**.
   Retrieves the parameters for the station id and enters them into the form.

4. Click **[OK]**.
   Saves the values you set.

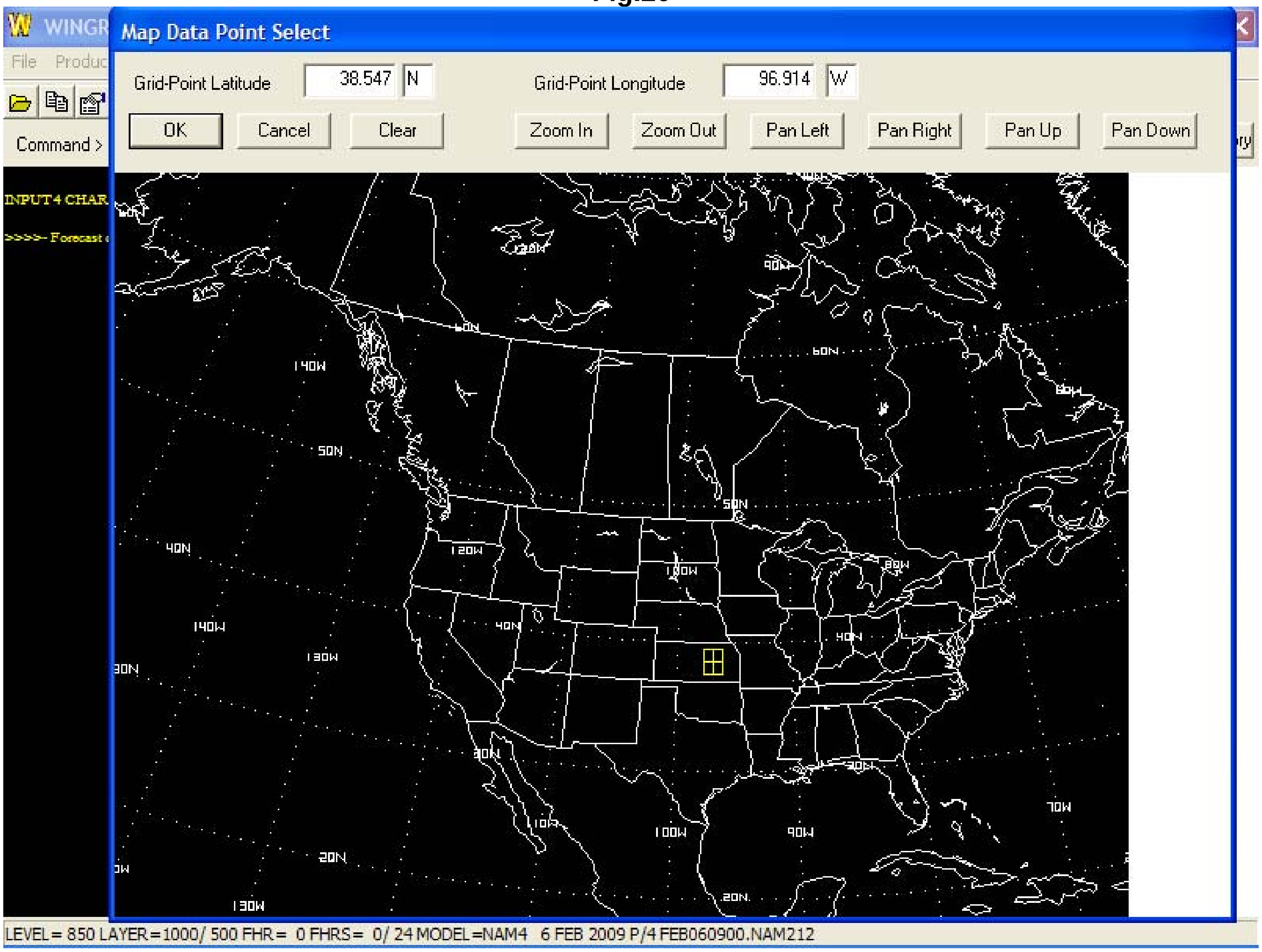
Fig.19



To select an entry from the Map Select (Fig.20)

1. Click **[Map Select]**.
   Activates the Map Time Section Select Window. A list of display mode options are shown on the screen.

Fig.20



As the mouse is moved within the Map Select window, the '*Grid-Point Latitude'* and '*Grid-Point Longitude*' numbers will dynamically change to show the location of the mouse pointer. The '*Zoom*' and '*Pan*' buttons allow the user to change the geographic area shown in the window for more accurate area selection.

2. To create a Time-Section selection, move the mouse around to the geographic area you wish the point to be. A single left mouse button click will store the location and the '*Grid-Point Latitude'* and '*Grid-Point Longitude*' numbers will no longer update when the mouse is moved.

3. Click **[OK]** to save the Time-Section selection. The Selection Window will close.

   OR

4. Click **[CLEAR]** to undo the Time -Section selection and start again.

   OR

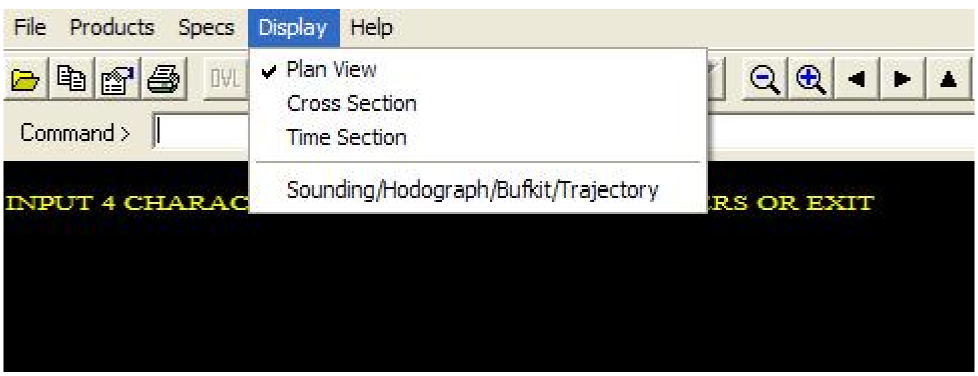
5. Click **[Cancel]** to close the Time -Section selection and clear any selection.

Note: You can define cross-section lines and time-section points that fall outside the plan view display area but within the area covered by the currently active gridded data set. However, they are not displayed on the plan view map.

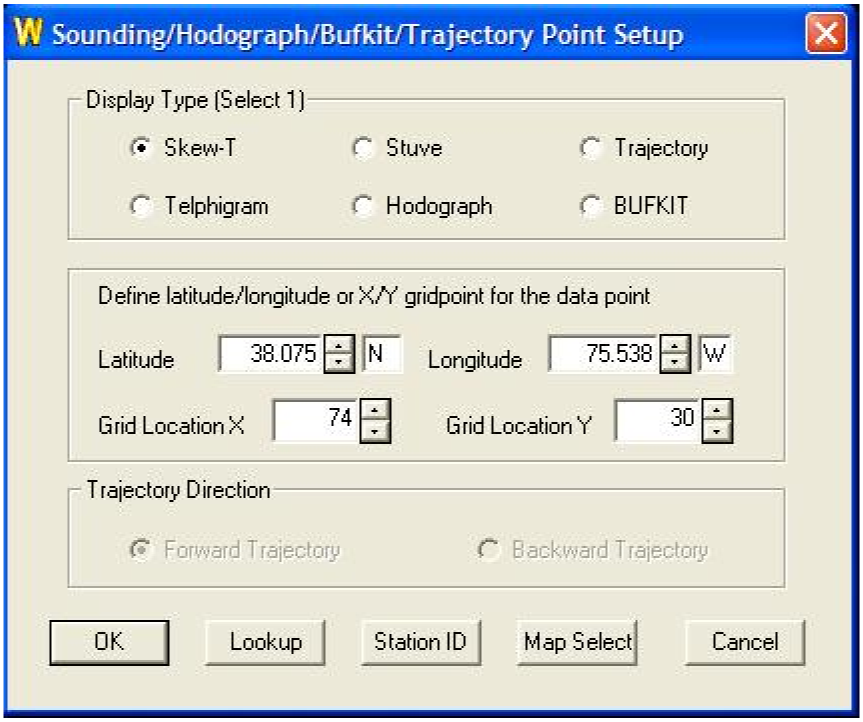
If both ends of the cross-section line or the time-section point fall outside the area covered by the currently active gridded data set, then the definition points for that display mode are canceled and you are returned to the plan view display mode.

Sounding/Hodograph/BUFKIT/Trajectory Point Setup

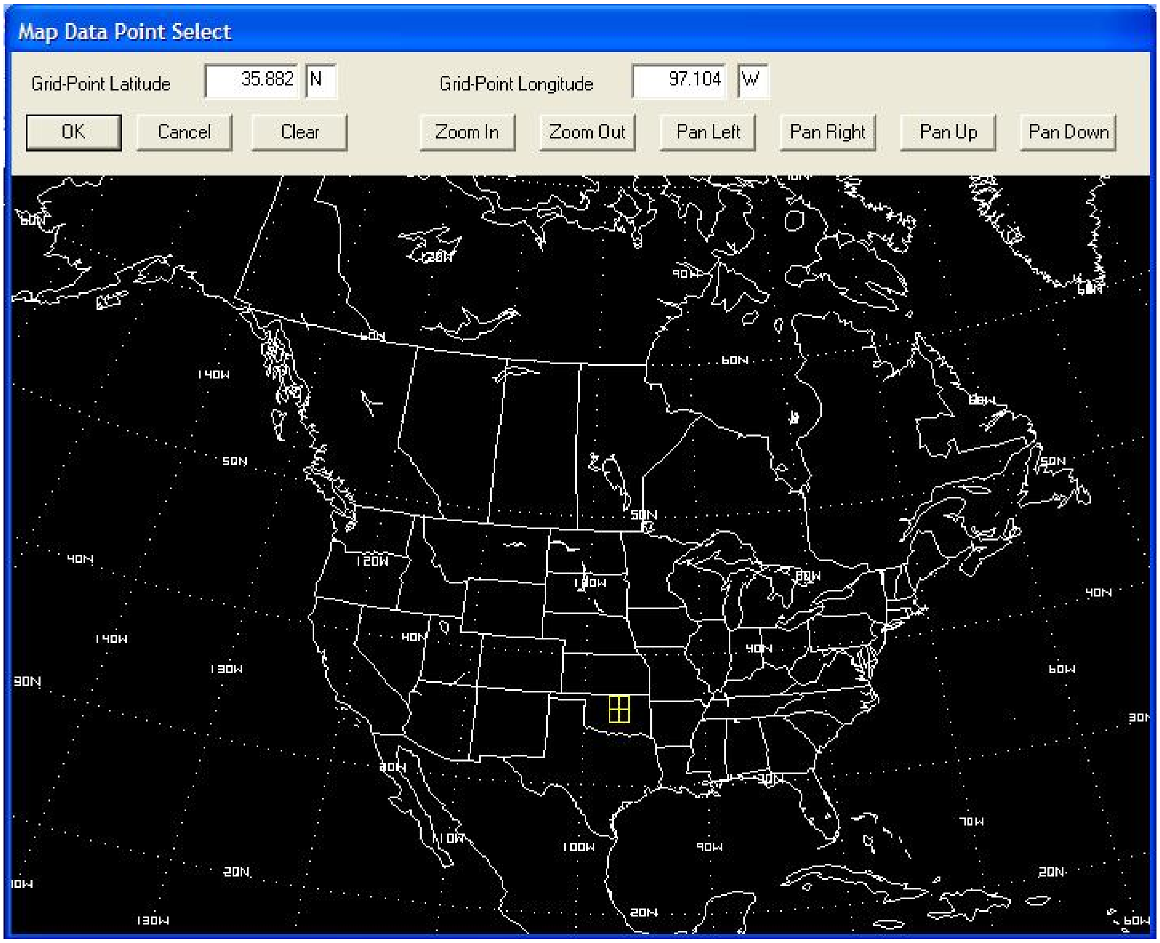
The WINGRIDDS 'Display' menu has an entry added at the bottom. There is a common dialog which is used to select a Sounding, Hodograph, Bufkit generation or Trajectory display. These are grouped together because they all show data from a single grid point or location. WINGRIDDS *must* be in 'Plan' view to create any of these displays.



The following dialog is displayed whenever the 'Sounding/Hodograph/Bufkit/Trajectory' menu selection is chosen.



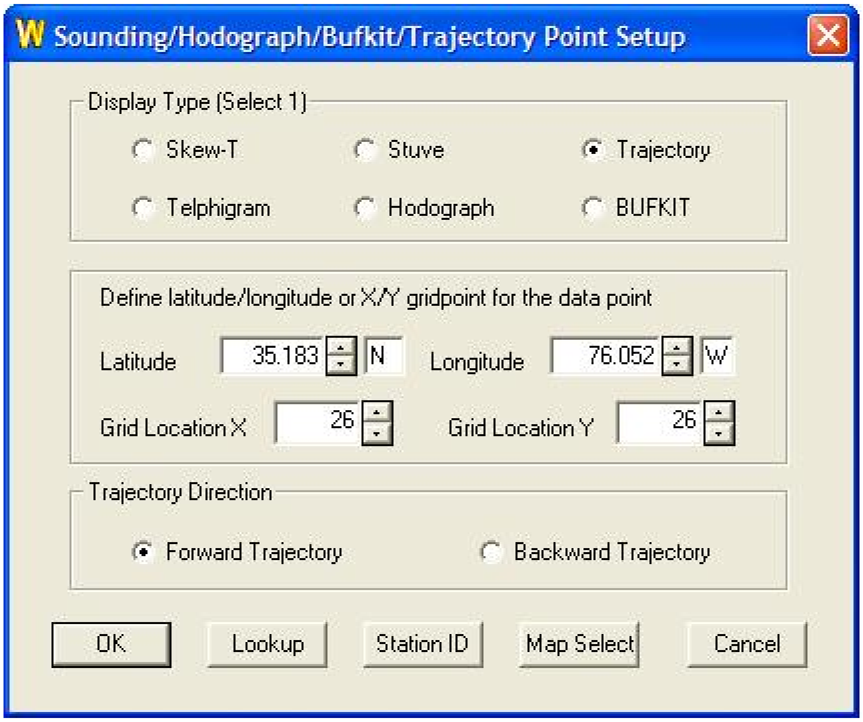
Within this dialog, the user can choose one type of display operation at a time. Each type of display (Sounding [Skew-T, Telphigram & Stuve], Hodograph, Bufkit & Trajectory) can store it's own separate location information and the last location used will be saved. As the Latitude or Longitude is changed, the Grid X/Y location is updated to reflect the new location and vice-versa. The 'Lookup' and 'Station ID' buttons work the same as on the 'Time Section Select' dialog. The new button (also on the 'Plan', 'Cross' & 'Time' dialogs but covered in their own section) is the 'Map Select' button. See below:



The ‘Map Data Point Select’ window opens and allows the user to graphically select the grid-point location for the operation requested. This works as follows; when the window opens, the full grid area is shown. As the user moves the mouse curser across the screen, the grid-point latitude and longitude dynamically update to show the real-time position of the curser. The user can pan around or zoom in or out using the buttons across the top. The selection of a point for use is made with the *single* left-click of the mouse. At that point, the grid-point locations are frozen at that location. If the user does not want that location and wishes to choose another, click the ‘Clear’ button and start again. If the user wishes to just cancel from the Map Select operation all together and reject any selection, click the ‘Cancel’ button. However, if the user has selected a valid location, click the ‘OK’ button. The window will close and the location information will be transferred to the Setup dialog.

Once the location and display type is selected in the Setup dialog, clicking the ‘OK’ button will cause the requested display or operation to be executed.

If a Trajectory display has been selected, the ‘Trajectory Direction’ selection area will be enabled as seen below:



Since trajectories can be computed in either forward direction (where the wind parcel is moving to) or backward direction (where the wind parcel is moving from), the selection should be made by the user. The default selection is a 'Forward Trajectory'.

Sounding Displays

WINGRIDDS can produce 3 different types of sounding displays and they apply for either model data or observation data. The 3 displays are Skew-T, Telphigrams and Stuve displays. If model data is displayed, data from all levels (except boundary and sigma levels) will be displayed. If data is requested from an observation data file, 2 situations exists; if the data request is from a RAOB reporting station, the full RAOB report will be displayed. However, if the data request is from an area between reporting stations, only the interpolated gridded data will be displayed.

WINGRIDDS Commands

The Sounding displays can either be created using the menu dialog (above) or from the WINGRIDDS command line. Command-line location can be requested from either a Lat/Lon location, Grid-point X/Y location or Station ID. The commands for Skew-T plots are as follows:

`SKEW LAT25.82N LON80.28W`	> Lat/Lon location
`SKEW X71 Y13`	> Grid X/Y location
`SKEW STIDKMIA`	> Station ID selection

NOTICE – there is a space between command parameters *however* there are no spaces in the command parameters. "LAT25.82N" is all one continuous string with no spaces. This is the same for the longitude, the grid 'X' & 'Y' values as well as the Station ID. The Station ID (STID) should be the

4-letter WMO ID (KMIA).

The commands for Telphigram and Stuve plots are similar:

```
TEPH LAT25.82N LON80.28W        > Lat/Lon location
TEPH X71 Y13                    > Grid X/Y location
TEPH STIDKMIA                   > Station ID selection

STUV LAT25.82N LON80.28W        > Lat/Lon location
STUV X71 Y13                    > Grid X/Y location
STUV STIDKMIA                   > Station ID selection
```

Sounding Plots

The text within the sounding display is as follows from bottom to top:

MULPL – Most Unstable Lifted Parcel Level
MULCL - Most Unstable Lifted Condensation Level
MULFC - Most Unstable Level of Free Convection
WBZ – Wet Bulb Zero level
FRZLVL – Freezing Level
MUEQL - Most Unstable Equilibrium Level
TROPO – Tropopause (only displayed if listed in observation RAOB report)

Sounding Winds

Winds are displayed in 5 layers in height by color; 0-3km, 3-6km, 6-9km, 9-12km, above 12km

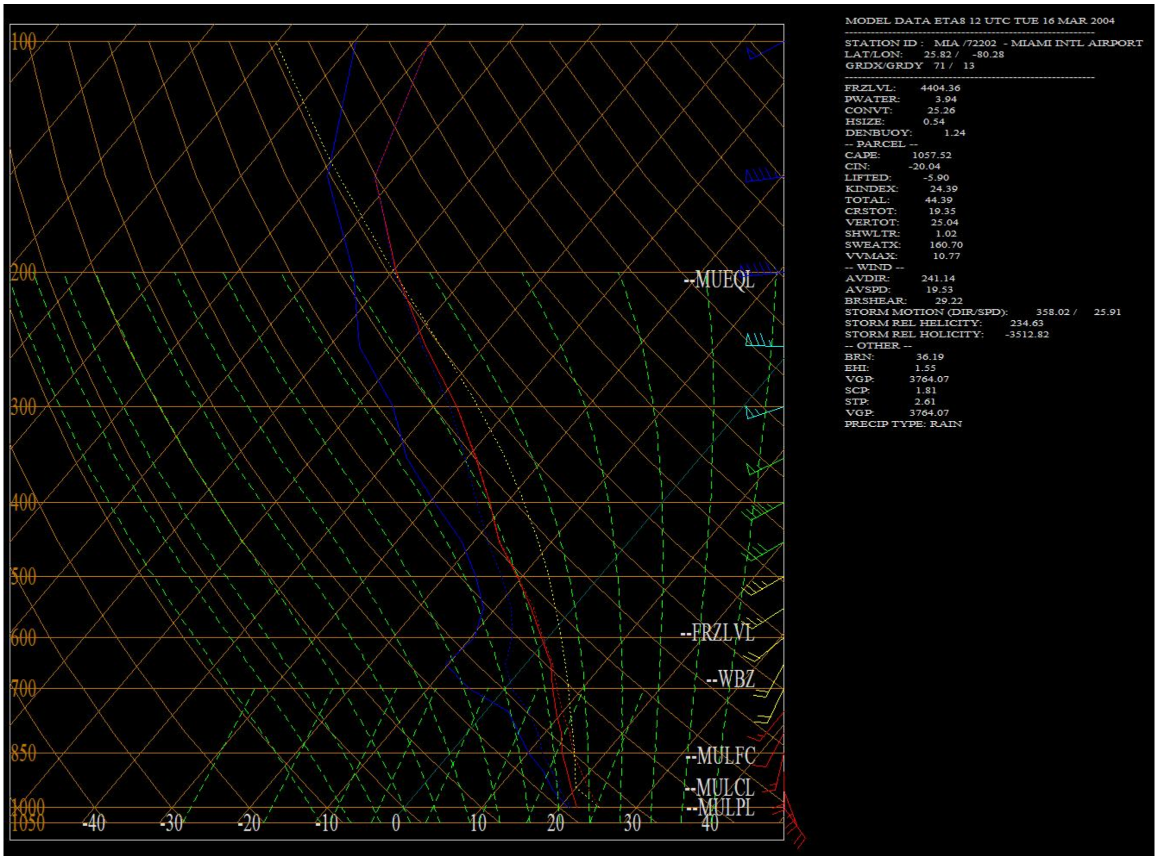
Sounding Plots

The following data are displayed (as referenced in the plot below): Temperature (solid red line), Virtual Temperature (dotted red line), Dew Point (solid blue line), Wet Bulb Temperature (dotted blue line), Parcel track (dotted yellow line). The line characteristics are fixed, the colors are selectable.

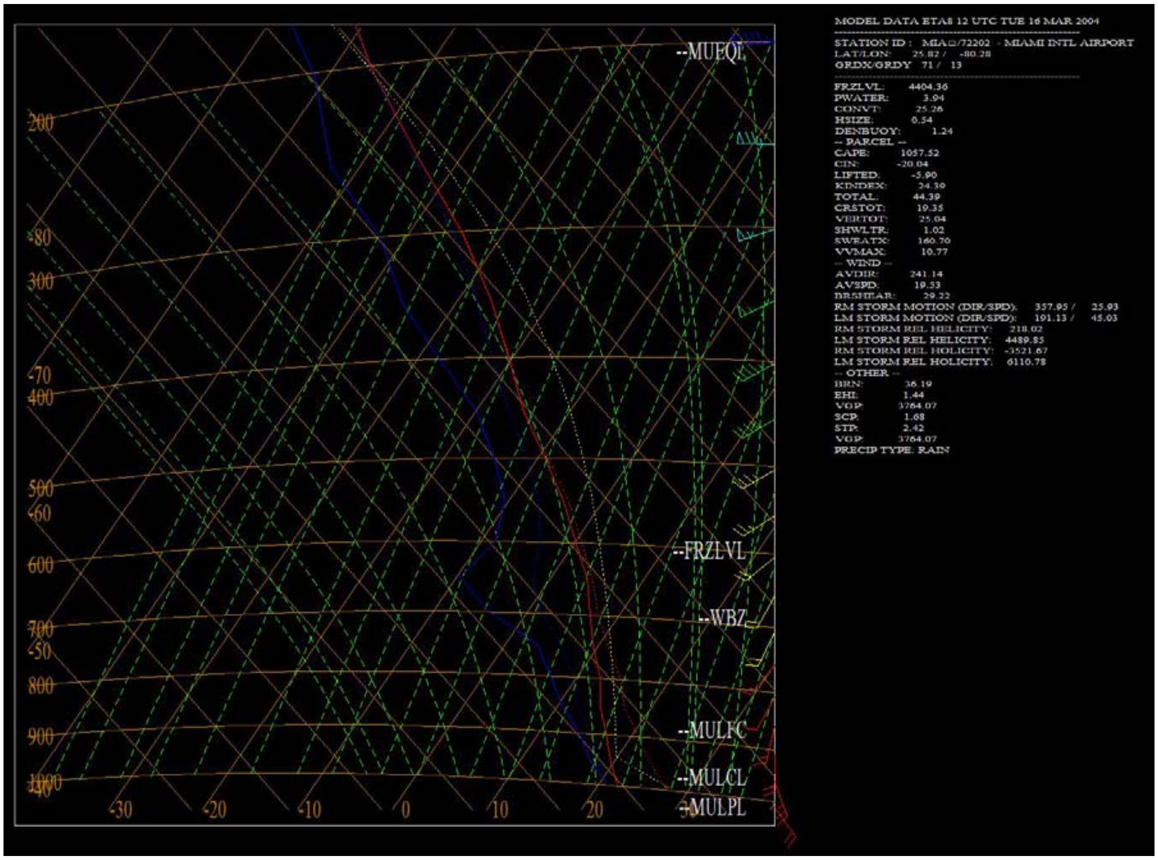
Sounding Text Information

```
MODEL DATA NAMA 00 UTC FRI 26 SEP 2008          > Model data – model name – Date-Time Group
----------------------------------------------------------
STATION ID :   MIA /72202  - MIAMI INTL AIRPORT  > Station Location Info
LAT/LON:      25.82 /    -80.28                   > Location Latitude and Longitude
GRDX/GRDY   71 /   13                             > Grid X/Y Location
----------------------------------------------------------
FRZLVL:       4696.99                             > Freezing Level (meters)
PWATER:          4.08                             > Precipitable Water (cm)
CONVT:         28.77                              > Convective Temperature
HSIZE:          1.12                              > calculated Hail Size
DENBUOY:         1.00                             > Density Buoyancy
-- PARCEL --
CAPE:          847.55                             > Convective Available Potential Energy
CIN:          -10.53                              > Convective Inhibition
LIFTED:         -3.57                             > Lifted Index (deg c)
KINDEX:         25.93                             > K Index
TOTAL:          40.92                             > Totals Index
```

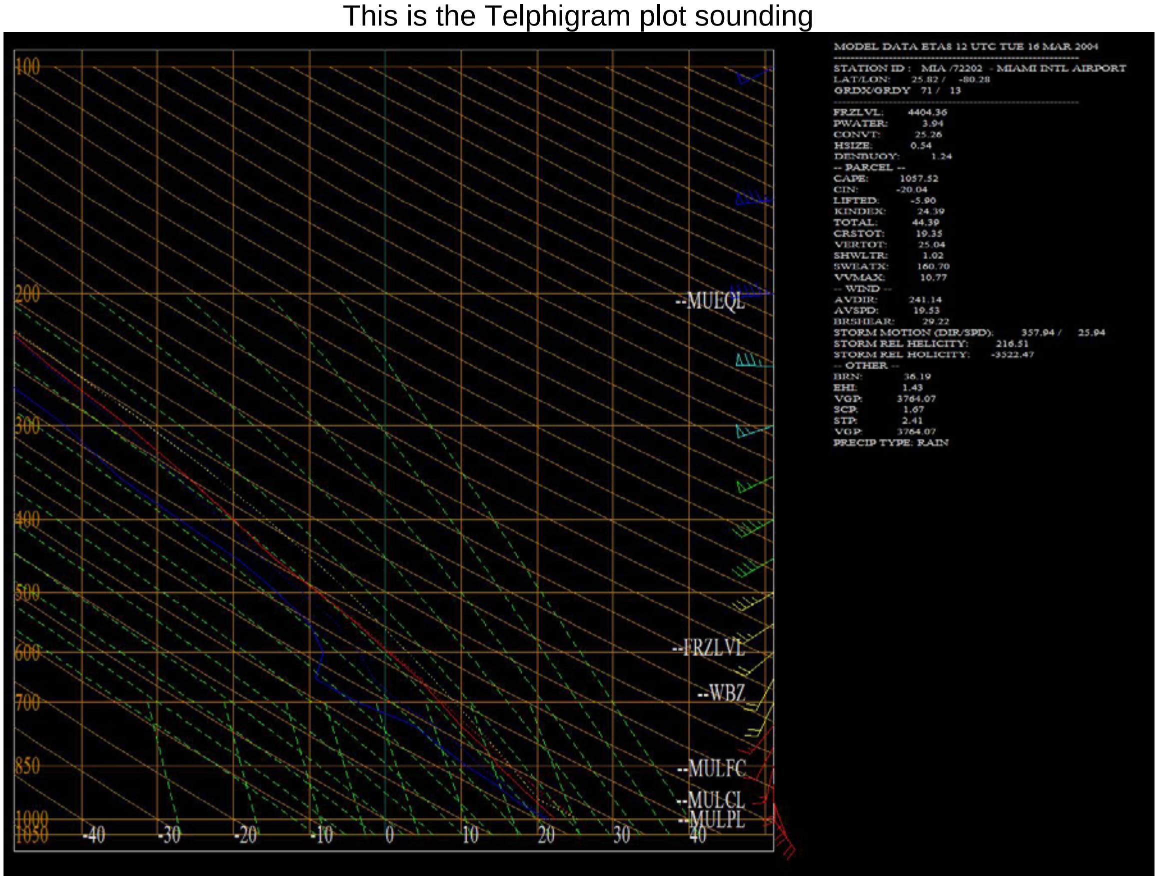
CRSTOT: 18.08 .> Cross Totals Index
VERTOT: 22.84 > Vertical Totals Index
SHWLTR: 1.88 > Showalter Index
SWEATX: 163.27 > SWEAT Index
VVMAX: 15.46 > Vertical Velocity Maximum (mps)
-- WIND --
AVG DIR: 247.19 > Average Wind Direction
AVG SPD: 12.62 > Average Wind Speed (kts)
BRSHEAR: 11.97 > Bulk Richardson Shear
STORM MOTION (DIR/SPD): 316.55 / 14.15 > Right-Moving Storm Motion
STORM REL HELICITY: -1664.46
STORM REL HOLICITY: -225.95
-- OTHER --
BRN: 70.81 > Bulk Richardson Number
EHI: -8.82 > Energy Helicity Index
VGP: 126.92 > Vorticity Generation Potential
SCP: -4.22 > Supercell Composite Parameter
STP: -5.78 > Significant Tornado Parameter
PRECIP TYPE: RAIN



This is the Skew-T plot sounding.



This is the Telphigram plot sounding



This is the Stuve plot sounding

Hodograph Displays

WINGRIDDS can produce hodograph displays and they apply for either model data or observation data. If model data is displayed, data from all levels (except boundary and sigma levels) will be displayed. If data is requested from an observation data file, 2 situations exists; if the data request is from a RAOB reporting station, the wind from the full RAOB report will be displayed. However, if the data request is from an area between reporting stations, only the interpolated gridded data will be displayed.

The wind speed rings are either dynamically scaled to the maximum wind speed so the whole display area is filled or they can be set to a fixed maximum wind. (refer to '*Customizing WINGRIDDS'*.)

WINGRIDDS Commands

The Hodograph displays can either be created using the menu dialog (above) or from the WINGRIDDS command line. Command-line location can be requested from either a Lat/Lon location, Grid-point X/Y location or Station ID. The commands for hodograph plots are as follows:

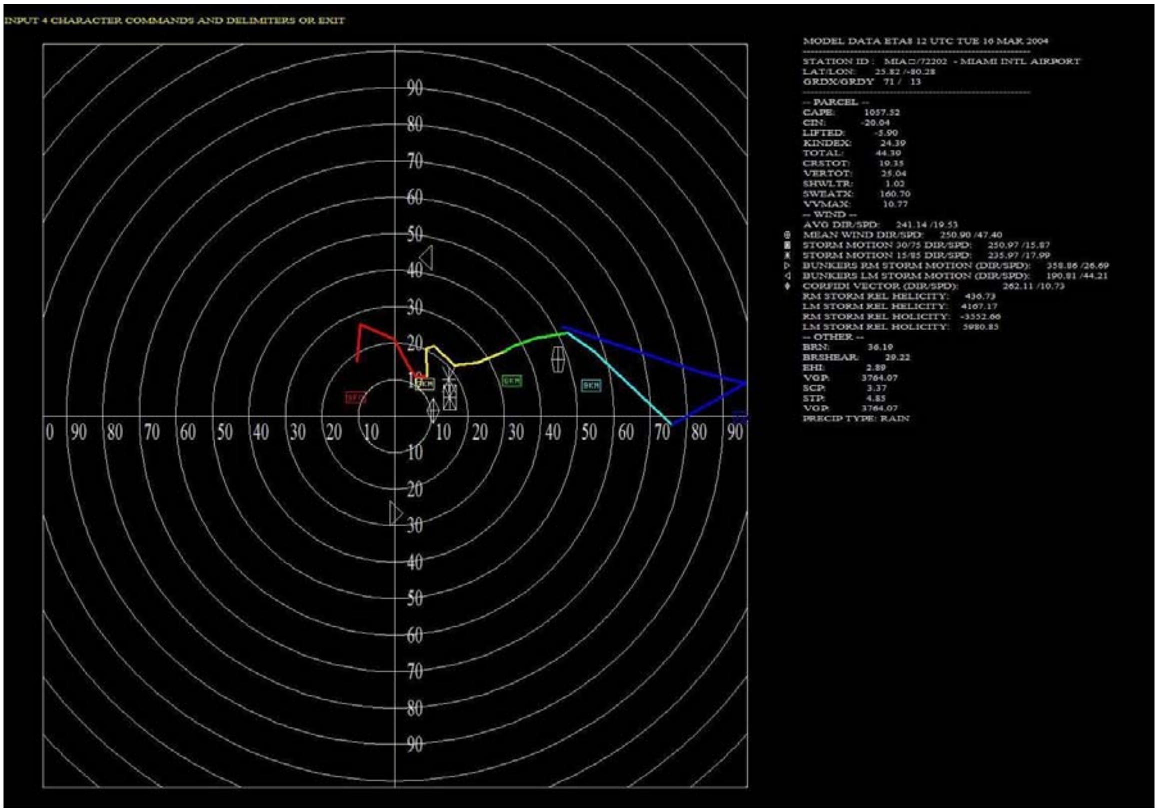
```
HODO LAT25.82N LON80.28W         > Lat/Lon location
HODO X71 Y13                     > Grid X/Y location
HODO STIDKMIA                    > Station ID selection
```

NOTICE – as with the sounding commands, there is a space between command parameters *however* there are no spaces in the command parameters. "LAT25.82N" is all one continuous string with no spaces. This is the same for the longitude, the grid 'X' & 'Y' values as well as the Station ID. The Station ID (STID) should be the 4-letter WMO ID (KMIA).

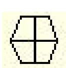
Hodograph Text Information

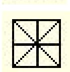
```
MODEL DATA NAMA 00 UTC FRI 26 SEP 2008              > Model data – model name – Date-Time Group
--------------------------------------------------------
STATION ID :  MIA /72202  - MIAMI INTL AIRPORT      > Station Location Info
 LAT/LON:     25.82 /   -80.28                      > Location Latitude and Longitude
 GRDX/GRDY   71 /  13                               > Grid X/Y Location
--------------------------------------------------------
-- PARCEL --
CAPE:        847.55                                 > Convective Available Potential Energy
 CIN:        -10.53                                 > Convective Inhibition
 LIFTED:      -3.57                                 > Lifted Index (deg c)
 KINDEX:      25.93                                 > K Index
 TOTAL:       40.92                                 > Totals Index
 CRSTOT:      18.08                                 .> Cross Totals Index
 VERTOT:      22.84                                 > Vertical Totals Index
 SHWLTR:       1.88                                 > Showalter Index
 SWEATX:     163.27                                 > SWEAT Index
 VVMAX:       15.46                                 > Vertical Velocity Maximum (mps)
 -- WIND --
 AVG DIR/SPD:    247.19 /12.62
 MEAN WIND DIR/SPD:    252.24 /28.00
 STORM MOTION 30/75 DIR/SPD:    254.00 /7.24
 STORM MOTION 15/85 DIR/SPD:    239.00 /8.20
 BUNKERS RM STORM MOTION (DIR/SPD):    316.55 /14.15
 BUNKERS LM STORM MOTION (DIR/SPD):    164.31 /14.86
 CORFIDI VECTOR (DIR/SPD):    262.11 /10.73
 RM STORM REL HELICITY:   -1664.46
```

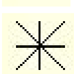
LM STORM REL HELICITY: -1041.40
RM STORM REL HOLICITY: -225.95
LM STORM REL HOLICITY: 1664.55
-- OTHER --
BRN: 70.81
BRSHEAR: 11.97
EHI: -8.82
VGP: 126.92
SCP: -4.22
STP: -5.78
VGP: 126.92
PRECIP TYPE: RAIN

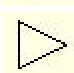


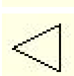
The following markers are present on the Hodograph display:

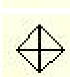
 - Mean Wind Direction/Speed Marker

 - Storm Motion 30/75 Direction/Speed Marker

 - Storm Motion 15/85 Direction/Speed Marker

 - Bunkers Right-Moving Storm Motion Direction/Speed Marker

 - Bunkers Left-Moving Storm Motion Direction/Speed Marker

 - Corfidi Vector

BUFKIT File Generation

WINGRIDDS can produce BUFKIT Data files and they apply for only model data. The files will be generated for each forecast hour from the gridded data file contents and any diagnostic commands which are required will be executed to create the needed data points. The BUFKIT Data file will be stored in the BUFKIT Destination Directory which is selected in the 'Properties' dialog (refer to '*Customizing WINGRIDDS'*).

WINGRIDDS BUFKIT Data File Naming Convention

The BUFKIT Data File naming style within WINGRIDDS uses the following convention:

XXXXXXXXX_YYYYYY.buf
Model Name   Location.buf

The Model name will be the 3-letter ID for the model used in WINGRIDDS. The Location can be either the Station ID, Lat/Lon point or the Grid X/Y point.

Therefore, for a Lat/Lon entry, the BUFKIT file name would be;
NAM_37.97N 75.69W.buf

or, for a Wallops Island, Va. Station ID entry, the BUFKIT file name would be;
NAM_KWAL.buf

or, for a Grid X/Y entry, the BUFKIT file name would be;
NAM_37X 75Y.buf

WINGRIDDS Commands

The BUFKIT Data files can either be created using the menu dialog (above) or from the WINGRIDDS command line. Command-line location can be requested from either a Lat/Lon location, Grid-point X/Y location or Station ID. The commands for BUFKIT Data file generation are as follows:

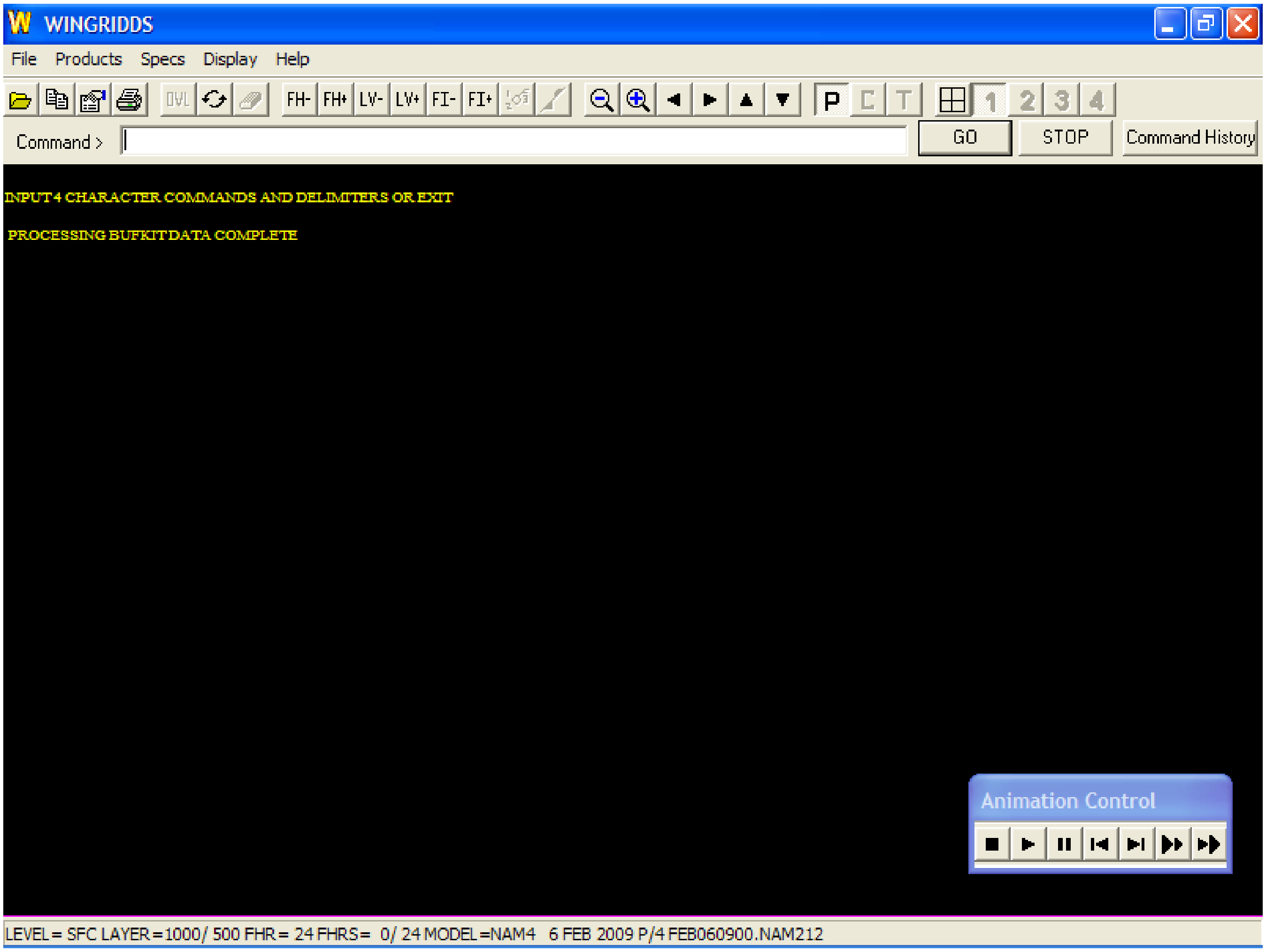
```
BUFK LAT25.82N LON80.28W          > Lat/Lon location
BUFK X71 Y13                      > Grid X/Y location
BUFK STIDKMIA                     > Station ID selection
```

NOTICE – as with the sounding commands, there is a space between command parameters *however* there are no spaces in the command parameters. "LAT25.82N" is all one continuous string with no spaces. This is the same for the longitude, the grid 'X' & 'Y' values as well as the Station ID. The Station ID (STID) should be the 4-letter WMO ID (KMIA).

When the BUFKIT Data File generation command is accepted, WINGRIDDS will go through each forecast hour of the currently opened model data file and process the required parameters and diagnostic calculations. The screen will show the progress of the process by showing the following message in the upper left corner of the screen;

PROCESSING BUFKIT DATA...PLEASE WAIT - FORECAST HOUR

With the forecast hours increasing till it reaches the end. At that time the screen will show the following:



Trajectory Display

WINGRIDDS can generate Trajectory plots which show the movement of air parcels over time in either the forward direction (parcel moving away from location) or backward direction (air moving toward the location). Trajectories are plotted on either constant pressure surfaces or constant theta (Isentropic) surfaces.

WINGRIDDS Commands

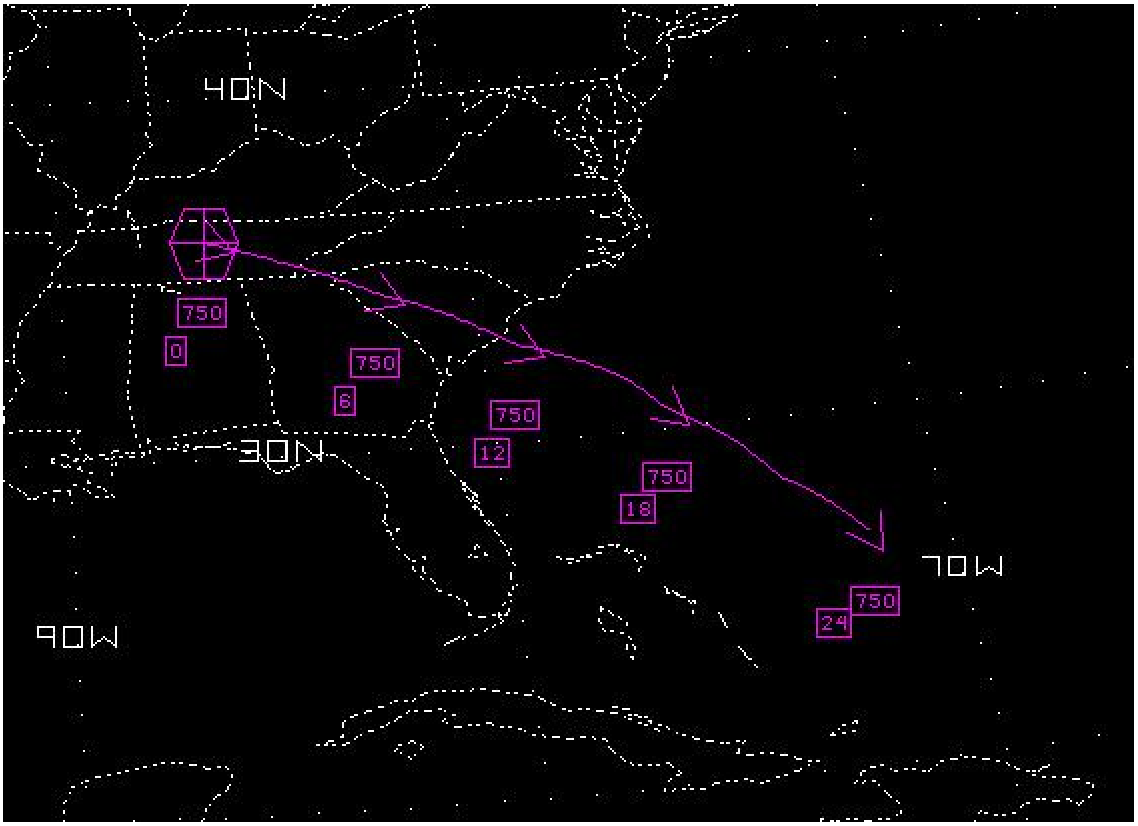
The Trajectory displays can either be created using the menu dialog (above) or from the WINGRIDDS command line. Command-line location can be requested from either a Lat/Lon location, Grid-point X/Y location or Station ID. The commands for trajectory plots are similar to the other grid-point plots but has an extra direction command as follows:

`TRAJ LAT25.82N LON80.28W FWD`	> Lat/Lon location – forward
`TRAJ X71 Y13 FWD`	> Grid X/Y location - forward
`TRAJ STIDKMIA BKW`	> Station ID selection - backward

NOTICE – as with the sounding commands, there is a space between command parameters *however* there are no spaces in the command parameters. "LAT25.82N" is all one continuous string with no spaces. This is the same for the longitude, the grid 'X' & 'Y' values as well as the Station ID. The Station ID (STID) should be the 4-letter WMO ID (KMIA).

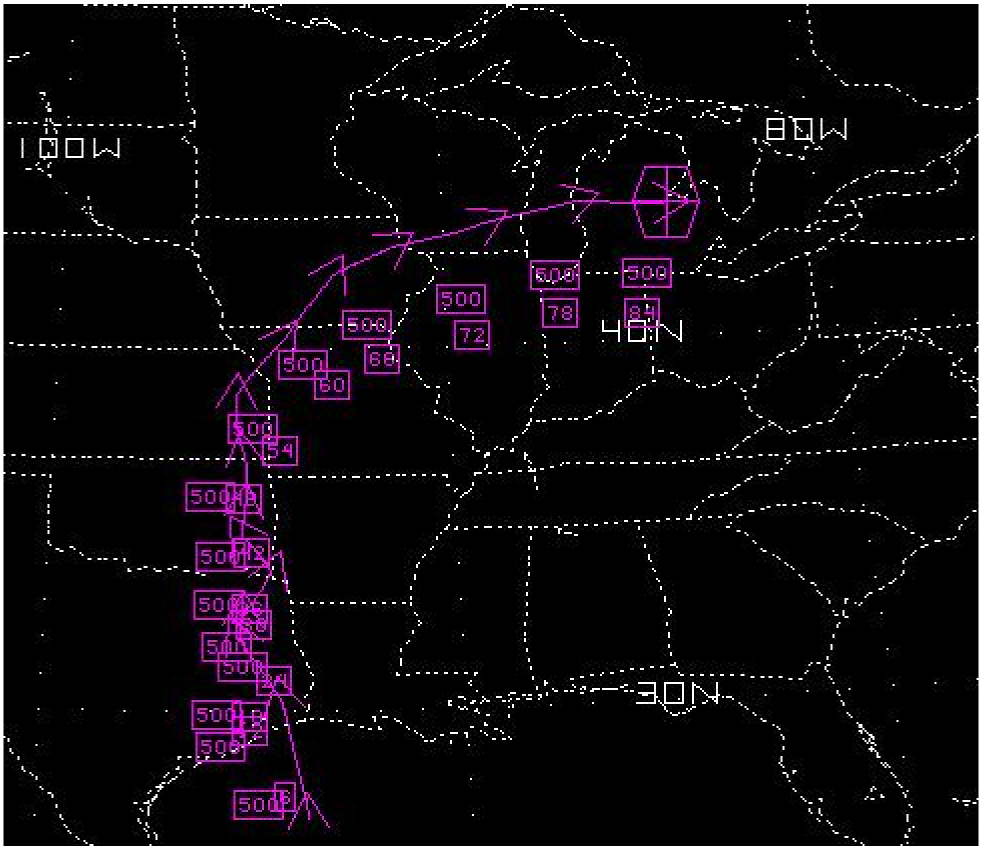
The extra command at the end (FWD/BKW) shows the direction the trajectory should be calculated. If the trajectory should be plotted on an isentropic surface, the level must be selected prior to issuing the TRAJ command.

Trajectory Display - Forward



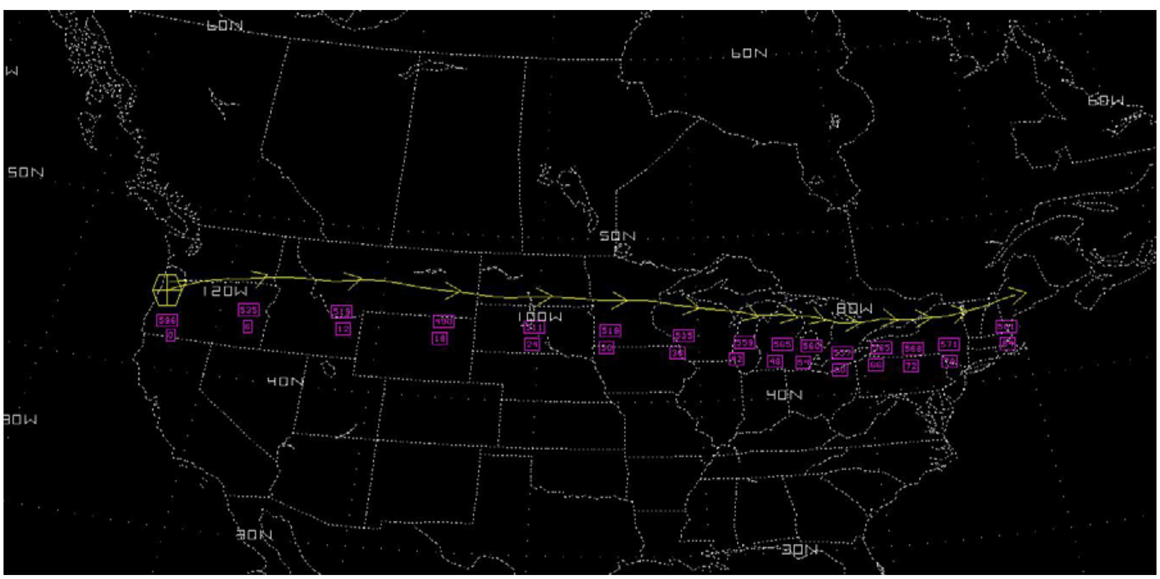
This is showing a forward trajectory plot on a constant pressure surface. At each forecast hour location there will be an arrow head drawn as well a two boxes. The boxes will show the pressure level at that location and the forecast hour at that location. On constant pressure plots, the pressure value will not change.

Trajectory Display - Backward



This is showing a backward trajectory plot on a constant pressure surface. The boxes are the same as on the forward trajectory on pressure surface.

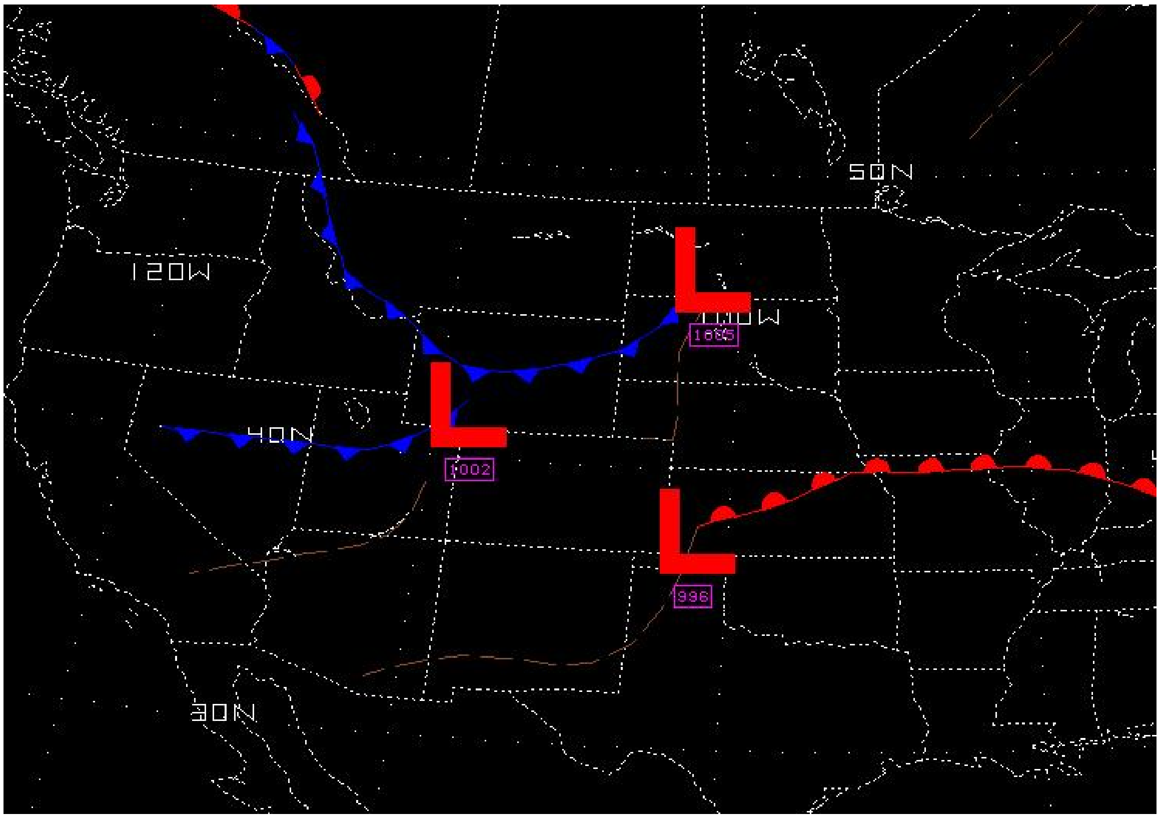
Trajectory Display – Forward - Isentropic



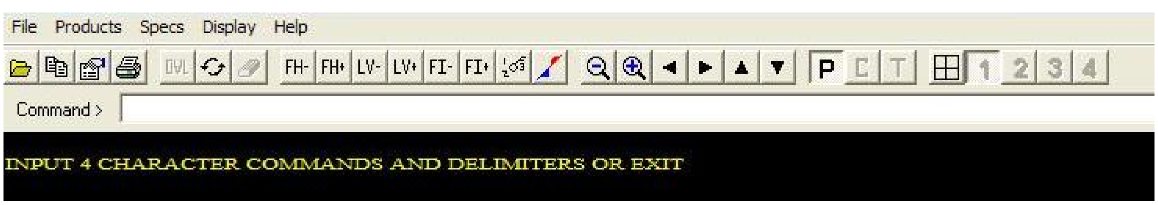
This is showing a forward trajectory plot on an Isentropic (constant theta) surface. The boxes are the same as on the forward trajectory on pressure surface but notice the pressure values are changing with the movement of the air parcel on the isentropic surface height.

Surface Frontal Positions

WINGRIDDS now has the ability to read the NCEP issued ASUS Coded Surface Bulletin files (both regular and High resolution versions). See the screen shot below:



There is a new Frontal Display button on the WINGRIDDS toolbar right next to the Observation Data button.



WINGRIDDS can only plot frontal positions when an observation data file is opened and when there is an ASUS Coded Surface Bulletin file exists with the time that matches the observation time.

When the user opens an observation data file, WINGRIDDS searches the ASUS Coded Surface Bulletin data files which are stored in the WINGRIDDS\Obs\Surface\Front directory to see if there are any files with date-time groups which match the observation time in the observation data file. If a match is found, WINGRIDDS remembers the ASUS Coded Surface Bulletin file name and enables the Frontal Display button on the WINGRIDDS toolbar. If the opened data file is from a model or there is no ASUS Coded Surface Bulletin data file to match the opened observation data file, this button is grayed out and disabled. When the user wishes to display frontal positions and the Frontal Display button is enabled, just click on the Frontal Display button or, from the WINGRIDDS command line, type 'FRNT'.

Since ASUS Coded Surface Bulletin data files are issued every 3 hours, if there is an obs data file which does not match the frontal data file time exactly, when WINGRIDDS performs its' search, it will check to see if there are any frontal data files which may be up to 2 hours older that the obs data file. If a file is found, it will use the frontal file closest to the obs file time automatically.

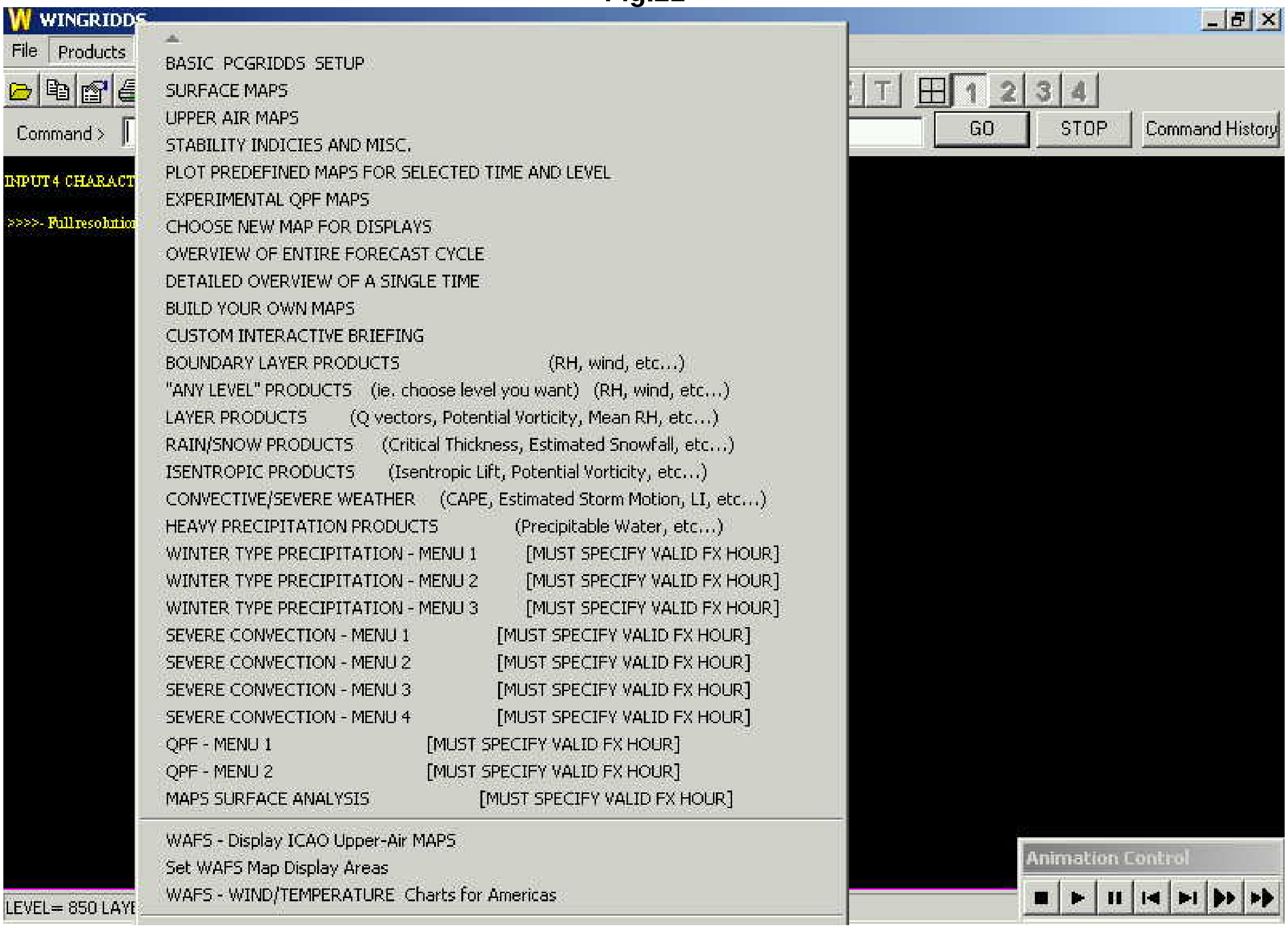
-- Product Menus

This menu option controls the display of WINGRIDDS products. A product is a display generated by executing a series of WINGRIDDS commands contained in a macro file (refer to *'Defining Products'*). When you select this option, the '*Product Category*' menu is displayed (Fig.21). When you select a choice from the '*Product Category*' menu, the corresponding '*Command Window'* window is displayed (Fig.22).

Product Category

This menu displays a list of product categories that are available in your version of WINGRIDDS and is similar to the 'Table of Contents' of a book. Each category contains a group of related products that belong to it. Both the product categories and the actual products in each category can be modified by your system administrator to meet the needs of your environment (refer to *'Defining Products'*).

Fig.21

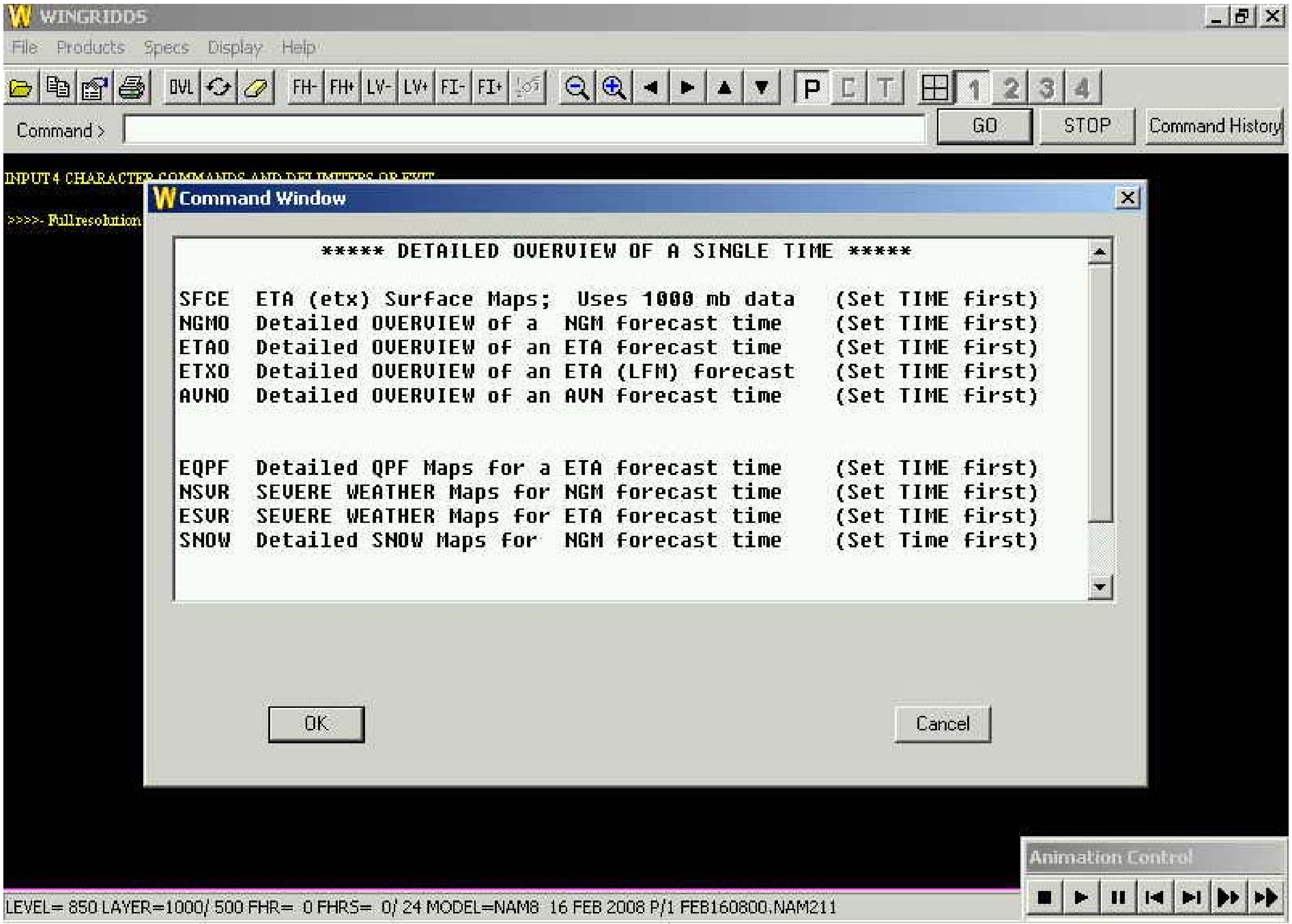


Position the mouse to the desired choice and click. After a category is selected, a list of products available in that category is displayed.

Command Window

The '*Command Window*' menu contains a description of the products that are available for the product category you selected. The name of the product category you chose from the '*Product Category*' menu is shown at the top of the menu. When you select a product, the results are displayed on the screen.

Fig.22



Selections from the '*Command Window*' window are made using the same procedures as for the '*Product Category*' menu.

Position the mouse to the desired choice and click.

Product overlays

Two or more product displays can be overlaid using the Overlay button. After the display of the first product is completed, click **,** then the next product selection or command entered will be overlaid on the current display.

Stepping through product displays for successive times

Special Tool Bar buttons are provided which allow you to step through displays of products at sequentially increasing or decreasing forecast hours.

Displays the current product at the next time.
Displays the current product at the previous time.
Redisplays the current product at the current forecast hour.

The forecast hours selected by the time looping characters depend on the forecast hours within the data file.

Erasing the Screen

The command **EMAP** will erase the display area and show a blank map or clicking the 'Erase Map' button on the Toolbar.

Print Options

The command to print the screen is **PRNT** or clicking the 'Print Screen' button on the Toolbar.

-- Command Line Operations

The Command Line commands to be entered to start and control all processes (refer to Appendix C). Using this mode allows the greatest flexibility, but also requires the greatest understanding of WINGRIDDS. Once commands are entered in the command line, either click the Go Button or press the **[Enter]** key on the keyboard.

NOTE: All command requests are processed from right to left (a la Reverse Polish Notation). As such, the command **HGHT&WIND** will produce a Wind field first, followed by a Height field in a second color.

-- 1 Panel/4 Panel Operations

The WINGRIDDS viewing area can be viewed as a traditional single viewing area or it can be subdivided into 4 windows. The following commands have been added;

1PNL – switch from 4 panel view mode to 1 panel view mode
4PNL – switch from 1 panel view mode to 4 panel view mode
WIN1 – select Window 1 to display data (default in 1PNL mode)
WIN2 – select Window 2 to display data (not available in 1PNL mode)
WIN3 – select Window 3 to display data (not available in 1PNL mode)
WIN4 – select Window 4 to display data (not available in 1PNL mode)

The commands 1PNL & 4PNL must be entered as standalone commands and can not be combined with other commands in a command string.

Each window is treated as a separate viewport so any data combinations can be displayed in each window. However, remember, WINGRIDDS can be in only one data 'state' at a time (PLAN mode, CROSS mode or TIME mode) and it does not care which window it draws to and it is not up to WINGRIDDS to keep track. For example, you display some PLAN mode data in Window 1. You then switch to Window 2 and configure for a CROSS mode display. This will work fine and cross section data will be processed and displayed in Window 2. However, if you switch back to Window 1 but stay in CROSS mode, the next command(s) will be displayed in CROSS mode in Window 1 unless you switch to back to PLAN mode after switching to Window 1. You, the operator, must be explicit about what data you want to be displayed and in which window. This also applies to viewing different data files in different windows. When switching windows, you must also explicitly switch to the data file which matches that window.

When switching between different panel modes, it is *highly* advised you re-calculate any PLAN, CROSS or TIME displays.

The 4 panel windows can be displayed in one of two variations with a window banner or without. There is an entry in the WINGMODE.DAT file which controls this feature which will be covered later.

The most important thing to remember when using WINGRIDDS is 4 panel mode is that the more space, the better. The higher you can make your computer screen resolution, the better the data display will appear.

The tool bar at the top of the main WINGRIDDS window has 4 buttons which control the panel mode and window selection.

Screen Printing – When the PRNT command is issued by itself in 4 Panel mode, only the current active window will be printed. If the PRNT is preceded by the ALWN command, all 4 windows will be printed (along with the command line).

Screen Saving – When the SAVS command is issued by itself in 4 Panel mode, only the current active window will be printed. If the SAVS is preceded by the ALWN command, all 4 windows will be saved (along with the command line).

Animation – 4 Panel animation can ONLY be accomplished through the use of the ANMA (Animate Macro) command in a command macro. Below is an example of the use of the ALWN command in an animation macro. This macro will be using both a Plan view and a Cross Section view. Whenever Plan & Cross view are combined in a 4 Panel animation, it is presumed the Plan view & Cross section view have been configured prior to the execution of the macro to animate them together.

Defining Products

A product is a display produced by executing a sequence of WINGRIDDS commands that are stored in an ASCII formatted file. These files which are called *macros* or *command files* are placed in the MACROS directory. Macro filenames are composed of a 4 character macro name followed by the extension **CMD** (for example, **DWPD.CMD**). You can execute a macro from both *Command Line* and *Products Menu*.

-- Command Line execution

To execute macros

To execute a macro from the *Command Line* enter the name of the macro followed by **[.]**.

DWPD.

The above entry erases the screen and produces a display of DeW Point Depression.

To overlay macros

A macro can be overlaid on the display produced by a previous command or macro. To overlay a macro enter the name of the macro followed by **[:]** (colon key).

TEMP
DWPD:

The above sequence of commands erases the screen, displays TEMPerature, and overlays temperature with DeW Point Depression.

Frequently used macro

The name **!!!!.CMD** is reserved for a frequently used macro. This file is created by copying an existing macro or using a text editor to enter a set of frequently used WINGRIDDS commands. To execute this macro from *Command Line* press **[.]** (period key).

-- Products Menu execution

To display products

A product is generated by executing a series of WINGRIDDS commands contained in a macro file. The results are displayed on the screen.

1. Select '*Products*' from the main menu.
   The *'Product Category'* menu appears which shows you a list of product categories that are available.

2. To select a category, position the mouse to the desired choice and left-click.
   After a category is selected, the '*Command Window*' menu appears which shows you the first page of a list of products available under the selected category.

3. Select a specific product in the same manner as a category.
   The 4 letters that appear to the left of the product description are the name of the macro which is executed to create the desired product.

To overlay two or more products

1. Select the first product.

2. When the display of the first product is complete, press  button then select the product you wish to overlay.

Default products

WINGRIDDS is delivered with a default set of menus and products. You are encouraged to develop additional products to meet the needs of your environment. The command lines required to display a product must be stored in a macro file. You must then add to and/or modify the menu system before you can display new products in *Products Menu*. Remember to include the associated HELP files. These procedures are discussed in the following sections.

-- **Overlay data from different files**

Overlaying is the term used to refer to the simultaneous display of multiple data fields. Data from different files can be overlaid on the same plot providing the following conditions are met:

1. The data must be on the same grid projection, though not necessarily from the same model.
2. The initial and final grid points used in any data subsetting must be the same. This means that the areas selected during the ingest process must be identical.

If the above conditions are not met, a message is displayed indicating that the files are of a different size or type. If this condition occurs when a file is opened, the current plot is cleared from the screen and the available fields for the current forecast hour are displayed.

-- Product directories

The product menus and the macro files used by WINGRIDDS are stored in the product directory **WINGRIDDS\MACROS**. The **MACROS** directory is the <u>*active*</u> directory from which WINGRIDDS references files.

-- Product menus

The product menus are stored in ASCII formatted files which are located in the **\WINGRIDDS\MACROS** directory and may be modified by your system administrator. The *'Product Category'* menu is similar to the 'Table of Contents' in a book. It provides a list of product categories. When you select an entry from the *'Product Category'* menu, a list of the available products in that category is displayed (*'Product List'* menu).

Product Category file

Name The entries for the *'Product Category'* menu are stored in the file, **CMDMENU.LST**.

Format This file can be modified using a standard text editor. Each line in the file defines a specific product category. A maximum of 72 characters can be entered on a line. The lines are displayed sequentially in groups of 18 lines per screen. The file can contain a maximum of 10 screens of data (180 categories).

WINGRIDDS automatically 'numbers' the order of appearance for each entry on the menu page. All other characters displayed for the entry lines must be contained in the menu file. All lines in the menu must contain text. If you wish to leave an empty line for clarity, add dashes as shown in the example below. Supply a dummy '*Product List*' file that contains a line of blanks. For the example below, the file **CMDMENU.012** is a dummy file (refer to Appendix A).

The file contents for the first screen of the default *'Product Category'* menu are listed below. A complete listing is contained in Appendix A.

```
         ............... Begin file CMDMENU.LST ............................
BASIC  PCGRIDDS  SETUP
SURFACE MAPS
UPPER AIR MAPS
STABILITY INDICIES AND MISC.
PLOT PREDEFINED MAPS FOR SELECTED TIME AND LEVEL
EXPERIMENTAL QPF MAPS
CHOOSE NEW MAP FOR DISPLAYS
OVERVIEW OF ENTIRE FORECAST CYCLE
DETAILED OVERVIEW OF A SINGLE TIME

BUILD YOUR OWN MAPS
CUSTOM INTERACTIVE BRIEFING
BOUNDARY LAYER PRODUCTS                                (RH, wind, etc...)
"ANY LEVEL" PRODUCTS    (ie. choose level you want)    (RH, wind, etc...)
LAYER PRODUCTS         (Q vectors, Potential Vorticity, Mean RH, etc...)
RAIN/SNOW PRODUCTS      (Critical Thickness, Estimated Snowfall, etc...)
ISENTROPIC PRODUCTS       (Isentropic Lift, Potential Vorticity, etc...)
CONVECTIVE/SEVERE WEATHER     (CAPE, Estimated Storm Motion, LI, etc...)
HEAVY PRECIPITATION PRODUCTS                (Precipitable Water, etc...)
WINTER TYPE PRECIPITATION - MENU 1          [MUST SPECIFY VALID FX HOUR]
WINTER TYPE PRECIPITATION - MENU 2          [MUST SPECIFY VALID FX HOUR]
WINTER TYPE PRECIPITATION - MENU 3          [MUST SPECIFY VALID FX HOUR]
SEVERE CONVECTION - MENU 1                  [MUST SPECIFY VALID FX HOUR]
SEVERE CONVECTION - MENU 2                  [MUST SPECIFY VALID FX HOUR]
SEVERE CONVECTION - MENU 3                  [MUST SPECIFY VALID FX HOUR]
SEVERE CONVECTION - MENU 4                  [MUST SPECIFY VALID FX HOUR]
QPF - MENU 1                                [MUST SPECIFY VALID FX HOUR]
QPF - MENU 2                                [MUST SPECIFY VALID FX HOUR]
MAPS SURFACE ANALYSIS                       [MUST SPECIFY VALID FX HOUR]
----
WAFS - Display ICAO Upper-Air MAPS
Set WAFS Map Display Areas
WAFS - WIND/TEMPERATURE  Charts for Americas
         ............... End page CMDMENU.LST ................................
```

Product List file

Name All the files for the *'Product List'* menus have the name **CMDMENU**. The line number of the entry in the *'Product Category'* file (**CMDMENU.LST**) determines the extension of the file (**CMDMENU.###**) that provides the information for the corresponding *'Product List'* menu. For example, if you select the entry *'SURFACE MAPS'* which is on line 1 of the *'Product Category'* file, the product list contained in the file, **CMDMENU.001**, is displayed.

Format This file can be modified using a standard text editor. Each line in the file describes a specific product. The lines are displayed sequentially in groups of 17 lines per screen. The file can contain a maximum of 10 screens of data (170 products).

A maximum of 72 characters can be entered on a line. The first 4 characters of each line in a *'Product List'* file must be the name of the macro file that corresponds to the selected entry. For example, if you select the entry, '*Mean Sea-level Pressure and 1000-500mb Thickness'* from **CMDMENU.001** (listed below), the macro file, **SFTH.CMD**, is executed.

WINGRIDDS automatically 'numbers' the order of appearance for each entry on the menu page. All other characters displayed for the entry lines must be contained in the menu file. In the example below, some entries are left blank for clarity. If the user selects a blank entry, WINGRIDDS return to the menu.

The contents for the first screen of the default *'Product List'* file, **CMDMENU.001**, are listed below. Complete listings of all the default *'Product List'* files are contained in Appendix A.

```
         ............. Begin file CMDMENU.002 ...............................
                    *****  SURFACE MAPS *****
SFTH Mean Sea-level Pressure and 1000-500mb Thickness   (Set TIME first)
10TH 1000 mb Height and Winds, 1000-500mb Thickness     (Set TIME first)
10TD 1000 mb Height, Dew Point and Wind                 (Set TIME first)
10TE 1000 mb Height, Equiv. Pot. Temp., and  Winds      (Set TIME first)
NSTM NGM MSL Pressure, S982 Temperatures and Winds      (Set TIME first)
NSTD NGM MSL Pressure, S982 Dew Points and Winds        (Set TIME first)
NSTE NGM MSL Pressure, S982 Equiv. Pot. Temp. and Winds (Set TIME first)
ESTM ETA MSL Pressure, B015 Temperature and Winds       (Set TIME first)
ESTD ETA MSL Pressure  B015 Dew Points and Winds        (Set TIME first)
ESTE ETA MSL Pressure, B015 Equiv. Pot. Temp. and Winds (Set TIME first)
THPW MSL Pressure, 1000-500mb Thickness, Precip. Water  (Set TIME first)
PCPP 12 hour Total and Convective Model Precipitation   (Set TIME first)
P24L Loop 24 Hour Precipitation Totals for Model cycle(Reset TIME after)

SFIL Change Active File           (Must have multiple files open)
SFHR ** Set TIME  ** (Forecast Hour: F00,F12,F24,F36,F48,...)
         .............. End page CMDMENU.002 ................................
```

-- MACRO files

MACRO files contain a sequence of WINGRIDDS command lines that are executed in series and can be used as shorthand notations for frequently used command sequences or to produce specific graphical products. The command lines may contain a maximum of 16 WINGRIDDS commands and aliases in upper or lower case letters (refer to '*User Defined Alias Commands*'), but they cannot reference another macro.

Note: The commands within a command line are processed from *right to left*. Refer to Appendices B, C, and D for a more detailed description of the full set of WINGRIDDS commands.

The following parameters can be set from within a macro: forecast hour, time range, vertical level, and layer. If the macro is run from *Command Line*, these settings will remain in effect after the completion of the macro. If the macro is run from *Products Menu*, the settings normally remain in effect *only* for the duration of the macro. At the end of the macro, the settings return to the values they had before the macro was started. If you want the settings defined in a macro to remain in effect after the completion of the macro, you *must* add the **PMSV** command to the beginning of the macro.

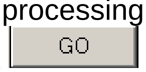
To execute a command macro from the command line, type the name of the macro file followed by a period '.' . For example, if the command macro is named **WTMP.CMD**, you would enter:

WTMP.

and click 

or press **[Enter]** .

To execute a command macro from the Products Menu, simply click on the 'Products' entry on the menu line, then select the category of your choice from the Products menu which opens a Command Menu. Here, you select the actual Command Macro from the selection listed by either double-clicking with the mouse on the selection or single-clicking the selection then click the **OK** button.

When a macro is executed, the results from processing the requested command lines are displayed in sequence with a prompt to click 

or press **[Enter]** between displays when needed. Below is listed a sample macro file which requires you to press **[Enter]** after each command line. This sample file sets the display to PLAN view, requests the user to press **[Enter]**, then reads the WIND data, converts the Vector wind to KNoTs (VKNT), and plots the resulting vectors as wind BARBs.

```
PLAN
BARB VKNT WIND
```

If you want to eliminate the prompt to press **[Enter]** after each command line, use the **LOOP** and **ENDL** (END Loop) commands. All command lines between these commands are then executed without a request to press **[Enter]**. The command file listed below only pauses for you to press **[Enter]** after the **ENDL** command.

```
LOOP
PLAN
BARB VKNT WIND
ENDL
```

Listed below is an example of a macro file (**WTMP.CMD**) that displays wind as barbs and temperature contours as dashed lines. An explanation is included after every line to describe the action of each command in the line.

Note: Within a macro, either the **&** or the **/** can be used to indicate that two sets of data will be overlaid on the same display.

LOOP
- **--** LOOP The prompt to press **[Enter]** is suppressed until the ENDL command is executed or the end of file is encountered.

PLAN
- **--** PLAN Set screen to PLAN view

LNDF
- **--** LNDF Do Not print DeFault Labels

LTX1 WIND / TEMPERATURE Contours
- **--** LTX1 Display the Label TeXt following this command on line 1 of the plot.

LTM1 LLN1
- **--** LLN1 Display the Label, forecast LeNgth, on line 1 of the plot.
- **--** LTM1 Display the Label, TiMe, on line 1 of the plot.
- **--** The label on line 1 has the order: text, forecast length, time.

LFD2 LFL2
- **--** LFL2 Display the Label, Flight Level, on line 2 of the plot.
- **--** LFD2 Display the Label, Forecast model Date, on line 2 of the plot
- **--** The label on line 2 has the order: level, date.

LMN3 LFO3
- **--** LFO3 Display the Label, Forecast model Origination, on line 3 of the plot.
- **--** LMN3 Display the Label, forecast Model Name, on line 3 of the plot.
- **--** The label on line 3 has the order: origination, name.

CLR2 DASH CIN2 TEMP&CLR7 BARB VKNT WIND

- **--** WIND Get the WIND field from the gridded data file.
- **--** VKNT Convert units for Vector wind data to KNoTs.
- **--** BARB Plot wind as BARBs.
- **--** CLR7 Use data-display CoLoR 7 for the barbs.
- **--** & End plot 1 and prepare to overlay next plot.
- **--** TEMP Get the TEMPerature field from the gridded data file.
- **--** CIN2 Set Contour INterval to 2 units (degrees)
- **--** DASH Use DASHed lines for contours.
- **--** CLR2 Use data-display CoLRr 2 for the contour lines.

ENDL

- **--** ENDL Reinstate the need to press **[Enter]** after <u>each</u> command line. This command is optional if it is the last command in the macro.

Listed below is an example of a macro file (**IC24.CMD**) that sets the flight level to 240, displays wind as barbs and displays temperature values at the grid points. An explanation is included after every line to describe the action of each command in the line.

LOOP

- **--** LOOP The prompt to press **[Enter]** is suppressed until the ENDL command is executed or the of file is encountered.

PLAN

- **--** PLAN Set screen to PLAN view

LNDF

- **--** LNDF Do Not print DeFault Labels

LTX1 WIND / TEMPERATURE

- **--** LTX1 Display the Label TeXt following this command on line 1 of the plot.

LTM1 LLN1

- **--** LLN1 Display the Label, forecast LeNgth, on line 1 of the plot.
- **--** LTM1 Display the Label, TiMe, on line 1 of the plot.
- **--** The label on line 1 has the order: text, forecast length, time.

LFD2 LFL2

- **--** LFL2 Display the Label, Flight Level, on line 2 of the plot.
- **--** LFD2 Display the Label, Forecast model Date, on line 2 of the plot
- **--** The label on line 2 has the order: level, date.

LMN3 LFO3

- **--** LFO3 Display the Label, Forecast model Origination, on line 3 of the plot.
- **--** LMN3 Display the Label, forecast Model Name, on line 3 of the plot.
- **--** The label on line 3 has the order: origination, name.

CLR7 BARB VKNT WIND SLVL 400

- **--** SLVL 400 Set the pressure LeVeL to 400 hPa
- **--** WIND Get WIND data from the gridded data file.
- **--** VKNT Convert units for Vector wind data to KNoTs.
- **--** BARB Plot wind as BARBs.
- **--** CLR7 Use data-display CoLoR 7 for the barbs.

PPLS DAT+ SCL0 SSUM TEMP RGTN 0 MLTN 0 VCMP LAST CLR2&

- **--** *This command line overlays temperature data plots on the previous wind display. Temperature values are expressed as unscaled whole integers and unsigned values are negative. The digits are plotted <u>above</u> the grid point, but only at grid points where the V component of the wind is positive ('southerly') to prevent the wind barbs from overwriting the temperature data.*
- **--** & Overlay the following plot on current display.
- **--** CLR2 Use data-display CoLoR 2.
- **--** LAST Retrieve the previous fields (WIND) already stored in memory. This operation is faster than retrieving data from the gridded data file.
- **--** VCMP Get the V CoMPonent of the wind field that is stored in memory.
- **--** MLTN 0 Set all values Less ThaN 0 as missing data (10**31).
- **--** RGTN 0 Replace all values Greater ThaN 0 with 0. This produces a field of zeros and missing values.
- **--** TEMP Get the TEMPerature field from the gridded data file.
- **--** SSUM SUM the previous two Scalar fields. This produces a field of temperature values and missing values. The missing values are located at grid points where the V component of the wind is less than 0.
- **--** SCL0 Rounds displays to whole integer numbers.
- **--** DAT+ Plot DATa values above (+) the grid point.
- **--** PPLS Plot PLuS signs. Unsigned numbers are negative. Plus signs are plotted before positive numbers.

PPLS DAT- SCL0 SSUM TEMP RLTN 0 MGTN 0 VGRD CLR2&

- **--** *This command line overlays the remaining temperature data on the previous display. Temperature values are expressed as unscaled whole integers and unsigned values are negative. The digits are plotted <u>below</u> the grid point, but only at grid points where the V component of the wind is negative ('northerly') to prevent the wind barbs from overwriting the temperature data.*
- **--** & Overlay the following plot on current display.
- **--** CLR2 Use data-display CoLoR 2.
- **--** VGRD Retrieve the the V component of the wind from the Gridded data file. The wind field is no longer available in memory as it was in the previous command line.
- **--** MGTN 0 Set all values Greater ThaN 0 as missing data points (10**31).
- **--** RLTN 0 Replace all values Less ThaN 0 with 0. This produces a field of zeros and missing values.
- **--** TEMP Get the TEMPerature field from the gridded data file.
- **--** SSUM SUM the previous two Scalar fields. This produces a field of temperature values and missing values. The missing values are located at grid points where the V component of the wind is greater than 0.
- **--** SCL0 Rounds displays to whole integer numbers.
- **--** DAT- Plot DATa values below (-) the grid point.

--	PPLS	Plot PLuS signs. Unsigned numbers are negative. Plus signs are plotted before positive numbers.

ENDL

--	ENDL	Reinstate the need to press **[Enter]** after each command line. This command is optional if it is the last command in the macro.

Command macros can have comment lines included when the left-most character on the line is a **'#'**. Any line which starts with a **'#'** is ignored. There for, the macro 'HGHT.CMD' which is:

```
LOOP
PLAN
HGHT
ENDL
```

Can now also look like this:

```
#***********************************************
# THIS IS A TEST FOR COMMENTS
#***********************************************
#  ENTER THE LOOP
#
LOOP
#
#  ENSURE DISPLAY IS PLAN MODE
#
PLAN
#
#   PLOT THE HEIGHTS
#
HGHT
#
#  END THE LOOP
#
ENDL
```

-- MACRO Help files

Users who create new macro files are strongly encouraged to also create a macro help file to describe what the macro is doing. Macro help files a simple text files with the same name as the macro but with **.hlp** as a file extension. They are to be stored within the HELP/ directory for use within WINGRIDDS. For a reference & template as to how help file should be constructed, refer to the preexisting help files within the HELP/ directory. Your assistance in this area will be greatly appreciated by all other users of your macros.

-- Plot Labels

Default labels

Plots are automatically labeled with a default label format. Sample default labels for a temperature plot are shown below.

Plan view

```
WAFG= 250:LYR=1000/ 500 :FHR= 12:FHRS=  0/ 24::FIL1=WAF28APR.00Z
95/ 4/28/ 0--TEMP
V:10/2003--N/X/MN/SD=   -56.49   -42.85   -48.43     3.17
```

The plan view label displays the following information:

Line 1

WAFG	Forecast model name
LVL= 250	Pressure level
LYR=1000/ 500	Pressure layer
FHR= 12	Forecast hour
FHRS= 0/ 24	Time range
FIL1=WAF28APR.00Z	Last active forecast data file

Line 2

95/ 4/28/ 0	Last active forecast model date (yy/mm/dd/hh)
TEMP	Command line that produced the display

Line 3

V:10/2006	WINGRIDDS version
N/X/MN/SD	Statistics line key: minimum/maximum/mean/standard deviation
-56.49	Maximum data value
-42.85	Minimum data value
-48.43	Mean
3.17	Standard deviation

Time-section (TSCT)

```
WAFG:Lat/Lon 35S/ 59W=> 36/  0 :FHR= 12:FHRS=  0/ 24::FIL1=WAF28APR.00Z
95/ 4/28/ 0--TEMP
```

The time-section label displays the following information when **TSCT** is used to define the time-section point:

Line 1

WAFG	Forecast model name
Lat/Lon 35S/ 59W	Latitude and longitude coordinates of the time-section point
=> 36/ 0	Hour range over which the time-section is displayed
FHR= 12	Forecast hour (used for plan and cross-section)
FHRS= 0/ 24	Time range (used for plan and cross-section)
FIL1=WAF28APR.00Z	Last active active forecast data file

Line 2

95/ 4/28/ 0	Last active forecast model date (yy/mm/dd/hh)
TEMP	Command line that produced the display

Time-section (TSTN)

```
WAFG: BOS@42N/ 71W=> 48/  0 :FHR= 12:FHRS=  0/ 24::FIL1=WAF28APR.00Z
95/ 4/28/ 0--TEMP
```

The time-section label displays the following information when **TSTN** is used to define the time-section point:

Line 1

WAFG	Forecast model name
BOS	Station located at the time section point
@42N/ 71W	Latitude and longitude coordinates of the time-section point
=> 48/ 0	Hour range over which the time-section is displayed
FHR= 12	Forecast hour (used for plan and cross-section)
FHRS= 0/ 24	Time range (used for plan and cross-section)
FIL1=WAF28APR.00Z	Last active active forecast data file

Line 2

95/ 4/28/ 0	Last active forecast model date (yy/mm/dd/hh)
TEMP	Command line that produced the display

Cross-section (XSCT)

```
WAFG:Lat/Lon 53N/ 14E=> 28N/ 77E :FHR= 12:FHRS=  0/ 24::FIL1=WAF28APR.00Z
95/ 4/28/ 0--TEMP
```

The cross-section label displays the following information when **XSCT** is used to define the cross-section line:

Line 1

WAFG	Forecast model name
Lat/Lon 53N/ 14E	Left latitude and longitude coordinates of the cross-section line
=> 28N/ 77E	Right latitude and longitude coordinates of the cross-section line
FHR= 12	Forecast hour
FHRS= 0/ 24	Time range
FIL1=WAF28APR.00Z	Last active active forecast data file

Line 2

95/ 4/28/ 0	Last active forecast model date (yy/mm/dd/hh)
TEMP	Command line that produced the display

Cross-section (XSTN)

```
WAFG: ORD> BOS@42N/ 88W=>42N/ 71W :FHR= 12:FHRS=  0/ 24::FIL1=WAF28APR.00Z
95/ 4/28/ 0--TEMP
```

The cross-section label displays the following information when **XSTN** is used to define the cross-section line:

Line 1

WAFG	Forecast model name
ORD	Station located at left end of cross-section line
> BOS	Station located at right end of cross-section line
@42N/ 88W	Left latitude and longitude coordinates of the cross-section line
=>42N/ 71W	Right latitude and longitude coordinates of the cross-section line
FHR= 12	Forecast hour
FHRS= 0/ 24	Time range
FIL1=WAF28APR.00Z	<u>Last</u> active active forecast data file

Line 2

95/ 4/28/ 0	<u>Last</u> active forecast model date (yy/mm/dd/hh)
TEMP	Command line that produced the display

-- Custom labels

You can produce custom labels using the WINGRIDDS label commands.

Output commands

Eleven of the label commands are 4 character output commands. The first three characters identify the command. The fourth character, indicated schematically by the symbol #, specifies the line number within the total label message. For example, if the entire label contains 3 lines, then **LPL2** specifies that the label for pressure level is on line 2. Listed below are the eleven possible output commands, the type of information displayed, and a sample of the output format.

LTM# TiMe and TiMe range

```
VT 12 UTC FRI 28 APR 1995
VT 12 UTC TUE 7 JUN 1994-00 UTC MON 6 JUN 1994
```

LPL# Pressure Level and Pressure Layer

```
LEVEL=250
LAYER=1000/500
```

LFL# Flight Level and Flight Layer

```
FL 340 (250 hPa)
FL LAYER 050-180
```

LDN# Data file Name

```
FILE=WAF28APR.00Z
```

LFD# Forecast model Date

```
From 12 UTC 22 MAR 1991
```

LMN# forecast Model Name

```
WAFG
```

LFO# Forecast model Origination (text in file WINGLBL.USR)

```
DOC/NOAA/NWS    WAFC-WASHINGTON
```

LLN# forecast LeNgth

```
12H FORECAST
```

LLL# Latitude and Longitude (time-section and cross-section only)

```
LAT/LON: 35S/ 59W
LAT/LON: 53N/ 14E=>28N/ 77E
```

LSN# StatioN identifier (time-section and cross-section only)

```
STNID:  BOS
STNID:  ORD=> BOS
```

LTX# user TeXt

```
WIND/TEMPERATURE
```

Label message lines

The symbol # in all the above commands indicates the line number within the total label message. The total number of lines in a label message depends on the value of the maximum line number specified in the label commands for a plot. If the commands **LFL1 LFO3 LTM1** are issued, then the total message will contain three lines with line 2 blank.

Line 1	`VT 12 UTC FRI 28 APR 1995   FL 340 (250 hPa)`
Line 2	
Line 3	`DOC/NOAA/NWS    WAFC-WASHINGTON`

Command entry

LTX# must be entered on a single line followed by its associated text. It cannot be combined with any other commands. The remaining nine commands can be entered on separate lines or combined on one or more lines. All label commands for a plot must be entered before the command line that actually produces the display.

Note: The first label command on a line must start in the leftmost column.

Examples I, II, and III produce the same results: a pressure level label on line 1 and a time label on line 2. Example IV is incorrect because the label command, **LPL2**, is issued after the plot command line (TEMP).

I	II	III	IV
LPL1 LTM2	LTM2 LPL1	LPL1	LPL1
TEMP	TEMP	LTM2	TEMP
		TEMP	LPL2

Label construction

Label commands are combined to produce message lines. The labels for a line are displayed in the order that the commands are processed. If multiple commands are on one line, they are processed starting with the *rightmost* command. **LTX#** is the exception in that the specified *text will always be left justified within the message line*. A maximum of 132 characters can be output on one line of a printed copy, but only the first 78 characters are displayed on the screen.

A sample command sequence and its corresponding message lines are shown below.

Commands: LTM1 LPL2 LLN2
LTX2 TEMPERATURE
TEMP

Label:
```
VT 12 UTC FRI 28 APR 1995
TEMPERATURE   12H FORECAST   LEVEL=250
```

Note: The forecast length precedes the pressure level in the label because the commands are processed from *right to left*.

Default labels

The initial setting for each plot is to display default labels. This condition is *always restored* at the start of a new display after all overlays are completed.

Default labels can be combined only with the **LTX#** and **LWT#** label commands. If any other label commands are used, default labels are automatically turned off for the *current* plot. Default labels are restored for the next plot regardless of whether it is a new display or an overlay, unless the **LNDF** command is used.

LNDF (No DeFault labels) This command turns *off* the default labels. No labels are produced unless you enter label commands. This condition will remain in effect for all overlays except menu overlays using the **[F2]** key. The default label state is restored when all overlays are completed. The **LNDF** command is useful when overlaying multiple data fields. If label commands are entered when the first data field is displayed, the **LNDF** command prevents the display of default labels for the remaining overlays.

LDEF (DEFault labels) This command turns *on* the default labels. If **LNDF** was used to turn off the default labels, you can use the **LDEF** command to turn on the default labels before all overlays are completed. It will remain in effect until the another **LNDF** command is issued.

Label processing

The control label commands (**LNDF**, **LDEF**, **LWT#**) and the **LTX#** command are processed for all command sequences that produce a display. The remaining output label commands are *only* processed for command sequences that generate a display from gridded data fields. If gridded data fields are not displayed, output label commands are ignored and no label of any kind except text is displayed for the current plot. For example, if you are in time-section mode, the command **LFO1 HOUR** does *not* produce labels because hour lines are generated internally and not from a gridded data field. Similarly, if you are in plan view, the command **LFO1 LATT** does *not* produce labels because latitude lines are not produced from a gridded data field. However, the command **LFO1 TEMP** *does* produce labels because TEMP is a gridded data field. The following examples illustrate these rules.

Example 1

Commands:	LNDF	Turn off default labels.
	LTM1	Command is not processed because LATT does not use gridded data.
	LATT	Display latitude lines.
	TEMP&	Overlay temperature contours on latitude lines.
Label:	No labels	

Example 2

Commands:	LATT	Display latitude lines. Default labels are produced.
	LNDF	Turn off default labels.
	LTM1	Display time label on line 1 of the label message.
	TEMP&	Overlay temperature contours on latitude lines.

Label:

```
VT 12 UTC FRI 28 APR 1995
95/ 4/28/ 0--LATT
V:10/2003--N/X/MN/SD=    -28.75   -56.25   -42.50   8.29
```

Example 3

Commands:	LNDF	Turn off default labels.
	LATT	Display latitude lines.
	LTM1	Display time label on line 1 of the label message.
	TEMP&	Overlay temperature contours on latitude lines.

Label:

```
VT 12 UTC FRI 28 APR 1995
```

Label display

Labels are automatically displayed on the screen after a data field is processed. All previous labels are rewritten on the screen with the display of each overlay. This prevents contour lines from writing over the label text. By default a set of label message lines starts on line 1, the line following the command line on the screen.

For printed output the label message lines are written consecutively at the bottom of the page immediately below the plot. The number of label lines you can print depends on the maximum number of lines reserved for labels. The default value is 6. You can revise this value by modifying the file WINGMODE.DAT (Refer to '*Customizing WINGRIDDS*').

LWT# (begin WriTe) This command specifies the line number of the screen to start WriTing the current label set. If this command is not used then the label set starts at line 1. This command has no effect on the label position for printed plots.

Overlays

Overlaying is the term used to refer to the simultaneous display of multiple data fields. If an overlay is composed of two plots with identical time and level specifications and user labels are requested for both plots, only one set of labels will be displayed. This applies to all label commands except **LTX#**. The text associated with an **LTX#** command will always be displayed. The example below illustrates the overlay restrictions.

Note: The pressure level label is not displayed because it is requested for plot 2 and labels are suppressed for overlays with the same time and level specifications.

Commands:	LTM1	Display time on line 1
	LTX2 WIND	Display text on line 2
	WIND	Display wind data
	LPL3	Display pressure level on line 3
	LTX4 TEMPERATURE	Display text on line 4
	TEMP&	Overlay temperature contours

Label:

```
VT 12 UTC FRI 28 APR 1995
WIND

TEMPERATURE
```

Overlays produced by using the **REST** command (refer to '*Print Commands*' in *'Printing'*) to display saved graphics are treated as separate displays for label purposes. This means that user labels for both the restored graphics and the first overlay are displayed. Menu overlays produced using  also fall into this category. The previous example was modified slightly to illustrate this concept.

Note: The pressure level label is now displayed because the overlay was used in conjunction with the **REST** command.

Commands:	SAVE PLT1	Save graphics in file PLT1.SVG
	LTM1	Display time on line 1
	LTX2 WIND	Display text on line 2
	WIND	Display wind data
	ENDS	Stop saving graphics
	ERAS	Erase screen
	REST PLT1	Restore graphics in file PLT1.SVG
	LPL3	Display pressure level on line 3
	LTX4 TEMPERATURE	Display text on line 4
	TEMP&	Overlay temperature contours

Label:

```
VT 12 UTC FRI 28 APR 1995
WIND
LEVEL= 250
TEMPERATURE
```

Annotation of screen displays

Default labels and those produced by label commands are displayed both on the screen and on printer output. The **TXT#** command can write text annotation only to the screen.

TXT# (screen TeXT) This command must be entered on a single line followed by its associated text. It cannot be combined with any other commands. The # symbol indicates the line on the screen to which the text is written. Text written with the **TXT** command will never be output to the printer nor can it be displayed with the **REST** command. This command is processed and output immediately. It should be issued AFTER the data field is displayed.

WINGRIDDS Command Line Operations

The following discussions describe the operation of WINGRIDDS *Command Line*.

NOTE: The operating mode of WINGRIDDS is no longer *only* Menu mode or Command mode. The two have been blended together so both the Menu selections and the Command Line are available for use.

Command Mode requests are input as series of FOUR LETTER INSTRUCTIONS separated by Spaces or Delimiters, followed by the **[Enter]** key or clicking the 

Button.

A maximum of 16 commands can be entered on 1 line as indicated by the following guiding template line which is displayed at the top of the screen.

NOTE: With few exceptions, a line of commands is processed in order from
RIGHT to LEFT or Reverse Polish Notation (RPN),
so the last command entered on a line is the first to appear.

****- Initial Default values -**

The default Flag Variable values are:

A Forecast Hour (**FHOR**) -- Default = **12**

A four letter Grid Level (**LEVL**) -- Default = **850**

A pair of Forecast Hours (**FHRS**) consisting of -- Default = **00/24**
[See **FHR1** and **FHR2** later -- Used for time differences, etc.]

A grid layer (**LAYR**) consisting of two levels -- Default = **1000 500**
[See **LVL1** and **LVL2** later -- Used for level differences, etc.]

The default values can be customized by the user by modifying the file **USER\INITGRID.SPC**, in which the initial values of the six variable parameters **LEVL LVL1 LVL2 FHOR FHR1 FHR2** are specified.

**- Changing Flag Variable Values - Level/Layer Specification

The LeVeL/LaYeR defaults can be Set by typing **SLVL** or **SLYR** followed by the four character specifications in the next input positions. For example,

SLVL 1000 - Changes default level to 1000 mb,
SLVL MSL - Changes default level to mean sea level,
SLVL SFC - Changes default level to Surface level,
SLVL S896 - Changes default level to the Sigma level centered at 896 mb,
SLVL I300 - Changes default level to the 300K Isentropic level,
SLVL Y240 - Changes default level to the Hybrid-B level 240 (if in data file),
SLVL H150 - Changes default level to the 15,000 ft Height level,
SLYR 850 300 - Changes layer bottom and top default levels (in order) to 850 and 300 mb.

For convenience, the LeVeL can also be specified by simply typing the desired level as part of the command line to the right of the desired field, e.g., reading from RIGHT to LEFT, the command sequence **TEMP 850** will first set the level to 850 mb and then read, decode and contour the temperature field.

**- Changing Flag Variable Values - Time Specification

The time defaults can be changed by typing **FHOR** [or **SFHR**] or **FHRS** [or **SFHS**] and answering a free-format prompt.

Alternatively, the time defaults can be changed by typing SFHR or SFHS followed by the desired hour in the next 4 character command line locations. For example,

SFHR 12 - Changes the time default to a 12 hour Forecast,
SFHR -1 - Changes the time default to the ANALysis,
SFHR 00 - Changes the time default to the 00 h initialized fields,
SHFS 12 24 - Changes the time pair defaults to the 12 and 24 h Forecasts.

For convenience, **SFHR** can also be omitted from the command string if desired, typing instead only **ANAL, F00, F12, F24, F36** or **F48** for those specific times, e.g., reading from RIGHT to LEFT, the command sequence **TEMP 850 F24** will first set the forecast hour to 24 hours, then set the level to 850 mb and lastly read and contour the temperature field.

**- Specifying the Display Area

The display area can be changed by typing **AREA** at the LEFT end of the command line, followed a new central latitude and longitude (given by degrees followed immediately by the letters N/S or E/W to indicate hemisphere) and North-to-South display distance in degrees. For example, the command sequence **AREA 40N 20E 20** will provide a display over southern Europe, extending roughly from 30 to 50 N.

If no hemisphere indicator is included, positive values are used to represent Northern and Western hemispheric locations. -- If no lat/lon information is included, a prompt will appear showing location at the center of the grid.

The Entire grid area can be displayed by entering **AREA** followed by 3 zeros, e.g., **AREA 0 0 0**. The initial display **AREA** used in each WINGRIDDS session can be specified in a file **INITMAP.CRD**.

**- Choosing Custom Map Backgrounds

The AREA command has been modified in WINGRIDDS V1.1. Now, the map background can be customized by the addition of the argument **MAP*** as the last **AREA** argument. The '*' is 1-9/A-Z, for example, **MAP1 – MAP9** and **MAPA - MAPZ**.

The **MAP*** command argument refers to the user-created MAP*.DAT files located in the WINGRIDDS\USER directory. These file(s) contain the same information as the MAPFILE.DAT file; a list of map data files which the user wants displayed on the screen.

The MAP* argument can be used this way; say, for example, with a wide-view of the grid area, the user wants little detail. So, in MAP1.DAT, the user lists a low resolution map file. The command:

AREA 0 0 0 MAP1

Is executed. However, when the user zooms in to an area of interest, they may want more map detail like county outlines or rivers. So, in MAP2.dat, the user enters a high resolution map file and a county or river map file. Then, the user executes:

AREA 40N 20E 20 MAP2

And the new map is drawn with the contents of the MAP2.DAT file. This allows the user to have map background flexibility on the fly instead of modifying the MAPFILE.DAT for every change of the display.

If the MAP* argument is not included in the AREA command, the map is drawn from default data from the WINGMODE.DAT and/or MAPFILE.DAT configuration files.

The Area can also be defined centered at a STatioN location using the **ASTN** command followed by a 3 or 4 character station identifier and a North-to-South display distance. If no N-to-S distance is included, a value of 30 is used. This default can be changed using NS##, where ## is the N-to-S distance.

**- Choosing 1 Panel or 4 Panel Display Mode

WINGRIDDS support a display area with either I panel or 4 panels. The initial configuration is set in the WINGMODE.DAT file. The panel mode can be changed from 1 Panel to 4 Panel by typing **4PNL** at the LEFT end of the command line. The panel mode can be changed from 4 Panel to 1 Panel by typing **1PNL** at the LEFT end of the command line.

Once either operation is complete, to ensure the map or CROSS/TIME Section grid background is properly displayed, you must recalculate the map/grid by going to the respective configuration dialogs (PLAN, CROSS, TIME) under the Display Menu and just click the **[OK]** button and allow the backgrounds to be recalculated to fit properly in the new windows. If no CROSS or TIME sections have been configured when the panel mode is switched, they do not need to be recalculated.

**- Command Structures -- Displaying Primary Data Fields -

Once a file has been opened, data can be displayed by typing a series of requests on the command line. In general, a command line is read by the program from RIGHT TO LEFT to request grids and perform various functions.

Results of the last (left most) operations are then displayed automatically.

To display any of the grids stored in the gridded data set, simply type the 4 letter NAME of the grid followed by [Enter]. (Again, a list of the available grids will be shown by typing **LIST** .) For example,

HGHT - will clear the screen & display contours of the 850 mb HeiGHT field
TEMP - will clear the screen & display contours of the 850 mb TEMPerature

A listing of the parameters possibly included in the gridded data sets follows:

****- Primary Gridded Data Fields:**
HGHT > Geopotential HeiGHT (meters)
PRES > Pressure (mb)

TEMP > TEMPerature (degree C)
THTA > Potential Temperature - THeTA(degree K)

MIXR > MIXing Ratio (g/kg)
RELH > Relative Humidity (%)
DWPT > DeW Point Temperature (degree C)
TMPK > TeMPerature (degrees K)
TMPF > TeMPerature (degrees F)
THTE > Equivalent Potential Temperature - THeTa/E (degree K)

WIND > Total WIND vector (m/sec)
WSPD > Total Wind Speed (m/sec)
WDDF > Packed value of Wind Direction/speed (tens of degrees and m/sec)
WDRC > Wind DiReCtion (degrees)
BWND > WiND Barbs (m/sec)
BKNT > Wind Barbs (KNoTs)

PMSL > Mean Sea Level Pressure fields, provided without resetting LEVeL
Note: If mean sea level pressure (GRIB ID=002) is not available, then an attempt is made to retrieve the RUC Reduction, the Eta Model Reduction, and the Standard Atmosphere Reduction, in that order.

TPCP > Total Precipitation fields, provided without resetting LEVeL (mm)
CPCP > Convective Precipitation fields, provided without resetting LEVeL (mm)
TPCI > Total Precipitation fields, provided without resetting LEVeL (in)
CPCI > Convective Precipitation fields, provided without resetting LEVeL (in)

NOTE: **TPC**x/**CPC**x attempt to retrieve a 12 hour accumulation. If this is not possible, then they try to obtain the longest accumulation (6,3,2,1) available.

LIFT > Pre-calculated LIFTed Index, provided without resetting LEVeL
PWAT > Precipitable Water fields, provided without resetting LEVeL

THCK > Generates Thickness fields determined by LVL1/LVL2 settings
THWN > Generates Thermal Wind determined by LVL1/LVL2 settings

****- Automatically derived parameters -**
In addition to displays of **LIST**ed forecast fields already in the data file, a number of derived parameters and functions can also be requested and calculated automatically as the data are being read from the computer. For example, a request of **THTA** will automatically calculate and display the potential temperature (THeTA) field. Some of the automatically calculated derived parameters include:

THTA (Potential Temperature)
SDEF (Saturation Deficit)
MIXR (Mixing Ratio)
SMIX (Saturation Mixing Ratio)

GEOS (Geostrophic Wind - vector)
AGEO (Ageostrophic Wind - vector)

LNDX > Provides Lifted Index calculated between LVL1 and LVL2
PLCL > Calculates the Pressure of the LCL from LEVeL data
PDEF > Calculates the Pressure lift needed for saturation form the LCL

See the Appendix or the Online Command Help for more commands and detailed explanations.

<u>- Overlaying displays on a single command line -</u>**
Command requests can also be presented in strings, with & (or /) as a command delimiter to indicate field overlays. For example,

RELH& - will overlay the RELative Humidity analysis on the previously requested fields in a second color, according to the sequence of colors on the color bar at the bottom of the screen.

TEMP&HGHT - will display contours of HeiGHTs at 850 mb and the 850 mb TEMPerature field in different colors on the same map.

NOTE: All command requests are processed from right to left (a la Reverse Polish Notation). As such, the command **TEMP&HGHT** will produce a Height field first, followed by a temperature field in a second color.

Data from different files can be overlaid under the following conditions:
1. The data must be on the same grid projection (models can differ)
2. The initial and final grid points used in any data subsetting must be the same (i.e., identical areas must be selected during the ingest process).

If these conditions are not met, a message is displayed indicating the files are a different size or type. The current plot is cleared; processing stops.

<u>- Changing Contour Intervals -</u>**

The Contour INTerval will be calculated automatically based on the variability of the field by default. Specific Contour INTerval requests can be specified in several ways. By typing **CINT** to the left of a field requested for display, the maximum and minimum of the field will be written on the screen and a prompt for a desired contour interval will appear. For example,

CINT HGHT - will read the height field and ask the user for a desired contour interval (to be input in free format, with a 0 input requesting an automatically calculated 'reasonable' interval.

NOTE: A contour interval specification normally is only in effect for one plot. To keep a contour specifications from one plot to another, type **CISV** The contour interval specification mode can be returned to the single plot convention by typing **CINX**. For example,

HGHT CINX&DWPT&TEMP CISV CIN5 - will read the TEMPerature and DeWPoinT field and display them with a 5 degree contour and then reset to automatic contour determination and overlay the HeiGHT contours.

<u>- Simplified Contour Interval selection -</u>**

Any contour interval can also be requested without the additional user prompt by including any of the following commands to the left or right of the desired field:

CIN5 - contour intervals of 5 units
CIN# - contour intervals of # units
CI10 - contour intervals of 10 units
CI#**0** - contour intervals of #0 units
C100 - contour intervals of 100 units
C#**00** - contour intervals of #00 units
CI.2 - contour intervals of .2 units
CI.# - contour intervals of .# units
C2+3 - contour intervals of 2000 (10**2) units
C#**+**$ - contour intervals of #*10**$ units
C2-3 - contour intervals of .002 (10**-2) units
C#**-**$ - contour intervals of #*10**-$ units

For example, the command line –

HGHT CI60 SLVL 500&PRES CIN4 SLVL MSL - will display the Mean Sea Level PRESsure field contoured at 4 mb intervals and the 500mb HeiGHTs contoured at 60m intervals.

****- Changing Contour Colors / Dashed Contours**

The Contour / Wind display colors will be assigned automatically in sequence according to the template shown at the bottom of the screen. The default color can be overridden by using the **CLR**# command,

where **CLR1** refers to the first color on the template,
CLR2 refers to the second color on the template, . . .
CLRA refers to the tenth color on the template, . . .
CLRH refers to the first dashed color on the template, . . .
CLRX refers to the first dotted color on the template.

Dashed contours can also be produced by including **DASH** in the command line. **DASH** is only in effect for one plot and must be reset for additional displays.

The commands **DNEG** and **DPOS** can be used to dash either the Negative or Positive contours in a data field.

**** - Single Line Contour Plot –**

WINGRIDDS can plot single-line scalar plots. For example, if you wish to plot the 5700 dm height contour on the 500 mb level, enter the following commands:

HGHT 500&SLIN 5700

The new command, **SLIN** ####, is Single LINe followed by a four digit value of the contour you wish to plot. This is valuable for creating "spaghetti plots" of the same contour from different model runs or comparing different times or making a single contour stand out from the others like the freeze line. The **SLIN** command is valid for only that one plot and must be called every time it is needed.

****- Plotting Digital Grid Values at Data Points / Scaling Output**

Digital values of the gridded data can also be requested as follows:
DATA > Sets display mode to plot data values at grid points.
DATT > Sets display mode to plot data values above grid points.
DATB > Sets display mode to plot data values below grid points.
DATO > Sets display mode to plot data values high Over grid points.
DATU > Sets display mode to plot data values low Under grid points.

Data Displays and Contour Labels can be requested to display specific digits using the following Scaling and Modulo commands:

SCL0 / DML0- Display only signed digits greater than or equal to 10**0 (1)
SCL1 / DML1 - Display only signed digits greater than or equal to 10**1 (10)
SCL# / DML# - Display only signed digits greater than or equal to 10**#
SC-1 / DM-1 - Display only signed digits greater than or equal to 10**-1 (.1)
SC-# / DM-# - Display only signed digits greater than or equal to 10**-#
MOD# > Display labels using Modulo of SCALED display value and 10**#

**- Wind Displays -

Vector displays will be generated automatically for vector quantities, or when two grids area queued for plotting. Again, 4 letter commands can be used to change the mode of display to either arrows {**AROW**} , barbs {**BARB**, m/s} or streamlines {**STRM**}. Winds can be displayed on pressure, height, Sigma or Isentropic levels.

Several wind options are available. These include:

WIND to display the gridded total wind data,
GEOS to display the geostrophic wind, and
AGEO to display the ageostrophic wind.

For example,

WIND&HGHT - displays contour of the height field with wind arrows overlaid

A number of shorthand alias requests are also available, including

WKNT > Retrieves the total wind Vector in knots.
WMPH > Retrieves the total wind Vector in mph.
WKPH > Retrieves the total wind Vector in kph.
BKNT > Retrieves the total wind Vector in knots and sets display as wind barb.
BMPH > Retrieves the total wind Vector in mph and sets display as wind barb.
BKPH > Retrieves the total wind Vector in kph and sets display as wind barb

To have the ability to filter the plot of wind vectors direction and speed, two new commands have been added. '**WDFL**' is the Wind Direction FiLter command and '**WSFL**' is the Wind Speed FiLter command. The filters allow data to be plotted if the values fall between a Min & Max value issued with the command. There for, to only plot winds which blow between 90 & 180 deg, the command is

WIND WDFL 90 180

The Direction limits cannot be less that 0 or greater than 360. To plot winds with speeds only between 20 – 50 M/S, the command is

WIND WSFL 20 50

The WDFL & WDSL commands can be used together as well.

**- Changing Wind Arrow Length –

The contour interval specification also acts as means for changing the length of arrows used in wind displays. Normally, the lengths of wind arrows are scaled so that the arrow representing the largest wind speed in a display is set to be equal to the distance between two adjacent grid points. Adjustments in the length can be made using the "CI" commands, where the requested "contour interval" specifies the speed to be plotted as a one grid interval length arrow. For example,

WIND CI10 - will produce wind arrows in which the length of a 10 m/s wind is one grid spacing unit.

Displaying Wind Barbs or Streamlines-

Winds can also be displayed as Barbs by typing **BARB**.
Winds can also be displayed as Streamlines by typing **STRM**.
To return the wind display to Arrows type **AROW**.

**- Use of Layers or Multiple time periods -

Layer and/or time manipulation of PRIMARY DATA VARIABLES can be triggered by inserting keywords to the right of the desired variable. Options include:

LDIF (Layer Difference)
LAVE (Layer Average)
LTOT (Layer Sum or Total)
TDIF (Time Difference)
TAVE (Time Average)
TTND (Time Tendency - TDIF/time)
TTOT (Time Sum or Total)

NOTE: These commands MUST be positioned to the RIGHT of the variable name and can ONLY be used with PRIMARY VARIABLES.

For example, the sequence of commands

SLYR 1000 500 - will calculate the DIFference in HGHT between the top and
HGHT LDIF bottom levels defined by the SLYR command, in this case producing a 1000 to 500 mb thickness field, and

SFRS F00 F24 - will calculate and display the difference
HGHT TDIF in the HeiGHT fields between the initial conditions and the 24 h forecast.

Entries in the **SLYR** or **LVL**# may be in either pressure, Height, Sigma or isentropic levels.

For example, the command line

SLYR 750 400 - will set the layer limits to 750 and 400 mb
SLYR I300 I320 – will set the layer limits to the isentropic layers of 300K and 320K.

Calculations using either the top or bottom levels of the layer defined by SLYR and/or the beginning or end times of a forecast period defined by FHRS can be requested without explicitly resetting the level or time defaults by inserting the following keywords to the right of the desired variable:

LVL1 (First level of LAYR)
LVL2 (Second level of LAYR)
FHR1 (First time of FHRS)
FHR2 (Second time of FHRS)

For example, the command line

HGHT LDIF&HGHT LVL2&HGHT LVL1 CI60 SLYR 1000 500 - will set the layer limits at 1000 and 500 mb and then produce contours of the 1000 and 500 mb HeiGHTs, followed by the 1000-500 mb thickness, all contoured with 60 m intervals.

NOTE: Once a layer or time period is set, it continues in effect for the remainder of that plot request unless overturned by another entry.

<u>** - Native RUC (Rapid Update Cycle) Hybrid-B Levels –</u>

WINGRIDDS can work with the native RUC level format of Hybrid-B levels. Hybrid-B coordinates are defines as roughly equivalent to levels of constant Theta (Isentropic). The RUC Hybrid-B levels are identified in WINGRIDDS with the 'Y###' symbols with '###' standing for the numbers ranging from 010 to 500 in increments of 10. These levels roughly correspond to Isentropic levels in the following way:

HYBRID = THETA	HYBRID = THETA
Y010 = I224	Y260 = I312
Y020 = I232	Y270 = I314
Y030 = I240	Y280 = I316
Y040 = I245	Y290 = I318
Y050 = I250	Y300 = I320
Y060 = I255	Y310 = I322
Y070 = I260	Y320 = I325
Y080 = I265	Y330 = I328
Y090 = I270	Y340 = I331
Y100 = I273	Y350 = I334
Y110 = I276	Y360 = I337
Y120 = I279	Y370 = I340
Y130 = I282	Y380 = I343
Y140 = I285	Y390 = I346
Y150 = I288	Y400 = I349
Y160 = I291	Y410 = I352
Y170 = I294	Y420 = I355
Y180 = I296	Y430 = I359
Y190 = I298	Y440 = I365
Y200 = I300	Y450 = I372
Y210 = I302	Y460 = I385
Y220 = I304	Y470 = I400
Y230 = I306	Y480 = I422
Y240 = I308	Y490 = I450
Y250 = I310	Y500 = I500

If WINGRIDDS is in Pressure level mode, and a Hybrid-B data file is loaded, any parameter or diagnostic command will be automatically interpolated from Hybrid-B to the requested pressure level.

** - Animation –

WINGRIDDS has the ability to animate both PLAN and CROS screen plots. This is accomplished in one of three ways. From the WINGRIDDS Command-line, to animate the 500 mb heights through the full forecast length of the model run, you enter:

HGHT 500 & ANIM

The command for animation is **ANIM** and must be the most right command on the line. This command will cycle through every forecast hour in the active model file. The following are other animate commands:

ANMA – ANimate Macro
ANFA – ANimate Forecast hours
ALWN – Use ALL WINdows in Animation

Command Macros can now be animated as well. To animate a simple, single-loop, non-animated macro from the command line, for example the K-Index macro KIND.CMD, enter;

KIND:ANIM

To build a specific animated command macro, the command ANMA (Animate Macro) must be before any LOOP command and there must be only one LOOP/ENDL set in the macro.

If you wish to compare two or more model runs which may have different time steps or you wish to only animate specific time steps, it is easiest to create a Macro but the function can be done from the Command line if the total commands are less than 16. Use the following example to use only the 00h, 12h, and 24h time steps out of the 00h, 06h, 12h, 18h and 24h time steps available:

From the Command line:

ENDA&ENDL&HGHT 500&SFHR 24&LOOP&ENDL&HGHT 500&SFHR 12&LOOP& ENDL&HGHT 500&SFHR 00&LOOP&ANFA

Or in a Macro:
ANFA
LOOP
SFHR 00
HGHT 500
ENDL
LOOP
SFHR 12
HGHT 500
ENDL
LOOP
SFHR 24
HGHT 500
ENDL
ENDA

If you notice, the first Macro command is **ANFA** and the plots are made up of repeating the **LOOP/ENDL** command with the last Macro command being **ENDA** which is ENDAnimation creation. When the **ANFA** command is executed, WINGRIDDS proceeds through the forecast hours and “builds” the animation frames. Once it has cycled through all the forecast hours, it will begin to loop through the animation cycle with a preset delay between frames and with a longer delay between cycles to show the end of the cycle.

NOTICE – While WINGRIDDS is building the animation sequence, the user can not go and do other WINGRIDDS or Windows operations which will affect the screen. In building the animation sequence, WINGRIDDS is actually taking a “snap-shot” of every screen and it will capture whatever is on the screen whether it pertains to the animation process or not.

-- Animation in 4 Panel Mode

WINGRIDDS can perform animations while in 4 Panel mode with either the animation in a single panel or in all 4 panels, each with different information. Animations in a single panel work exactly the same as if WINGRIDDS was in 1 Panel mode. The animation commands will be effective to the panel which has control focus. However, the technique to perform animation which involve all 4 panels is different and can only be done through a Command Macro file using the **ANMA** command along with the **ALWN** command instructing the animation function to use “All Windows”.

******NOTICE –**

1) WINGRIDDS must already be in 4 Panel mode before attempting a 4 panel animation.
2) The **ALWN** must be inside the LOOP
3) The WIN* commands to change focus to the respective window is a separate command line

Below is an example MACRO

```
ANMA
LOOP
ALWN
PLAN
WIN1
HGHT
WIN2
WIND/WSPD CTFG
WIN3
CROS
TEMP/MIXR
WIN4
THTA
ENDL
```

-- Animation Control

There are seven controls on a floating Tool Bar. This Floating Tool Bar can be positioned anywhere within the main WINGRIDDS Window. The operator can use the buttons within the Tool Bar to control the animation operation while the animation is cycling; the  button speeds up the loop speed, the  button slows down the loop speed.

The animation cycle can also be switched from a free-run mode to a step-mode at any time by pressing the  button to step forward one frame or press the  button to step back one frame or pressing the  button to pause the motion.

The animation cycle will stay in the step mode till the  button places it back in loop mode. The animation cycle is terminated by pressing the  button. At the end of the animation sequence, all of the bitmap files in the ANIMATION directory are deleted.

<u>- Specify a Cross Section Path</u>**

Cross-section displays can display data on isentropic surfaces and constant height surfaces as well as pressure surfaces. The isentropic levels are predefined from 270K-400K every 10k. The height surfaces can be displayed in either feet or meters. This selection is made within the '*WINGRIDDS Settings'* tab of the *'Properties'* dialog. The vertical range for CROS sections in height mode is 500 ft to 65,000 ft in 5,000 ft increments or 2000 meters to 24,000 meters in 2,000 meter increments. These are fixed in software. The user can use pressure and forecast hour data in the file **USER\INITGRID.SPC**, which is the default settings or the user can utilize all the model pressure levels or use the commands **XLVL** (followed by file name) to use predefined pressure levels. Cross-section displays for pressure surfaces can be established by typing **XSCT,** displays for Isentropic surfaces can be established by typing **XSCI** and displays for height surfaces can be established by typing **XSCH.** They are followed by the left display latitude and longitude and the right latitude and longitude. (If no lat/lon information is included, a prompt will appear.) Two formats can be used, either latitudes and longitudes followed IMMEDIATELY (no spaces between) by 1 character hemisphere indicators (e.g., 40S for 40 degrees South latitude) or signed numeric values, where positive values indicate Northern and Western Hemispheres.

Cross-sections can also be defined between two Station locations using the Command **XSTN** for pressure levels, **XSTI** for Isentropic levels or **XSTH** for Height levels followed by two 3 or 4 letter station identifiers. Once a cross-section has been defined, the base map can be redrawn with the cross section path shown as a dotted line using either the **MAP** command (to overlay a map on the existing product) or the **EMAP** command to erase the screen before drawing the map.

To set up a cross section using all model levels, these commands are executed:
ALVL
XSCT 55.00 80.00 25.00 80.00

To set up a cross section using XLVL with the file name '505m' , these commands are executed:
XLVL 505m
XSCT 55.00 80.00 25.00 80.00

The look of the Cross section display is created by a series of commands executed from the files **USER\CROSSSECTION.DAT** for cross sections. This file can be customized by the user to change the look of the display. If these files are not found while attempting to build a CROS section, to program will default to the current operational CROS display.

The following commands are what are in the included in the **USER\CROSSSECTION.DAT** file:

NLBL XLTN&
NCLB NLBL PRES&
XLBL SCL0 NLBL LAST&
XLBB SCL0 NLBL ALAT&
XLBB SCL0 NLBL DATT ALON&

To remove the cross section path, type either **XSTN 9999** or **XSCT 9999**.

Defining a cross section path also initiates the cross section display mode. Display modes can be switched from cross section to plan view by typing **PLAN**, and from plan view to the previously established cross section by typing **CROS**.

**- Cross Section Wind displays

Cross-sectional wind displays can be modified to provide rotated, cross-section relative wind representations by typing **XREL** to the left of the desired wind type. Individual cross-sectional relative components can be displayed using **TANG** and **NORM** for contour of the tangential and normal wind components and **VTNG** and **VNRM** for vector component displays.

Vertical circulations displays of the tangential component of the wind and the vertical velocity are produced by typing **VCRC** followed by a wind type.

A number of shorthand notation aliases are available for cross-sectional wind displays, including:

WNDX to display the total wind rotated relative to the cross section
GEOX to display the geostrophic wind rotated relative to the cross section
AGEO to display the ageostrophic wind rotated relative to the cross section
WCRC to display vertical/tangential circulations of total wind
GCRC to display vertical/tangential circulations of geostrophic wind
ACRC to display vertical/tangential circulations of ageostrophic wind

**- Specify a Time Section Point

Time-section displays can display data on isentropic surfaces and constant height surfaces as well as pressure surfaces. The isentropic levels are predefined from 270K-400K every 10k. The height surfaces can be displayed in either feet or meters. This selection is made within the '*WINGRIDDS Settings'* tab of the *'Properties'* dialog. The vertical range for TIME sections in height mode is 500 ft to 65,000 ft in 5,000 ft increments or 2000 meters to 24,000 meters in 2,000 meter increments. These are fixed in software. The user can use pressure and forecast hour data in the file **USER\INITGRID.SPC**, which is the default settings or the user can utilize all the model pressure/forecast hours or use the commands **XLVL** and **THRS** (followed by file names) to use predefined pressure levels and forecast hours respectively.

The direction, length and increment of default forecast hours along the bottom of the screen is determined by line three of the file **USER\INITGRID.SPC** as shown below:

13 72 66 60 54 48 42 36 30 24 18 12 06 00 00 00 00 00 00 00 1

This shows the forecast hours will span from hours 00 to 72 every six hours and increase from right to left. If it is desired for the forecast hours to increase from left to right, the entry should look like this:

13 00 06 12 18 24 30 36 42 48 54 60 66 72 00 00 00 00 00 00 1

For full information concerning **USER\INITGRID.SPC** configurations, see:
Customizing the WINGRIDDS System -- Initial Pressure Levels and Forecast Hours

When creating a Time-section with all model forecast hours (ATIM), the direction of the forecast hours will be determined by the order of the hours in the **USER\INITGRID.SPC** file.

Time-section displays can be established for pressure surfaces by typing **TSCT,** for Isentropic surfaces by typing **TSCI** and for Height surfaces by typing **TSCH.** They are followed by the display latitude and longitude. (If no lat/lon information is included, a prompt will appear.) Two formats can be used, either latitudes and longitudes followed IMMEDIATELY (no spaces between) by 1 character hemisphere indicators (e.g., 40S for 40 degrees South latitude) or signed numeric values, where positive values indicate Northern and Western Hemispheres.

Time-sections can also be defined for a Station location using the **TSTN** command followed by a 3 or 4 letter station identifier. Once a time-section has been defined, the base map can be redrawn with the time section point shown as a dotted line using either the **MAP** command (to overlay a map on the existing product) or the **EMAP** command to erase the screen before drawing the map.

To set up a time section using all model levels, these commands are executed:
ALVL
TSCT 55.00   80.00 25.00   80.00

To set up a time section using XLVL with the file name '505m' , these commands are executed:
XLVL 505m
TSCT 55.00   80.00 25.00   80.00

To set up a time section using all model levels and all forecast hours, these commands are executed:
ATIM
ALVL
TSCT 42.37   71.03

To remove the time section point, type either **TSTN 9999** or **TSCT 9999**.

Defining a time section also initiates the time section display mode.
Display modes can be switched from time section to plan view by typing **PLAN**,
and from plan view to the established time section by typing **TIME.**

The look of the Time section display is created by a series of commands executed from the file **USER\TIMESECTION.DAT** for time sections. This file can be customized by the user to change the look of the display. If this file is not found while attempting to build a TIME section, to program will default to the current operational TIME display. The following commands are what are in the included in the **USER\TIMESECTION.DAT** file:

NCLB NLBL PRES&
XLBL SCL0 NLBL LAST&
XLBB SCL0 NLBL HOUR&
NLBL HOUR&

-Sounding Commands

The Sounding displays can either be created using the menu dialog (above) or from the WINGRIDDS command line. Command-line location can be requested from either a Lat/Lon location, Grid-point X/Y location or Station ID. The commands for Skew-T plots are as follows:

```
SKEW LAT25.82N LON80.28W        > Lat/Lon location
SKEW X71 Y13                    > Grid X/Y location
SKEW STIDKMIA                   > Station ID selection
```

NOTICE – there is a space between command parameters *however* there are no spaces in the command parameters. "LAT25.82N" is all one continuous string with no spaces. This is the same for the longitude, the grid 'X' & 'Y' values as well as the Station ID. The Station ID (STID) should be the 4-letter WMO ID (KMIA).

The commands for Telphigram and Stuve plots are similar:

```
TEPH LAT25.82N LON80.28W        > Lat/Lon location
TEPH X71 Y13                    > Grid X/Y location
TEPH STIDKMIA                   > Station ID selection

STUV LAT25.82N LON80.28W        > Lat/Lon location
STUV X71 Y13                    > Grid X/Y location
STUV STIDKMIA                   > Station ID selection
```

** -Hodograph Commands-

The Hodograph displays can either be created using the menu dialog (above) or from the WINGRIDDS command line. Command-line location can be requested from either a Lat/Lon location, Grid-point X/Y location or Station ID. The commands for hodograph plots are as follows:

`HODO LAT25.82N LON80.28W`	> Lat/Lon location
`HODO X71 Y13`	> Grid X/Y location
`HODO STIDKMIA`	> Station ID selection

NOTICE – as with the sounding commands, there is a space between command parameters *however* there are no spaces in the command parameters. “LAT25.82N” is all one continuous string with no spaces. This is the same for the longitude, the grid ‘X’ & ‘Y’ values as well as the Station ID. The Station ID (STID) should be the 4-letter WMO ID (KMIA).

** -Trajectory Commands-

The Trajectory displays can either be created using the menu dialog (above) or from the WINGRIDDS command line. Command-line location can be requested from either a Lat/Lon location, Grid-point X/Y location or Station ID. The commands for trajectory plots are similar to the other grid-point plots but has an extra direction command as follows:

`TRAJ LAT25.82N LON80.28W FWD`	> Lat/Lon location – forward
`TRAJ X71 Y13 FWD`	> Grid X/Y location - forward
`TRAJ STIDKMIA BKW`	> Station ID selection - backward

NOTICE – as with the sounding commands, there is a space between command parameters *however* there are no spaces in the command parameters. “LAT25.82N” is all one continuous string with no spaces. This is the same for the longitude, the grid ‘X’ & ‘Y’ values as well as the Station ID. The Station ID (STID) should be the 4-letter WMO ID (KMIA).

The extra command at the end (FWD/BKW) shows the direction the trajectory should be calculated. If the trajectory should be plotted on an isentropic surface, the level must be selected prior to issuing the TRAJ command.

** -BUFKIT Data Generation Commands_

The BUFKIT Data files can either be created using the menu dialog (above) or from the WINGRIDDS command line. Command-line location can be requested from either a Lat/Lon location, Grid-point X/Y location or Station ID. The commands for BUFKIT Data file generation are as follows:

`BUFK LAT25.82N LON80.28W`	> Lat/Lon location
`BUFK X71 Y13`	> Grid X/Y location
`BUFK STIDKMIA`	> Station ID selection

NOTICE – as with the sounding commands, there is a space between command parameters *however* there are no spaces in the command parameters. “LAT25.82N” is all one continuous string with no spaces. This is the same for the longitude, the grid ‘X’ & ‘Y’ values as well as the Station ID. The Station ID (STID) should be the 4-letter WMO ID (KMIA).

When the BUFKIT Data File generation command is accepted, WINGRIDDS will go through each forecast hour of the currently opened model data file and process the required parameters and diagnostic calculations. The screen will show the progress of the process by showing the following message in the upper left corner of the screen;

PROCESSING BUFKIT DATA...PLEASE WAIT - FORECAST HOUR

****- PRINTING –**

WINGRIDDS prints to the default system printer. This printer can be either local or networked and can print in either Portrait or Landscape mode. The command **PRNT** or clicking the  button on the Tool Bar will print the current screen contents automatically to the Windows default printer and no Print Dialog is displayed. If you wish to make any modifications to the Windows printer setup, it must be done outside of WINGRIDDS. There are no other print modes in WINGRIDDS as there were in the DOS PCGRIDDS. Print copies seem to look the best at 800x600 video mode. Special thanks goes out to Dave Ballinger for his programming contribution for this function.

Screen Printing – When the PRNT command is issued by itself in 4 Panel mode, only the current active window will be printed. If the PRNT is preceded by the ALWN command, all 4 windows will be printed (along with the command line).

****-Saving and Restoring Pre-Generated Graphics**

Plots can be saved for rapid redisplay by typing the command **SAVE** followed by a space and a 4-character file name (the qualifier .SVG will also be added automatically). All plot commands are saved until the command **ENDS** is used. To restore the saved plot file, either type **REST** followed by the file name (again without the .SVG qualifier) or type the file name followed by a semicolon. The results will be displayed over whatever is on the screen already, so be sure to erase the existing graphics using **ERAS** if you do not want the graphics overlaid on the existing screen display.

For example, the sequence of commands -
SAVE 500Z
VORT WIND&HGHT SLVL 500
ENDS
ERAS
REST 500Z   [This command line could alternatively be input as 500Z;]
- will create a .SVG file labeled 500Z.SVG, generate contours of the 500 mb HeiGHT and VORTicity fields and save the plotting commands, close the .SVG file, erase the screen and then restore graphics.

The screen contents can be saved to a BMP-format or PNG-format file. The command **SAVS** followed by a space and a file name up to 20 characters (the qualifier .BMP/.PNG will be added automatically) will save the contents of the screen.

File format is determined by the BMP or PNG entry on line 9 in the WINGMODE.DAT file.

If WINGRIDDS is in 4PNL mode and all 4 windows are to be saved as 1 image, enter **ALWN** followed by the **SAVS** command.

****- Ensemble File Calculations (EAVG, ESTD, EVAR) –**

WINGRIDDS has the ability to perform Ensemble-like calculations of grid-wide Averaging (EAVG), Standard Deviation (ESTD) and Variance (EVAR). WINGRIDDS had the ability to have up to 99 data files opened at the same time for processing. As long as all of those data file are of the same grid projection, areal coverage and model run-time, grid data can be overlaid and calculated. This is where the Ensemble commands come into play. As long as the above conditions are met, WINGRIDDS can calculate the Average, Standard Deviation and Variance of a data parameter or diagnostic calculation across all data files opened. For example, if you have 4 different Lat/Lon grid files opened (GFS, CMC, ECMWF, NOGAPS), to find the averaged temp at 850mb across all the data files, enter;

TEMP EAVG 850

WINGRIDDS will calculate the average of all the 850mb TEMP at the current forecast hour.

WINGRIDDS Contour Color Fill Operations

The programming library Winteracter, which is used to build and apply the GUI features within WINGRIDDS, also has graphics features which can be incorporated into programs. Incorporating these features into WINGRIDDS has yielded five new commands to accomplish a variety of color and pattern contouring within WINGRIDDS. The new features are as follows:

1) Line Based Contouring – this is the same as the regular contouring within WINGRIDDS.

2) Line Based, Graduated Color – This contouring still uses individual lines but each contour value is assigned a color. Color is assigned to Max & Min contour value.

3) Fill Based, Selected Pattern – This contouring uses a fill pattern of either lines at various angles for the contour value or a mesh pattern for the contour value.

4) Fill Based Selected Color – This contouring uses selected colors to be assigned to specific contour values.

5) Fill Based Graduated Color – This contouring uses continuous color gradually changing shades along the contour slope. Like the Line Based, Graduated Color, the color is assigned to the Max & Min contour value.

The individual features will be explained below in detail. **NOTE:** There is **NO** contour smoothing function available (yet) from Winteracter for these contour features. This means, at times, some contour lines or features may appear blocky or squared off instead of a smooth curve.

The CTLG, CTFP, CTFC & CTFG commands may use default color setting or they can each reference one of up to 35 configuration files to assign specific colors and/or assign specific max/min contour values. The configuration files area user configured to generate a unique display to make a certain scalar value stand out and are best utilized within command macros. The last alphanumeric in the configuration file name can be 1-9 or A-Z. The default color/pattern selections for CTLG, CTFP, CTFC & CTFG are contained within

WINGMODE.DAT file.

The Contour Fill-based, Selected Color (CTFC) and the Contour Fill-based, Graduated Color (CTFG) commands can be used with Vector (AROW, BARB & STRM) plots as well.

All colors are assigned in RGB (Red, Green, Blue) format with each color assigned a number from 0 – 255 with 0 = darkest & 255 = brightest. This allows for up to 16 million colors if the display is capable. For less color capable displays, the color assignment will be truncated.

WINGRIDDS Feature	COMMAND	CONFIG FILE (Optional)
Line Based Contouring	**CTLN**	-----
Line Based, Graduated Color	**CTLG**	CLN*(1-9,A-Z)
Fill Based, Selected Pattern	**CTFP**	CFP*(1-9,A-Z)
Fill Based Selected Color	**CTFC**	CFC*(1-9,A-Z)
Fill Based Graduated Color	**CTFG**	CFG*(1-9,A-Z)

Examples:

To display a Line Based Contour of HGHTs,
HGHT CTLN

To display a Line Based, Graduated Color contour of HGHTs with default max/min colors is,
HGHT CTLG

Or to display a Line Based, Graduated Color contour of HGHTs with assigned max/min colors for that type display is,
HGHT CTLG CLN1

NOTE: when you want to use one of the Color Fill features and overlay another scalar or vector value using regular contouring, the color-fill command **MUST** be executed first (most-right command) or else any data which is plotted will be overwritten by the color-fill feature. See the following examples:

TEMP & HGHT CTFC **GOOD!!!**
HGHT CTFC & TEMP **BAD!!!**

Line Based, Graduated Color

The Line Based, Graduated Color command CTLG (CLN*) will generate a contour line display with each contour line assigned a slightly different color from a graduated scale generated by the routine. The routine is passed a color value for the max of the contour scale and a color value for the min of the contour scale. The routine will generate a smooth contour graduation between the two colors and assign each contour line a specific color depending on the contour interval. The color values can either be the default values listed in the WINGMODE.DAT file or they, along with the min/max contour values, can be assigned through the Line Based, Graduated Color configuration files (CLN*). Below is an example of a Line Based, Graduated Color configuration file.

```
!
!Configuration file for Contour Line-Graduated Color
!Displays
!
!Min Values
!
0.0
!
!Max Values
!
9.8E29
!
!R-G-B Values (Top-min, Bottom-max)
!
127 255 0
255 0 0
*****************************************************
*****************************************************
*************   END-OF-DATA   **********************
*****************************************************
*****************************************************
```

These configuration files must follow this template & order of information. They allow comment lines preceded by an exclamation point '!' and ends with the '*****END-OF-DATA ***' section.

The Min/Max values MUST be in floating-point format and exponential notation is allowed.

RGB values range from 0-255 and are separated by single spaces.

Fill Based, Selected Pattern

The Fill Based, Selected Pattern command CTFP (CFP*) will generate a contour display filled with a line/pattern assigned a different pattern by the routine. The routine is passed a pattern mode. The routine will generate a pattern by looping through line angles (slope up, slope down, horizontal & vertical) and line density (sparse, medium, dense, very dense & extremely dense). The pattern mode value can either be the default value listed in the WINGMODE.DAT file or it, along with the min/max contour values, can be assigned through the Fill Based, Selected Pattern configuration files (CFP*). Below is an example of a Fill Based, Selected Pattern configuration file.

```
!
!Configuration file for Contour Line-Fill/Pattern
!Displays
!
!Min Values
!
-9.8E29
!
!Max Values
```

```
!
0.0
!
!Pattern Mode - 1=Hatched, 2=Crosshatched
!
2

*****************************************************
*****************************************************
*************   END-OF-DATA   ***********************
*****************************************************
*****************************************************
```

These configuration files must follow this template & order of information. They allow comment lines preceded by an exclamation point '!' and ends with the '*****END-OF-DATA ***' section.

The Min/Max values MUST be in floating-point format and exponential notation is allowed.

Pattern Mode can be only 1 or 2

Fill Based Selected Color

The Fill Based Selected Color command CTFC (CFC*) will generate a contour line display or a vector display with each value assigned a specific color from

1) 2 colors with interpolation between the 2 colors or
2) a small set of colors with interpolation between the colors to fill the contour range or
3) specific colors assigned to specific contour values.

The color values can either be the default values listed in the WINGMODE.DAT file or they, along with the min/max contour values, can be assigned through the Fill Based Selected Color configuration files (CFC*). The CFC files can have 3 different modes of operation. Below are examples of the 3 types of Fill Based Selected Color configuration files.

```
!
!Configuration file for Contour Line-Fill/Color
!Displays
!
!Color Mode - 1=MAX/MIN COLOR, 2=MULTI INTERPOLATION, 3=INDIVIDUAL COLORS
!
1
!
!Number of Data Entries (ONLY 2 ALLOWED IN COLOR MODE 1)
!
2
!
!Number of Color Entries (ONLY 2 ALLOWED IN COLOR MODE 1)
!
2
!
```

```
!Min to Max Values
!
-9.8E29
9.8E29
!
!R-G-B Values (Top-min, Bottom-max)
!
50 0 50
255 255 0
*****************************************************
*****************************************************
*************   END-OF-DATA   **********************
*****************************************************
*****************************************************
```

```
!
!Configuration file for Contour Line-Fill/Color
!Displays
!
!Color Mode - 1=MAX/MIN COLOR, 2=MULTI INTERPOLATION, 3=INDIVIDUAL COLORS
!
2
!
!Number of Data Entries (ONLY 2 ALLOWED IN COLOR MODE 1)
!
2
!
!Number of Color Entries (ONLY 2 ALLOWED IN COLOR MODE 1)
!
6
!
!Min to Max Values
!
-9.8E29
9.8E29
!
!R-G-B Values (Top-min, Bottom-max)
!
50 0 50
255 0 255
0 0 255
0 255 0
255 255 0
255 0 0
*****************************************************
*****************************************************
*************   END-OF-DATA   **********************
*****************************************************
*****************************************************
```

!
!Configuration file for Contour Line-Fill/Color
!Displays
!

```
!Color Mode - 1=MAX/MIN COLOR, 2=MULTI INTERPOLATION, 3=INDIVIDUAL COLORS
!
3
!
!Number of Data Entries (ONLY 2 ALLOWED IN COLOR MODE 1)
!
22
!
!Number of Color Entries (ONLY 2 ALLOWED IN COLOR MODE 1)
!
22
!
!Min to Max Values
!
4680.0
4740.0
4800.0
4860.0
4920.0
4980.0
5040.0
5100.0
5160.0
5220.0
5280.0
5340.0
5400.0
5460.0
5520.0
5580.0
5640.0
5700.0
5760.0
5820.0
5880.0
5940.0
!
!R-G-B Values (Top-min, Bottom-max)
!
50 0 50
101 0 101
153 0 153
204 0 204
255 0 255
191 0 255
128 0 255
64 0 255
0 0 255
```

0 26 218
0 51 181
0 77 144
0 102 107
0 128 70
0 191 35
0 255 0
85 255 0
170 255 0
255 255 0
238 214 0
222 174 0
205 133 0
****
****
************* END-OF-DATA ***********************
****
****

These configuration files must follow this template & order of information. They allow comment lines preceded by an exclamation point '!' and ends with the '*****END-OF-DATA ***' section.

The Color Mode entry may be 1, 2, or 3. **NOTE:** The selection of Mode 3 will override any contour interval from the command line.

Number of Data Entries and Number of Color Entries must match the number of entries in the respective section. There is a maximum of 200 Data/Color pairs allowed.

The Min/Max values MUST be in floating-point format and exponential notation is allowed.

RGB values range from 0-255 and are separated by single spaces.

The example Configuration file for Mode 3 is set up to show a rainbow display for 500mb HGHTs. The same type of setup can be built for MIXR, TEMP, VTCY PCPT or any scalar display.

Fill Based, Graduated Color

The Fill Based, Graduated Color command CTFG (CFG*) will generate a contour fill display or vector display with each value assigned a slightly different color from a graduated scale generated by the routine. The routine is passed a color value for the max of the contour scale and a color value for the min of the contour scale. The routine will generate a smooth contour graduation between the two colors and assign each contour value a specific color. The color values can either be the default values listed in the WINGMODE.DAT file or they, along with the min/max contour values, can be assigned through the Fill Based, Graduated Color configuration files (CFG*). Below is an example of a Fill Based, Graduated Color configuration file.

```
!
!Configuration file for Contour Fill-Graduated Color
!Displays
!
!Min Values
!
0.0
!
!Max Values
!
9.8E29
!
!R-G-B Values (Top-min, Bottom-max)
!
127 255 0
255 0 0
*****************************************************
*****************************************************
*************   END-OF-DATA   **********************
*****************************************************
*****************************************************
```

These configuration files must follow this template & order of information. They allow comment lines preceded by an exclamation point '!' and ends with the '*****END-OF-DATA ***' section.

The Min/Max values MUST be in floating-point format and exponential notation is allowed.

RGB values range from 0-255 and are separated by single spaces.

As you can see, there is a lot of flexibility but with flexibility, these things can get very involved and here is where I need your input to the following questions.

1) Is this the best way to implement these features or is there a better way to harness the power & capability of these features while keeping it easy to use & understand and do it within the confines of how WINGRIDDS works?

2) The configuration files are currently stored in the USER/ directory. Since they would probably be associated mostly with command macros, would it be better to store them in the MACROS/ directory?

Known bugs associated with third-party software (I can't fix myself)

1) There are times when you may find that color or line contours don't match exactly with the WINGRIDDS contours – or - contour edges may not go completely to the edge or may go beyond the edge of the display. These are issues associated with the third-party software

being used to perform the color-fill graphics. The company has been made aware if the issue and I am awaiting bug fixes.

WINGRIDDS Observation Data Operations

This is to document the new observation data processing and display features within WINGRIDDS.

Since its inception, PCGRIDDS/WINGRIDDS has been limited to ingesting and processing only GRIB-based data. With this release, WINGRIDDS can now handle both surface observations (METAR, Synoptic, Buoy, & Ship) reports as well as Upper-Air RAOB reports. A new observation ingest utility OBS2PCG.EXE has been created to parse the observation reports, perform Barnes Analysis on the data and map the data to a specific map projection to create a PCG Data file which is compatible with the GRIB-based PCG data files so the observation and model data can be viewed in the same context. Also, the OBS2PCG utility creates a concatenated text file of all surface and upper-air observations to be used to create Station Model Plots within WINGRIDDS.

***** NOTE: If you are not aware of how Barnes Analysis works, it is basically trying to arrange random scattered data (observation stations) into orderly, fixed-spaced data (grid data) and the more observations spread across the selected grid area there are, the better and more accurate the resulting Barnes analysis will be. It is not recommended, for example, that, in order to save time, you only download some coastal marine or buoy data and expect a Barnes analysis on a grid covering the entire U.S. to work because there is a big data hole covering the entire interior of the U.S. and the Barnes routines do not like big holes of nothing.

New additions have been added to the WINGMODE.DAT file, new directories have been created to accommodate the observation reports, a new dialog has been added to WINGRIDDS for the user to interface to the OBS2PCG utility, download scripts have been added to download observation data from known free Internet servers and a few new commands have been added to WINGRIDDS.

Observation Data Ingesting with OBS2PCG

The new utility OBS2PCG has been created to 1) convert individual observation reports to a PCG Data file format so observation data can be viewed in conjunction with model data and 2) concatenate the observation data into one text-based data file do build and plot station-model data now as well as skew-t and hodographs in later releases.

Since surface observation data is usually reported every hour and RAOB data is only twice a day (00Z & 12Z), OBS2PCG has the ability to combine surface and upper-air data from different times. Either surface only, upper-air only or both data sets can be processed.

The data must be conformed to a specific map projection to work within WINGRIDDS. The user can select most any map projection listed in the GRIB documentation (except Arakawa [staggered] grids or grids with irregular grid spacing [N/S spacing different from E/W spacing]) or the user can select one or more of the WAFS octants in the same way as is used with the WAFS GRIB Ingest utility GRIB2PCG32.

When an observation hour is selected, OBS2PCG filters the data and only allows observations centered at that hour +/- 15 min and once a station is processed, it will not process that station again if it is reported more than once.

Observation Data Ingesting with OBS2PCG (Command Line)

The command-line entry for OBS2PCG is as follows:

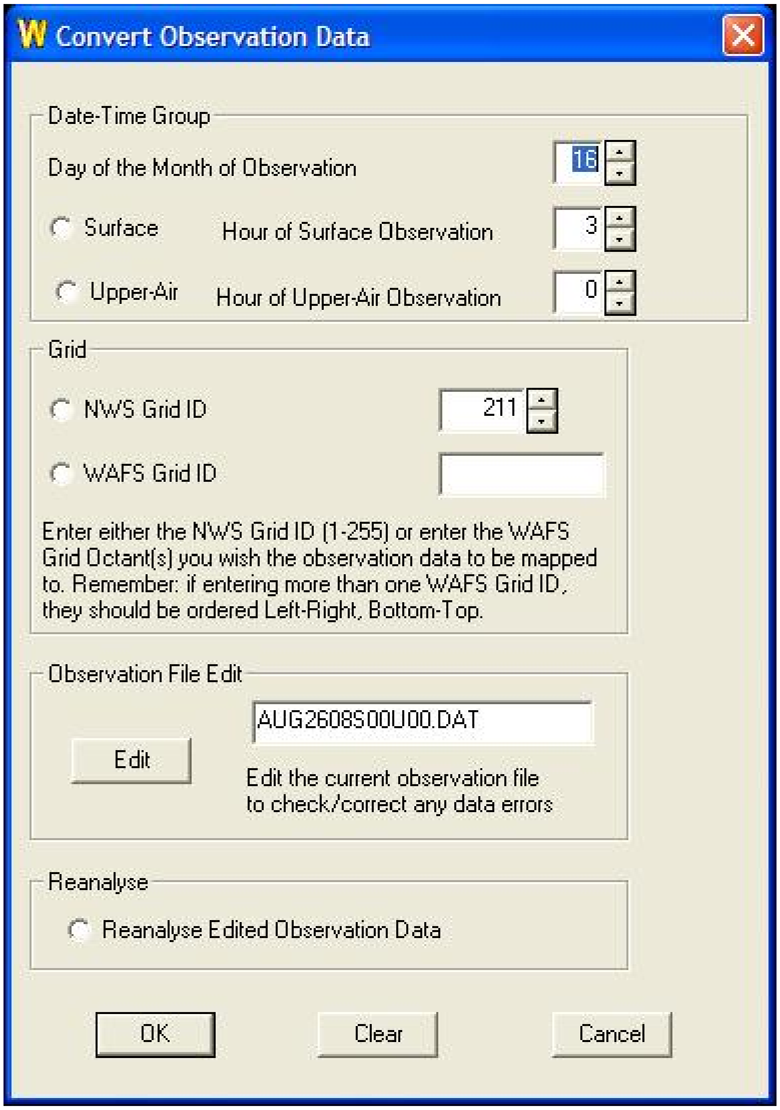
OBS2PCG Ddd Shh Uhh Nggg Woooooooo R

OBS2PCG - name of the utility
Ddd - the letter 'D' followed by a 2-digit day of the month
Shh - the letter 'S' followed by a 2-digit hour of surface report (UTC)
Uhh - the letter 'U' followed by a 2-digit hour of upper-air report (UTC)

Either:
Nggg - the letter 'N' followed by a 3-digit grid ID from GRIB documentation
or
Woooooooo - the letter 'W' followed by up to 8-letters (I-P) identifying the WAFS octant(s) the user wishes to use.

Optional:
R - the letter 'R' used to reanalyze the processed data to account for modified or corrected data or to perform a Barnes analysis to a different grid type on data which has already been processed

Below is the dialog from within WINGRIDDS to accomplish the same thing:



<u>Observation Data Ingesting with OBS2PCG from within WINGRIDDS</u>
When the user selects the WINGRIDDS menu selection: *Convert Observation Files* under the Files menu, the dialog *Convert Observation Data,* as seen above, is shown on the screen.

****Observation Date-Time Group Information**

The Date-Time Group section will be filled with the numeric day of the month and hours of Surface and Upper-Air Observations. The information will default to local time adjusted to GMT (Zulu) through the hour offset setting on line 2 in the file FTPCMD.DAT.

NOTICE***** If your computer is set to observe Daylight Savings Time, this GMT offset entry in the FTPCMD.DAT file will have to be modified by one hour when switching between Standard Time and Daylight Savings Time for any download and processing to be time accurate.

****Observation Grid Information**

The user can select one of two types of grids to map the observation data; NWS-standard grids or WAFS-standard grids. These grid areal coverage and resolution are described in the GRIB1 documentation included in the WINGRIDDS Help section. The user can select most any map projection listed in the GRIB documentation except Arakawa (staggered) grids or grids with irregular grid spacing (N/S spacing different from E/W spacing).

The NWS GRID ID default value is selected by entry line 16 of the USER\WINGMODE.DAT file. The user can change the value of the NWS Grid ID by either directly typing in the right-justified number or scrolling the values higher or lower with the up-down arrow buttons.

The WAFS Grid ID is a combination of anywhere from 1 to 8 of the WAFS octant letter IDs from *I* to *P*. The octant letter ID's ***MUST*** be entered in the following, specific order for processing to perform properly. If more than one octant is to be listed, the following rules must be followed:

1 – if more than one octant in the same N/S hemisphere is to be used, the octants must be listed from west to east.

2 – if more than one octant in different N/S hemispheres is to be used, the octants must be listed from most southwest octant, progressing east, then doing the same in the northern hemisphere ending with the most northeast octant.

****Observation Reanalyse Information**

The user can select the Reanalyse option to map a set of observation data which had previously been processed and the user has corrected for some bad data or the user wishes to have a barnes analysis performed on an observation data set and mapped to a different grid projection. The Reanalysis option makes the OBS2PCG utility skip over the initial raw data conversion and works, instead, from the text-based combined observation data files located in the GRIBDATA\OBS directory. The files here are text-based and can be edited with simple text editors. The combined observation data file formats are covered below.

Observation PCG Data File Names

The PCG data files created from OBS2PCG have a unique name convention to convey the data that was processed. The following are examples:

OCT2007S12U12.OBS211

This file name breaks down as follows:
OCT - Month of file creation
20 - Day of the month of data
07 - 2-digit year (2007)
S12 - Surface data for 12Z report

U12 - Upper-Air data for 12Z report
OBS - Identifying as Observation Data
211 - Grid ID which data is mapped to

OCT2007S12.OBSPL

Which breaks down as follows:

OCT - Month of file creation
20 - Day of the month of data
07 - 2-digit year (2007)
S12 - Surface data for 12Z report
OBS - Identifying as Observation Data
PL - WAFS Octants which data is mapped to

<u>Combined Observation Data File Names</u>**

A directory called OBS is located off the GRIDDATA directory and holds the combined observation data in text format to be read for plotting surface and upper-air station models. Using the previous PCG Data file name examples, if the OCT2007S12U12.OBS211 file is created in the GRIDDATA directory, there will also be a corresponding OCT2007S12U12.DAT file in the GRIDDATA\OBS directory. Also, if the OCT2007S12.OBSPL file is created, then OCT2007S12.DAT will be created in the GRIDDATA\OBS directory as well. These files can be edited with a simple text editor to correct for unreasonable or incorrect data which causes the Barnes Analysis to plot incorrect data. It is best, if incorrect data is found for a specific reporting station, to replace the bad value with value of -9999.00 which indicates MISSING data and will be ignored upon reanalysis.

Surface Data -
The following is an example surface data entry in the Combined Observation data file. Notice that the data are in specific positions and must remain that way when edited if it is to be read properly.

```
1111-22222-33333333-44444444-55555555-66666666-77777777-88888888-99999999
KCLT 72314    35.22   -80.93   234.00    14.40    13.30    29.91  1012.88

11111111-22222222-33333333-44444444-55555555-66666666-77777777-88888888
 1012.88   320.00     2.57   985.09  1025.00     4.00     1.00     9.00
```

Line 1:
1) KCLT – ICAO Station ID (4 digits)
2) 72314 - WMO Station ID (5digits)
3) 35.22 – Latitude (8 digits)
4) -80.93 – Longitude (8 digits)
5) 234.00 – Elevation in meters (8 digits)
6) 14.40 – Temperature Celsius (8 digits)

7) 13.30 – Dew Point Celsius (8 digits)
8) 29.91 – Altimeter in Inches (8 digits)
9) 1012.88 – Altimeter in Millibars (8 digits)

Line 2:
1) 1012.88 – Sea Level Pressure in Millibars (8 digits)
2) 320.00 – Wind Direction (8 digits)
3) 2.57 – Wind Speed (Meters/Second) (8 digits)
4) 985.09 – Station Pressure in Millibars (8 digits)
5) 1025.00 – Station Pressure Trend/Change (encoded) (8 digits)
6) 4.00 – Sky Cover (encoded) (8 digits)
7) 1.00 – Past Weather (encoded) (8 digits)
8) 9.00 – Present Weather (encoded) (8 digits)

Upper-Air Data -
The following is an example upper-air data entry in the Combined Observation data file. The data in this section are of a different format due to the volume of data need to be listed. The data are broken down into 3 sections: Station ID/Location, TTAA (all data from mandatory levels), TTBB (Pressure levels of significant Temp/Dewpoint) and PPBB (Height levels of significant Wind Direction/Speed). TTBB and PPBB entries do not have a fix number so there can be quite a few. Notice that the data are in specific positions and must remain that way when edited if it is to be read properly.

```
KWAL 72402
       37.93    -75.48     41.00
 TTAA
         13
 64.     1006.00    41.00    17.40    15.90   330.00     1.03
 32.     1000.00    64.00    19.00    14.10   345.00     2.06
 32.      925.00   734.00    16.20     7.20   320.00     4.63
 32.      850.00  1446.00    11.00     5.00   245.00     5.66
 32.      700.00  3051.00     5.40   -22.60   235.00    28.31
 32.      500.00  5720.00    -9.50   -25.50   220.00    41.70
 32.      400.00  7420.00   -17.10   -22.10   220.00    49.94
 32.      300.00  9520.00   -31.30   -55.30   230.00    53.02
 32.      250.00 10790.00   -40.30   -72.30   230.00    47.88
 32.      200.00 12270.00   -52.70   -80.70   225.00    48.39
 32.      150.00 14080.00   -63.50   -87.50   245.00    40.15
 32.      100.00 16540.00   -68.70   -90.70   240.00    16.47
  8.      306.00 -9999.00 -9999.00 -9999.00   225.00    53.54


 TTBB
         3
 64.     1006.00    41.00    17.40    15.90 -9999.00 -9999.00
  4.      996.00 -9999.00    19.80    12.80 -9999.00 -9999.00
  4.      967.00 -9999.00    19.40     9.40 -9999.00 -9999.00
 PPBB
         3
 64.    -9999.00    41.00 -9999.00 -9999.00   330.00     1.03
  2.    -9999.00   304.80 -9999.00 -9999.00   345.00     5.15
  2.    -9999.00   609.60 -9999.00 -9999.00   325.00     5.66
```

Line 1: Station ID (ICAO & WMO)
Line 2: Lat, Lon, Elevation
Line 3: Section ID
Line 4: Number of entries in section

Section Entries:

```
111----22222222-33333333-44444444-55555555-66666666-77777777
64.     1006.00    41.00    17.40    15.90   330.00     1.03
```

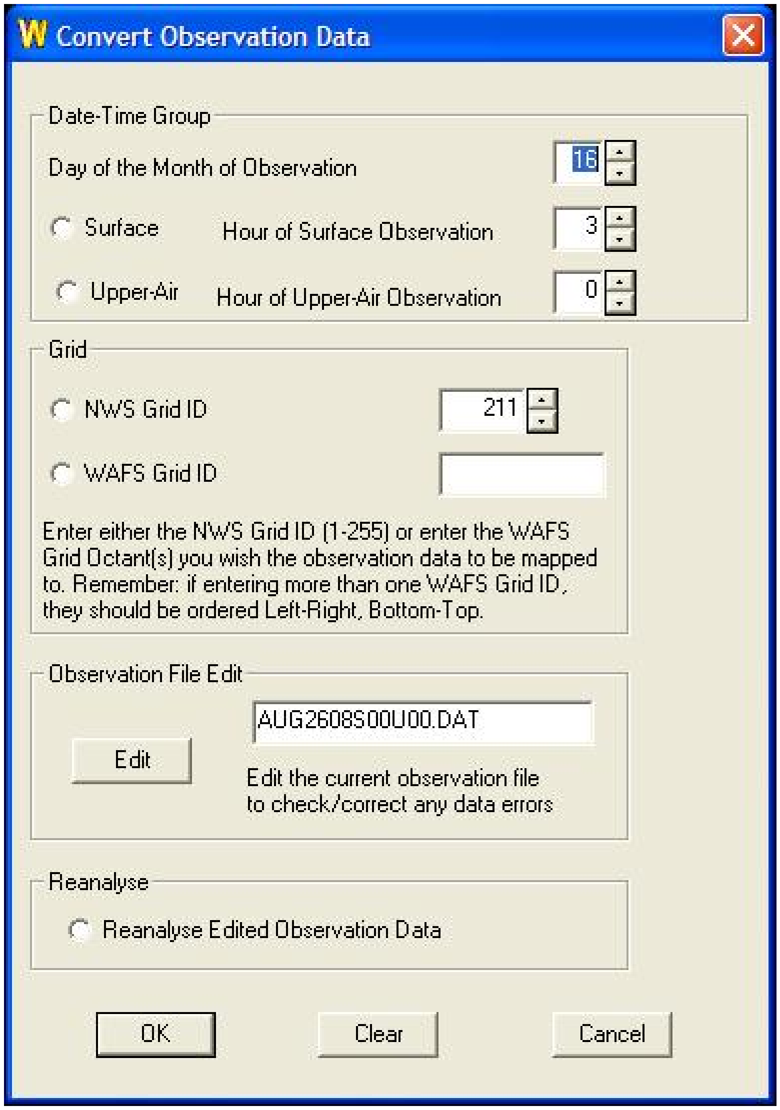
1) `64.` – Entry ID (3 digits)
   64 = Surface
   32 = Mandatory Pressure Level
   8 = Tropopause
   4 = Significant Temp/Dewpoint
   2 = Significant Wind Direction/Speed (M/S)

2) `1006.00` – Pressure Level in Millibars (8 digits)
3) `41.00` – Pressure Height Trend/Change (encoded) (8 digits)
4) `17.40` – Temperature Celsius (8 digits)
5) `15.90` – Dew Point Celsius (8 digits)
6) `330.00` – Wind Direction (8 digits)
7) `1.03` – Wind Speed (Meters/Second) (8 digits)

Editing Combined Observation Files

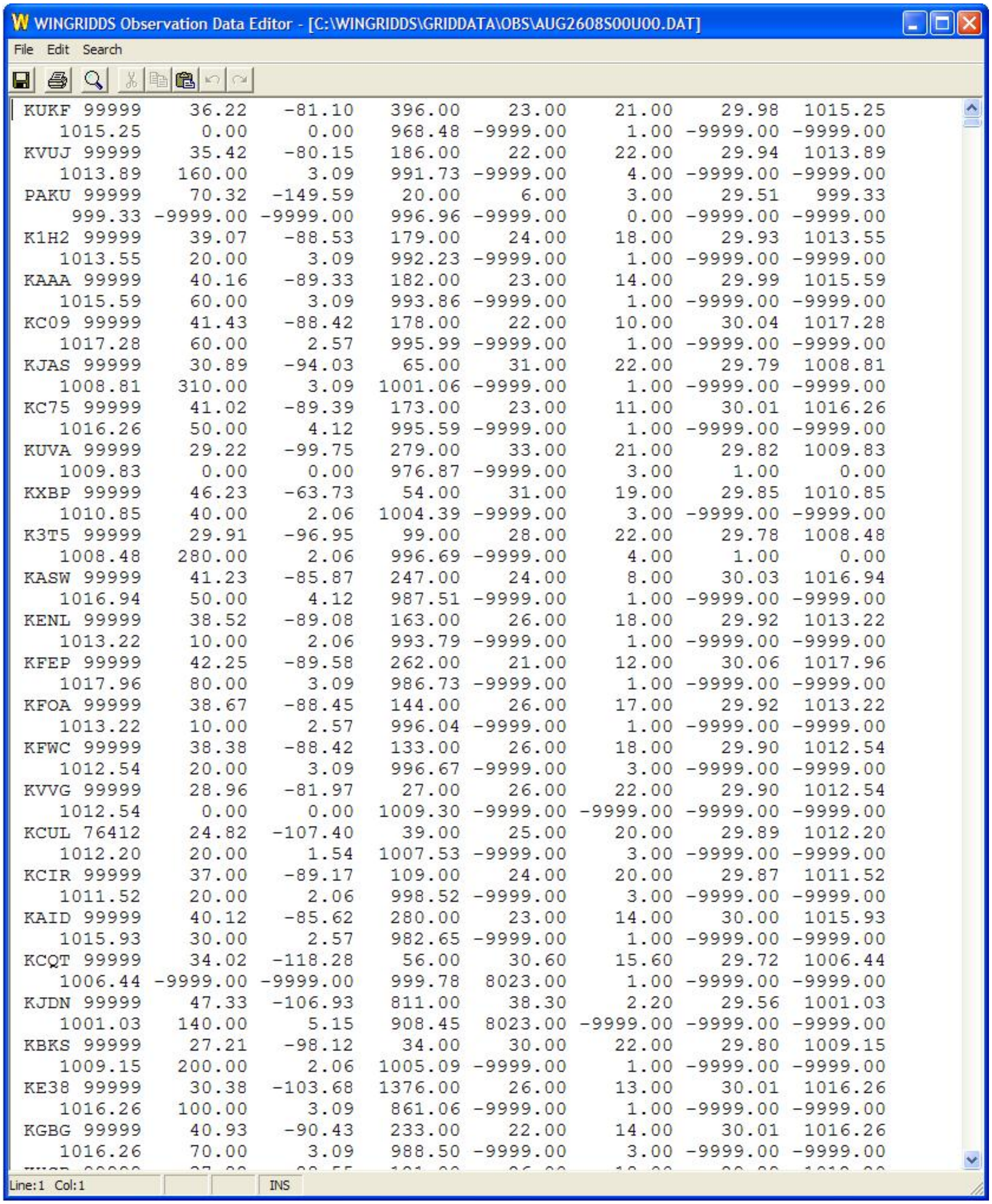
If, after the observation data has been processed and you view the Observation PCG data file and you see suspicious data effects (contour 'bulls-eyes' to unrealistic values), you can use the STID command to find the station ID at or near the bulls-eye center or plot the station model(s) for that area to find the suspect station. Then, open the combined observation data file with a text editor and search for that station ID with the suspect data value you saw. WINGRIDDS now has its' own text editor which will automatically open the current observation data file when executed. This editor is located within the 'Convert Observation Data' dialog. See below:

Once the station is found, and the suspect data value is seen, you can either enter a known good value or change the value to -9999.00 to denote "missing" data. Then, from within the 'Convert Observation Data' dialog, select the same Time & Grid parameters which match the observation data file that was edited and also, select the 'Reanalyze Edited Observation Data' section or, from the Windows Command Line, run OBS2PCG utility with the same parameters and add the 'R' flag at the end. The Combined Observation data file will be rescanned to perform a new Barnes Analysis on all of the data and a new PCG data file will replace the one with the bad data.



When an observation data file is opened within WINGRIDDS and it is determined the contents need to be edited follow these simple steps:

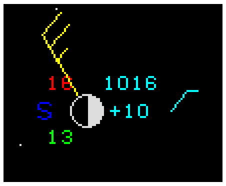
7) On the WINGRIDDS Plan display, locate the geographic area where the spurious data bulls-eye is located and note the parameter which is displayed (TEMP, HGHT, etc.)
8) Type the command ‘STID’ to show the reporting stations and find the station IDs in the area of the bad data.
9) Open the ‘Convert Observation Data’ dialog and click the ‘Edit’ button to open the Observation Data Editor (see below).



10) Perform a search for the station ID. Refer to the WINGRIDDS documentation for the data layout of the observation data file.
11) Once the station is found and the data value is seen, either correct the data value or replace the value with the 'missing' value of -9999.
12) Save the file and, from within the 'Convert Observation Data' dialog, check the 'Reanalyze' button and reprocess the observation data with the corrected data value and the data bulls-eye should be gone.

---Station Model Plot Color Control

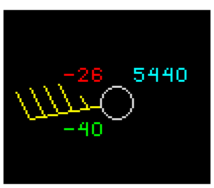
Below is an example of a surface station model plot:



Surface Station Parameters:

1 SKY COVERAGE SYMBOL
2 TEMPERATURE
3 CURRENT WEATHER SYMBOL
4 PRESSURE
5 PRESSURE TREND
6 DEW POINT
7 PAST WEATHER SYMBOL
8 WIND

Below is an example of an upper-air (500mb) station model plot:



Upper-Air Station Parameters:

1 SKY COVERAGE SYMBOL (ALWAYS CLEAR)
2 TEMPERATURE
4 PRESSURE LEVEL HEIGHT
6 DEW POINT
8 WIND

Station parameter location:

	8	
2		4
3	1	5
6		7

Each parameter can be assigned a unique color based on selection from within the ‘Properties’ dialog which is covered in ‘*Customizing WINGRIDDS’* section.

Plotting Station Model Data

The STWX command has been added for plotting station model data and it is only available to plot data when an observation data file is open. Station plots are governed by the FULG and NRMG flags which control data thinning on the display. If normal data thinning is in effect through the use of the NRMG flag (default), the station model plotting routine filters the station model plot display so that there are no stations over-writing each other. This is accomplished by selecting stations to plot by reading a new station list file called STNID-PRIME.DAT in the DATA directory. This file is a list of the preferred stations to plot. It is in the same format as STNID.DAT. The plot routine reads down the list and plots any station which is in the field of view of the display and observation data is available to plot. When the plot routine reads a station from the list and it finds data from that station to plot, it checks to see if the station to plot does not interfere with any previously plotted stations. Priority is given on a first-come, first-served basis. After the stations in the STNID-PRIME.DAT have been processed, the plot routine reads through the rest of the observation data file to plot any remaining station in the field of view of the display checking they do not overlap any previous station plots. Therefore, the wider the areal coverage of the display, the fewer stations which will be plotted. As the display is zoomed in, more stations will fill in the areas. To allow all stations to be plotted, first select the FULG command. If the level selected is not SFC, the plot routine will search for any upper-air reports and plot the station model if data is found for that level. A full list of station symbols are listed Appendix C.

WINGRIDDS Observation Commands

The following commands have been added to WINGRIDDS for the Observation data:

STWX – Plots the station model on the screen for the level selected
STID - Plots station ID information (WMO or ICAO) at the geographic location.

 This Tool Bar button will be enabled whenever an observation data file is selected. When pressed, it executes the ‘STWX’ command.

Diagnostic Functions –

**- Diagnostic Functions - Background and Philosophy -

The ability to calculate and combine a variety of quantities derived from the grid point data greatly enhances the diagnostic capabilities of the system. The diagnostics are expressed in functional form, in that a function name is followed by an ordered set of arguments, optionally enclosed in parentheses or brackets and separated by commas.

As an illustration, advection is expressed as the function **ADVT** followed by a Scalar quantity and a Wind Type. As such, the Temperature Advection field should be thought of as "ADVecTion of the TEMPerature by the Total WIND" and correspondingly requested using the sequence **ADVT(TEMP,WIND).** Similarly, the ageostrophic component of the Moisture Advection is expressed as "ADVecTion of the MIXing Ratio by the AGEOstropic wind" and requested by **ADVT(MIXR,AGEO).** Here, both the Mixing Ratio and Ageostrophic Wind are derived automatically.

Functional calls can also be chained together. For example, Vorticity Advection is thought of as "Advection of the Vorticity of the Total Wind by the Total Wind." As such, the functional request becomes **ADVT[VORT(WIND),WIND].**

For clarity, either parentheses - (and) - or brackets - [and] - can, as an option, be used to group the function arguments.

**- Available Diagnostic Functions -

See the Appendix or the Command Help option for full listing of available commands.

Some frequently used functions, include:

SSUM [Followed by 2 Scalars] > Calculates Scalar grid sum
SAVR [Followed by 2 Scalars] > Calculates Scalar grid average
SDIF [Followed by 2 Scalars] > Calculates Scalar grid difference
STND [Followed by 2 Scalars] > Calculates Scalar grid time tendency
SMLT [Followed by 2 Scalars] > Multiplies two Scalar fields
SDVD [Followed by 2 Scalars] > Divides two Scalar fields
SADC [Followed by a 4 digit value] > Sum of Scalar & specified constant
SSBC [Followed by a 4 digit value] > Difference of Scalar & specified constant
SMLC [Followed by a 4 digit value] > Multiplies Scalar by specified constant
SDVC [Followed by a 4 digit value] > Divides Scalar by specified constant
INVS [Followed by a Scalar] > Finds INVerSe of a Scalar
INV1 [Followed by a Scalar] > Finds INVerse of a Scalar with max. of 1
ABSV [Followed by Scalar] > Calculates ABSolute Value of Scalar grid
SINE [Followed by Scalar] > Calculates the SINE of Scalar grid (e.g., WDRC)
COSN [Followed by Scalar] > Calculates the COSiNe of Scalar grid (e.g., WDRC)
TNGT [Followed by Scalar] > Calculates the TaNGenT of Scalar grid (e.g., WDRC)
SNEG [Followed by Scalar] > Finds the NEGative of a Scalar grid

DSDX [Followed by Scalar] > Calculates X gradient of Scalar
DSDY [Followed by Scalar] > Calculates Y gradient of Scalar
MGRD [Followed by a Scalar] > Magnitude of the GRaDient of a Scalar field
GRAD [Followed by a Scalar] > Finds the GRADient of a Scalar field

NGRD [Followed by a Scalar] > Finds the Negative GRaDient of a Scalar field
MGRD [Followed by a Scalar] > Magnitude of the GRaDient of a Scalar field

VADC [Followed by a 4 digit value] > Sum of Vector & specified constant
VSBC [Followed by a 4 digit value] > Difference of Vector & specified constant
VMLC [Followed by a 4 digit value] > Multiplies Vector by specified constant
VDVC [Followed by a 4 digit value] > Divides Vector by specified constant
VNEG [Followed by Vector] > Finds the NEGative of a Vector field
VSUM [Followed by 2 Vectors] > Calculates the Vector sum
VAVR [Followed by 2 Vectors] > Calculates the Vector average
VDIF [Followed by 2 Vectors] > Calculates the Vector difference
VTND [Followed by 2 Vectors] > Calculates the Vector time tendency
VMLT [Followed by 2 Vectors] > Multiplies two Vectors by components
DOTP [Followed by 2 Vectors] > Calculates the DOT Product of 2 Vectors
CRSP [Followed by 2 Vectors] > Calculates the CRoSs Product of two Vectors
VDVD [Followed by 2 Vectors] > Divides two Vectors by components

VKNT [Followed by a Vector] > Converts a Vector from m/s to KNoTs
VMPH [Followed by a Vector] > Converts a Vector from m/s to MPH
VKPH [Followed by a Vector] > Converts a Vector from m/s to KPH
MAGN [Followed by a Vector] > Calculates MAGNitude of a Vector
SKNT [Followed by a Scalar] > Converts a Scalar (e.g., WSPD) from m/s to KNOTs
SMPH [Followed by a Scalar] > Converts a Scalar (e.g., WSPD) from m/s to MPH
SKPH [Followed by a Scalar] > Converts a Scalar (e.g., WSPD) from m/s to KPH

ISAL > Computes the Isallobaric Wind
INAD > Computes the Inertial Advective Wind
JCBN [Followed by 2 Scalars] > Computes the Jacobian determinate of two scalars
FRTG [Followed by wind Vector] > Computes Frontogenesis of the wind
DFCP [Followed by a vector] > Calculate the Deformation components
(X COMP, Y COMP) of any vector
FVCT > Calculates F (Normal wind) Vectors
QVCT > Calculates Q (Geostrophic wind) Vectors
THTS > Calculates Saturated Theta-e

ADVT [Followed by Scalar and Vector] > Calculates advection
DVRG [Followed by a Vector] > Calculates divergence
FLUX [Followed by a Scalar & a Vector] > Produces a flux Vector
SDVR [Followed by Scalar and Vector] > Calculates flux divergence
RVRT [Followed by a Vector] > Calculates relative vorticity
VORT [Followed by a Vector] > Calculates absolute vorticity
IPVO > Isentropic Potential Vorticity calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to Theta levels.
IPVA > Isentropic Potential Vorticity Advection calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to Theta levels.
PVTA > Isobaric Potential Vorticity (Theta) calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to pressure levels.
PVTE > Isobaric Potential Vorticity (Theta-E) calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to pressure levels.
PVTS > Isobaric Potential Vorticity (Theta-S) calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to pressure levels.
PVAA > Isobaric Potential Vorticity (Theta) Advection calculated between LVL1 and

LVL2 when LVL1 and LVL2 are set to pressure levels.
PVEA > Isobaric Potential Vorticity (Theta-E) Advection calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to pressure levels.
PVSA > Isobaric Potential Vorticity (Theta-S) Advection calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to pressure levels.

SMTH > Applies a binomial smoother to the active Scalar gridded data
VSMT > Applies a binomial smoother to the active Vector gridded data

ZPOS > Sets all positive values to zero
ZNEG > Sets all negative values to zero
RLTN [Followed by a 4 digit value] > Replaces values Less ThaN with that value
RGTN [Followed by a 4 digit value] > Replaces values Greater ThaN with value

****- Diagnostic Functions - Cross Section Specific:**
XREL [Followed by Vector] > Rotates Vector from earth to cross sector relative
TANG [Followed by Vector] > Finds cross-section relative tangential component
VTNG [Followed by Vector] > Plots cross-section relative tangential component
VCRC [Followed by Vector] > Plots **VTNG** & **VVEL**
VCR2 [Followed by Vector] > Plots **VTNG** & **VVEL** scaled by 2
VCR5 [Followed by Vector] > Plots **VTNG** & **VVEL** scaled by 5
NORM [Followed by Vector] > Finds cross-section relative normal component
VNRM [Followed by Vector] > Plots cross-section relative normal component

**- Examples of Diagnostic Functions -

Some sample diagnostic command sequences include:

MAGN(WIND) - will calculate and display isotachs of the MAGNitude of the total WIND.
SDIF(MIXR,SMIX) - will produce the difference between the true and Saturation MIXing Ratios --- the saturation deficit.
ADVT[TEMP,WIND] - will produce the TEMPerature ADVecTion field using the total WIND, - Note brackets/parends are interchangeable.
ADVT TEMP GEOS - will produce the TEMPerature ADVecTion field using the GEOStrophic wind, - Note brackets can be omitted
ADVT(PRES,WIND) S982 - will set the default level to the bottom sigma level of the NGM and calculate the ADVecTion of PRESsure on a sigma surface by the WIND, a measure of the orographic vertical motion,
DVRG[WIND] - will calculate and display the DiVeRGence of the total WIND,
SDVR(MIXR,WIND) - will contour the Scalar flux DiVeRgence of the MIXing Ratio using the total WIND, etc.

**- Shorthand specifications and Commonly Used Diagnostic Functions -

For simplicity, frequently used sequences of commands can be grouped together and given a 4 character ALIAS name. These alias names can be used in exactly the same fashion as all other WINGRIDDS commands, with the difference that they are completely user defined in the file **USER\ALIAS.DAT**.

Some predefined systems aliased diagnostic commands include,

WSPD > Generates isotachs for the Total wind
WVRT > Generates vorticity of the Total wind
GVRT > Generates vorticity of the Geostrophic wind
THCK |TKNS| > Generates Thickness fields on levels defines by LVL1/LVL2
THWN |TWND| > Generates Thermal Wind on levels defines by LVL1/LVL2

TADV > Generates Temperature Advection using the Total wind
QADV > Generates Mixing Ratio Advection using the Total wind

**- Repeating previous commands

A list of the previous 21 commands input from the keyboard is given by entering the command **CMDS**. This command ERASES the screen. Individual commands can be examined without erasing the screen by using the command **CMD**#, where # is the order number of the previous command, e.g., **CMD2** will list the 2nd previous command. For commands 10 through 21, the letters A through L are used.

A previous command can be repeated by using the command **RPT**#, where again # refers to the order number of the previous command. The command results can be overlaid on the existing graphics by including a & after the command. As such, **RPTB&** will overlay the 11th previous command on the existing graphics.

A historical record of all commands used in a particular session is stored in the file **COMMAND.OUT**. Reference to particularly complicated commands from this file can simplify writing the command files to be described next.

**-Calculating Convection and Shear Parameters

WINGRIDDS can now directly calculate numerous convection and wind shear parameters. WINGRIDDS also has new flag commands to control the way the convection and shear parameters are calculated. Below are the new control flags for convection:

VTMP – Virtual Temperature Correction
All convection parameters are calculated without virtual temperature correction by default. This flag enables that correction.
SBSI – Surface-Based Lifted Parcel Selected
MLSI – Mean-Layer Lifted Parcel Selected
MUSI – Most Unstable Lifted Parcel Selected
USSI – User-Selected Lifted Parcel Selected
If no Lifted Parcel method is selected, Surface-Based Lifted Parcel is default.

Examples –

To calculate CAPE with virtual temperature correction and using the Mean-Layer Lifted Parcel, enter:
CPOS VTMP MLSI

WINGRIDDS can also calculate various wind shear and supercell wind-motion parameters. There is a new control flag for shear calculations:

****KM** – Defines the Lower/Upper bounding levels in Kilometers
The first ***** (0-9) defines the lower level to use and the second ***** (0-9) defines the upper level to use. Therefore, a command **14KM** defines the 1km to 4km layer.

The wind shear Vector/Scalar diagnostics can be calculated on Pressure, Sigma, Isentropic or Height layers defined with the **SLYR** command or with the ****KM** flag:

Examples –

To calculate the total shear between the isentropic layers I320 and I350, enter:
TSHR & SLYR I320 I350

To calculate the right-moving storm-relative helicity through the 0-3km layer, enter:
SRHR 03KM

****
******* **NOTICE – NOTICE – NOTICE – NOTICE – NOTICE – NOTICE** ********
****

The calculations of shear and convection parameters may not exactly match what other programs calculate due to the variations in near surface/boundary-layer data used to calculate the parameters. Some calculations are very sensitive to the lower layer data. However, the results you get with WINGRIDDS should be very close to other programs' calculations. Remember – the accuracy of the product is only as good as the data used in the calculation. The less vertical data which is available then the less accurate the solution will be.

<u>- COMMAND {MACRO} FILES -</u>**

A command file is simply a sequence of command lines to be executed in series, and can be used as shorthand notations for frequently used or particularly complicated command sequences or to produce pre-defined products.

Pre-specified sequences of command lines can be written into an ASCII file using any word processor. The Command File can be given any 4 letter NAME and must be followed by the qualifier ".CMD". To execute the Command File, type the file NAME at the BEGINNING of a command line, followed IMMEDIATELY by a period. The requested command lines will be displayed in sequence, with a prompt to press [Enter] displayed between command lines.

Loops can also be set up by including the word **LOOP** alone at the beginning of any line of the Command File. Loops are ended by including the command line **ENDL**. User prompts at the end of each command line are NOT given while in LOOP mode. Pauses between looped command lines can be included by adding the commands **1SEC, 3SEC, 5SEC, 7SEC, or 9SEC**, depending on the number of seconds desired.

Annotation can also be added to any line on the screen using the **TXT**# command. For example, '**TXT3 This is line 3**' will write the text on the third line of the screen.

<u>- Sample COMMAND FILE (Macro) -</u>**

A sample Command File containing -

```
WIND&TEMP CIN5&HGHT CI60 SLVL  850  F00
LOOP
WIND&TEMP CIN5&HGHT CI60  F12
WIND&TEMP CIN5&HGHT CI60  F24 5SEC
WIND&TEMP CIN5&HGHT CI60  F36 5SEC
WIND&TEMP CIN5&HGHT CI60  F48 5SEC
ENDL
```

- will display the initial 850 mb heights, temperatures and winds, request the user to press [Enter], and then display a loop of the 12, 24, 36, and 48 h forecasts, pausing 5 seconds between each completed graphic.

Command macros can now have comment lines included when the left-most character on the line is a **'#'**. Any line which starts with a **'#'** is ignored. There for, the macro 'HGHT.CMD' which is:

```
LOOP
PLAN
HGHT
ENDL
```

Can now also look like this:

```
#***********************************************
# THIS IS A TEST FOR COMMENTS
#***********************************************
#  ENTER THE LOOP
#
LOOP
#
#  ENSURE DISPLAY IS PLAN MODE
#
PLAN
#
#   PLOT THE HEIGHTS
#
HGHT
#
#  END THE LOOP
#
ENDL
```

You must ensure there are no empty spaces or extra lines at the end of the file.

Diagnostic Functions - Advanced Explanations

**- VERTICAL LEVEL COMMANDS

Setting the vertical levels is quite easy within WINGRIDDS. For example, to set the vertical level to 500 millibars, simply type in 500 < return >. For isentropic surfaces (see MTHT), precede the isentropic surface by the letter "I", as in 1303. For sigma level surfaces (as found in the NGM gridded data), precede the midpoint pressure with the letter "S", as in S982.

(NO OUTPUT) The numeric signs #### or ### are a 3 or 4
digit integer that represent the vertical level. See SLVL.

SLVL [vertical level]
(NO-OUTPUT) This optional command sets the vertical level of data to be examined. The actual numerical value (see "####"; e.g., "700") can be entered directly or (optionally) the numeric vertical level may be preceded by "SLVL" (e.g. "SLVL 500"). A vertical level can be one of the following:

1) an isobaric (constant pressure) level (e.g., 850);
2) an isentropic level (e.g., I298); or
3) a model sigma level (e.g., S982); or
4) a boundary layer/10 meter anemometer ht. (e.g., M10); or
5) a constant height level in Meters or Feet (in hundreds) (e.g., H100)

To change the vertical level, enter a vertical level from one of the valid ones shown in the gridded display listing (see LIST). For example, entering "700" sets the vertical level to 700 mb. The current vertical level is displayed whenever LIST is invoked and can be found immediately below the command line. The default flag variable LEVL contains the current vertical level and is reset whenever the vertical level is changed. The default value for LEVL is initially set from the initialization file INITGRID.SPC.

The use of the command word SLVL is optional. Earlier versions of WINGRIDDS required the SLVL command. A valid vertical level must be entered or data will not display.

If you type in the wrong value of SLVL (e.g., you type in 860 instead of 850 mb), WINGRIDDS still accepts the bogus level, and the LIST command will show it - but nothing will ever be displayed since there are no data for that level. This is not an oversight in software design, but a way to allow for new vertical levels to be added at a future date without having to update the software. For example, at some later date, gridded data may become available for the 925 mb level. Hence, all you would need to type in is "925" and you would be ready to display the data for that level. The same rationale also applies for setting the forecast hour (F27 is as valid a forecast hour as F24).

B### (NO OUTPUT)
Sets the vertical level either to the 10-meter anemometer height (M10) or to some other boundary layer level. The default flag variable LEVL is set accordingly.

LVL1 (NO OUTPUT)
LYR1
Temporarily sets the vertical level to obtain data from bottom of layer for variables specified to the left. LVL1 is a system flag variable for the lower layer. For example, if the layer variables as shown on the WINGRIDDS variable line are "1000/500', then the command "WIND LVL2" will plot the total winds at 500 mb. See also SLYR,

VERTICAL LEVEL COMMANDS (cont.)

LVL2 (NO OUTPUT)
Temporarily sets the vertical level to obtain LYR2 data from bottom of layer for variables specified to the left. LVL2 is a system flag variable for the lower layer. For example, if the layer variables as shown on the WINGRIDDS variable line are "S982/S896", then the command "WIND LVL1" will plot the total winds for the sigma three layer. See also SLYR, LVL1.

LEVL (NO OUTPUT)
Overrides the LVL1 and LVL2 variables and gets data from original level. See also LVL1, LVL2, SLYR.

MMSL (NO OUTPUT)
Sets the vertical level to mean sea level (MSL) pressure for the NMC Rapid Update Cycle (RUC) hourly surface analysis using the same reduction-to-sea level technique as used in the Forecast Systems Laboratory (FSL) version of the Mesoscale Analysis and Prediction System (MAPS). See NMSL

NMSL (NO OUTPUT)
Sets the vertical level to mean sea level (MSL) pressure for the NMC Rapid Update Cycle (RUC) hourly surface analysis using the same reduction-to-sea level technique as used by NMC Automation Division. See also MMSL

S982 (NO OUTPUT)
Sets the vertical level to the sigma one level. This is the lowest sigma surface.

S943 (NO OUTPUT)
Sets the vertical level to the sigma two level.

S896 (NO OUTPUT)
Sets the vertical level to the sigma three level.

S784 (NO OUTPUT)
Sets the vertical level to the sigma five level.

S### (NO OUTPUT)
Sets the level to the sigma level centered at ### mb. Current valid sigma level for the NGM include: S982, S943, S896, S784, which represent the bottom, second, third, and fifth sigma levels, respectively. The default flag variable LEVL is set accordingly.

I### (NO OUTPUT)
Sets the vertical level to ### degrees Kelvin isentropic surface. This assumes the isentropic data for that level were already created using either the MTHT command or data from upper level MAPS output. For example, entering the command I303 causes all subsequent data requests to use data interpolated to the 303K isentropic surface. The default flag variable LEVL is set accordingly.

SLYR [LVL1 LVL2] (NO OUTPUT)
Sets the lower and upper layers for use in data selection. LVL1 is a system flag variable for the lower layer while LVL2 is the variable for the upper level. For example, the sequence SLYR 1000 500 will cause any of the WINGRIDDS commands that perform layer calculations (e.g., see LDIF, LSUM, LAVE, etc.) to set LVL1 equal to 1000 mb as the lower surface and 500 mb (= LVL2) as the upper surface.

The vertical levels can not only be pressure levels, but also isentropic or sigma level data, or a combination of each. For instance, the command SLYR S982 500 sets the bottom level (LVL1) to the bottom sigma level surface (S982) while setting the upper level (LVL2) to 500 mb.

****- COMMANDS TO ALTER CONTOUR INTERVALS**

By default, WINGRIDDS will select a contour interval automatically for each field displayed. For example, when you want a depiction of temperatures, you type TEMP. WINGRIDDS then determines what appears to be an "eye-pleasing" number of contours for the range of data over the given display area. An "eye-pleasing" number of contours would be between about six and twelve contours. A user can optionally override the WINGRIDDS choice of contour interval by following the command with a specific contour interval, e.g., TEMP CIN2 contours isotherms every two degrees C.

In addition, the WINGRIDDS command line interpreter (the software that processes commands), is quite flexible. The command processor looks for commands beginning with the letters "CIN" or "CI" and followed by a number as a contour interval. Examples are "CIN6", "CI10", "CI50", etc., which correspond to contour intervals of 6, 10, and 50 units, respectively. In addition, the processor uses a template of the form C#+# or G#-# when interpreting what contour interval command is given. With this in mind, contours intervals in the range of 9 x 10 * to 9 x 10 *9 are possible. For example, if a contour interval of every 0.01 is desired, one simply types in "C1-1"; if an interval of 0.05 is needed, then type in "C5-2". With a little practice, specifying contours becomes easy.

There commands to allow the user to interactively set the contour interval (see CINT). The maximum number of contours can be changed (see CNUM). A specific contour interval can be retained for all subsequent plots (see CISV) or until the command to resume automatic program selection of contours is given (CINX).

NOTE: specifying contour intervals having two significant digits (e.g., CI25, CI33, or CI75) will NOT produce the desired results of contouring every 25, 33 or 75 units. However, when two digits are specified, but with only one significant digit (e.g., CI20, CI30, etc.), the desired results are obtained.

The following are the contour interval commands:

CNUM [Followed by Integer]
Changes the maximum number of contours to display. The default maximum number of contours is 50.

CINT
Displays the maximum and minimum of preceded by a particular data field and then requests user input in setting the contour interval. For example, "DVRG WIND CINT prompts the user:

"CONTOUR INTERVAL = OE+00 - INPUT NEW VALUE - "

One can enter the new value in one of two ways:
1) type in a positive interval number directly, e.g., 2, 10, .05, 100, etc.
2) type the interval number in an "E-format", i.e., scientific exponent notation; 1E5, 1E+5, 5E-4, etc.

CISV
Sets mode where specified contour interval is retained for future plots. The contour interval is canceled by issuance of the command CINX.

COMMANDS TO ALTER CONTOUR INTERVALS (cont.)

CINX
Returns to mode in which program selects contour interval for each plot. See also CISV, CINT.

CIN#
Sets contour internal to # units. "#" can be in the range 1 to 9, inclusive.

C1N1
Sets contour interval to 1 unit.

CIN#
CIN2 Sets contour interval to 2 units. See CIN#.

CI#0
Sets contour interval to # of tens of units. "#' can be in the range 1 to 9, inclusive.

CI10
Sets contour interval to every 10 units. See CI#0.

CI20
Sets contour interval to 20 units. See CI#0.

C#00
Sets contour interval to # hundreds of units. "#" can be in the range 1 to 9, inclusive.

C100
Sets contour interval to 100 units. See C#00.

C200
Sets contour interval to 200 units. See C#00.

C#+#
Sets contour interval to # x 10** units. For example, C2+3 translates into a contour interval of 2 x 10+3 = 2000 units.

C1+3
Sets contour interval to 1000 units or 10+3. See C#+#.

C2+3
Sets contour interval to 2000 units or 2 x 10*3. See C#+#.

CI.#
Sets contour interval to tenths units (0.#) or # x 10 v See C#-1

CI.1
C1-1
Sets contour interval to 0.1 units. See C#.1 and CI.#.

CI.2
C2-1
Sets contour interval to 0.2 units. See CI.# and C#-1.

C#-#
Sets contour interval to # x 10^ units. For example, C2-3 translates into a contour interval of 2 x 10^ = .002 units.

C2-2
Sets contour interval to every .02 units. See C#-#. C5-3 Sets contour interval to .005 units. See C#-#.

<u>- COMMANDS TO ALTER FORECAST TIME</u>**

WINGRIDDS lets you easily change forecast hours (see, e.g., FOO, F12, etc.). Also, you can specify a default pair of forecast hours that allows you to compute time differences of some parameter (see SFHS). Lastly, you can obtain a grid from one (or both) of the forecast hour pairs without changing the default forecast time pair values (see FHR1 and FHR2).

F-1 or ANAL
Sets the default forecast hour to use the 00-hour grids (i.e., the "analyzed" model grids from the objective analysis routine before the grids have been subject to the model's initialization process).

FOO or INIT
Sets the default forecast hour to use the 00-hour (or initialized) grids. In most cases the "analyzed" (see F-1) and initialized data grids are nearly identical.

F12
Sets the default forecast hour to use the 12-hour grids.

F24
Sets the default forecast hour to use the 24-hour grids.

F36
Sets the default forecast hour to use the 36-hour grids.

F48
Sets the default forecast hour to use the 48-hour grids.

F##
F###
Interprets the '###" or "##" to be a number whose value is set to the default forecast hour. For example, F18, sets the default forecast hour to use the 18-hour grids, while the command F120 sets the forecast hour to use the 120-hour grids. The numeric value of ## or ### can be negative, e.g., F-3 sets the default forecast hour to use data grids 3 hours prior to the model initialization (see F-6, F-6).

NOTE: WINGRIDDS allows the use to set the default forecast hour to practically anything. However, the data grids are only available at set forecast hours (usually the main synoptic times). So setting the default forecast hour to say, F26, is permissible, but there is likely no data available at this forecast hour. The data grids available at a specified forecast hour can be seen with LIST.

GUES or equivalently F-3
F-3 Sets the default forecast hour to use "first-guess" grids used in developing the model's initial analysis grids. Usually, this is a grid valid 3-hours prior to the model analysis valid time.

GES6 or equivalents F-6
F-6 Sets the default forecast hour to use "first-guess" grids valid 6-hours prior to the model analysis valid time.

SFHS [forecast_hr1 forecast_hr2] or
FHRS

Sets the default forecast hour pair. The forecast hour pair is entered using either integer numbers (e.g., 12, 48, 06,120) or mnemonics (e.g., INIT). SFHS requires the user to type in the two forecast hours immediately to the right (e.g., SFHS INIT 24 sets the first forecast hour (FHR1) to use the 00-hour grids and the second forecast hour (FHR2) to use the 24-hour grids. In this case, you could compute the 24-hour change in some quantity, say, temperature at a given vertical level by typing the commands: TEMP TDIF which results in a difference field of temperatures between the initial and 24-hour forecasts. You can specify the forecast hours in any order (hence, SFHS 24 12 is valid).

The values of the FHR1 and FHR2 can be found on the default parameters lines immediately below the command line. Remember to use valid forecast hours (i.e., hours that the LIST command shows you actually have valid data). The FHRS command does the same thing as SFHS. See also TDIF.

SFHR #### FHOR
Sets the forecast hour system variable. The user can either enter an up to 4-character integer forecast hour immediately to the right of SFHR or the user is prompted for a number to input to set the default forecast hour. Number must be an integer (in other words, you cannot use mnemonics like "INIT or a program error occurs). SFHR and FHOR perform the same function.

FHR1
Gets data for the command(s) immediately to its left from first time of the "FHRS" time pair. The command string "SDIF TEMP TEMP FHR1" will subtract the temperature for the current forecast hour from the temperature at the "FHR1" forecast hour. See also FHR2, SFHS, FHRS.

FHR2 Gets data for command(s) immediately to its left from first time of the "FHRS" time pair. See also FHR2, SFHS, FHRS.

<u>- COMMANDS TO DISPLAY GRIDDED DATA</u>**

In general, most commands issued in WINGRIDDS will all display data from the given vertical level and forecast hour as noted by the LEVEL and FHOUR flags in the data listing (see LIST). The data displayed can be represented in one of three ways:

1) contours of a scalar field (e.g. temperature, mixing ration, vorticity);
2) a vector representation (e.g., wind, gradient of temperature) either as an arrow or a wind barb; and
3) a numeric data representation of the data at a grid point (see DATA, DDFF, etc.).

COMMANDS TO DISPLAY GRIDDED DATA (Cont.)

The commands below can be combined with other diagnostic functions. For example, "SDIF TEMP DWPT" computes the difference of the dry bulb temperature minus the dew point temperature at a given level and forecast hour and displays this difference as a contoured field (i.e., contours of dew point depression).

__- PRESSURE and GEOPOTENTIAL HEIGHT Commands__**

PRES (SCALAR)
Calculates pressure from available data fields. For example, if the vertical level is set to "S982" (i.e., the lowest sigma level in the NGM model), then typing "PRES" will, in essence, display a map of contoured terrain elevation, but in units of pressure (mb). This is because the NGM uses the terrain-following sigma coordinate system. The "982" for the first (lowest) sigma level refers to the pressure at the midpoint of the lowest sigma level assuming a surface pressure of exactly 1000 mb.

PMSL (SCALAR)
Contours Mean Sea Level (MSL) Pressure (in units of millibars).

HGHT (SCALAR)
Displays contours of geopotential height On meters) for the specified vertical level and forecast hour. For example, if the vertical level is 850 mb and the forecast hour is set to 12 hours, then entering the command HGHT will draw the 850 mb, 12-hour forecast contoured geopotential height field. It is invalid to type HGHT when the vertical level is set to either isentropic or sigma level coordinates.

__- TEMPERATURE Commands__**

TEMP (SCALAR)
TMPC
Displays contours of model forecast dry bulb temperatures in degrees Celsius (deg C) at a specified forecast hour and vertical level. The command TMPC does the same thing as TEMP.

TMPF (SCALAR)
Displays contours of model forecast temperatures in degrees Fahrenheit (deg F) at a specified forecast hour and vertical level.

TMPK (SCALAR)
TMPA
Displays contours of model temperatures in Kelvin (K) at a given forecast hour and vertical level. The command TMPA does the same thing as TMPK.

THTA (SCALAR)
Displays contours of potential temperature (customarily denoted by the Greek letter "theta") in Kelvin (K) at the specified forecast hour and vertical level. Potential temperature, as computed from Poisson's equation, is defined as the temperature which a parcel of dry air at some specified pressure and temperature would have if it were expanded (or compressed) dry adiabatically to a pressure of 1000 mb.

THTE (SCALAR)
Displays contours of equivalent potential temperature (denoted by the Greek letter "theta" with an E subscript or simply called Theta-E) at the specified forecast hour and vertical level in Kelvin (K).

Equivalent potential temperature is defined as the temperature an air parcel would have if all its latent heat were converted to sensible heat by means of a pseudo-adiabatic expansion to low pressure and temperature followed by a dry adiabatic compression down to 1000 mb. Hence, a field of Theta-E gives information on both the thermodynamic and moisture content at a given level.

**- WIND COMMANDS

Every WINGRIDDS gridded data file contains model forecast wind data broken down into **U** (north-south) and **V** (east-west) wind components. WINGRIDDS follows the conventional meteorological nomenclature for plotting the U- and V- components:

U is positive if the wind has a westerly component;
U is negative if the wind has an easterly component;

V is positive if the wind has a southerly component;
V is negative if the wind has a northerly component.

The U-component of the total wind is normally displayed The U- and V-wind components can be displayed automatically as vectors centered at each model grid point (see WIND). A vector quantity has both magnitude and direction. A scalar quantity (like temperature) has only magnitude. Any vector quantity (including not only winds but, e.g., the gradient of a scalar) can be displayed at each grid point using either 1) an arrow format (see AROW), 2) conventional wind barb format (see BARB) or 3) streamline format (see STRM).

A total of three different wind components can be displayed. They are: 1) the total model forecast wind (WIND), 2) the geostrophic (GEOS) wind, and 3) the ageostrophic (AGEO) wind components. The "total wind" is the vector sum of the geostrophic and ageostrophic winds. The geostrophic wind obeys the geostrophic-wind relationship which can be found in any dynamics textbook. To wit, the geostrophic wind blows parallel to isobars on a constant height surface; to geopotenial height contours on a constant-pressure surface, and to isopleths of the Montgomery streamfunction on an isentropic surface.

Units of wind speed for both the arrow and wind barb formats can be plotted using one of: meters/second, knots, miles/hour, or kilometers/hour (see WIND, WKNT, WMPH, and WKPH, respectively). If winds are plotted using the wind barb format, then the barbs points in the direction FROM which the wind is blowing. Each full stem represents ten units while each half stem denotes the fives unit. For example, any 25 unit wind speed (whether it be in knots, meters/sec, etc.) would always have two full stems and one half stem. If winds are plotted as arrows, then the arrow points in the direction TO which the wind is blowing. The length of the wind arrow is, by default, scaled so that the highest wind speed for the display domain spans one grid increment.

The individual U-and V-wind components can be displayed as contoured fields (see UGRD, VGRD and XCMP, YCMP). The wind direction over the display domain can be contoured (see DRCT - an isogonal analysis) as well as wind speeds - isotachs (see SPED, SPKT, SPML, SPKM, WSPD). A packed digital presentation of wind direction and speed is available (see DATA, DATT, DATE, DDFF).

Wind vectors in WINGRIDDS are displayed using the standard meteorological wind direction. This direction is the compass heading from which the wind is blowing. In a meteorological coordinate system, a south wind vector points north with a compass heading of 180 degrees. If a standard cartesian X-Y coordinate system is used (with the positive X abscissa axis increasing to the right, and the positive Y ordinate axis increasing up), the meteorological wind direction is the angle measured clockwise from the -Y axis. The mathematical wind direction is the angle measured counterclockwise from the positive X axis. To obtain the mathematical wind direction, simply subtract the meteorological wind direction from 270 degrees. (Figure here? from p. 19, Bluestein, 1992 book) The following commands for displaying and manipulating winds area given in alphabetical order.

AGEO (VECTOR)
Displays a computed field of ageostrophic winds derived from the total U- and V-wind components. The ageostrophic wind depicted in WINGRIDDS is the vector difference between the total (WIND) and geostrophic (GEOS) wind components. That is, you could produce a field of ageostrophic wind vectors by entering
"VDIF WIND GEOS".

AROW
Sets the default format for plotting vectors to arrows. All subsequent displays of any vector quantity (including winds) will be depicted using the arrow format.

BARB
Sets the default format for plotting vectors to wind barbs. All subsequent displays of a vector quantity (not just winds) will be depicted using the wind barb format.

STRM
Sets the default format for plotting vectors to streamlines. All subsequent displays of a vector quantity (not just winds) will be depicted using the wind streamline format.

BKNT (VECTOR)
Displays the total wind in wind barb format using units of knots (kts) and sets subsequent display of vectors in wind barb format.

BKPH (VECTOR)
Displays the total wind in wind barb format using units of kilometers per hour (km/hr) and sets subsequent display of vectors in wind barb format.

BMPH (VECTOR)
Displays the total wind in wind barb format using units of miles per hour (mph) and sets subsequent display of vectors in wind barb format.

BWND (VECTOR)
Displays the total wind in wind barb format using units of meters/second (m/s) and sets subsequent display of vectors in wind barb format. WNDB does the same thing.

DDDD [vector]
(NUMERIC) Displays digital values at every gridpoint of the direction On degrees) of any vector. Same as issuing the commands "DATA DRCT [vector]". See also DRCT.

DDFF [vector]
(NUMERIC) Displays digital values of any vector (typically a wind vector) in a packed format of 4 characters. If "XXYY" represents the packed format, then XX represents the direction of the vector in tens of degrees, while YY represents the magnitude of the vector in whatever units are displayed. The command line DDFF WIND displays a grid of 4 character groups (e.g., 1209) at every model grid point within the display domain. The example group "1209" is decoded as a wind direction of 120 degrees at 9 m/s.

DRCT [vector]
(SCALAR) Contours values of the direction of a vector (typically a wind vector-but .any vector quantity can be used) from 0 to 360 degrees in a meteorological sense (see introduction to winds). If "vector" is a wind vector, then the contours are equivalent to isogons. i.e. lines of constant wind direction. See also DDDD.

The DRCT command also acts as the Fortran equivalent to an "ATAN2" command, which computes the tangent angle of two linear components (rise over run). Hence, the command: "DRCT VGRD UGRD" takes the tangent of the u- and v-wind components and displays contours of meteorological degrees.

The "vector" used for DRCT need not be the wind but could be any x- and y-type quantity. When used as an "ATAN2" command, the y-component is given immediately to the right of DRCT, followed next by the x-component.

GEOS (VECTOR)
Displays a computed field of geostrophic winds from the total U and V wind components. The geostrophic wind expresses the balance between the horizontal Coriolis and pressure gradient (or geopotential height gradient) forces. On a constant isobaric level, the geostrophic wind blows parallel to the geopotential height lines with wind speeds inversely proportional to the spacing of the height lines. See also WIND, AGEO.

KMPH [scalar]
(SCALAR) Converts a scalar field having units of meters/sec (e.g., WSPD) to kilometers per hour (kph).

KNOT [scalar]
(SCALAR) Converts a scalar field having units of meters/sec (e.g., WSPD) to knots (kts).

MLPH [scalar]
(SCALAR) Converts a scalar field having units of meters/sec (e.g., WSPD) to mile per hour (mph).

SPED or SPED [vector]
(SCALAR) The command SPED by itself will display a contoured field of the magnitude of the total wind in meters/second, i.e., a contoured isotach field. SPED, by itself, is equivalent to the command sequence MAGN WIND. Also, WSPD is equivalent to SPED. See also MAGN.

Optionally, SPED followed by any vector quantity (e.g., SPED GEOS) to its right will display contours of the magnitude of that vector quantity. The two command sequences SPED GEOS and MAGN GEOS produce identical results: a contoured field of the magnitude of the geostrophic wind. SPED can be thought of as equivalent in usage to the MAGN command when a vector is specified.

SPKT [wind vector]
(SCALAR) Displays contours of the magnitude of a wind vector in knots converted from meters/second. Unlike SPED, a vector wind must be given with SPKT. Typically, the required vector is one of WIND, GEOS, or AGEO.

SPKM [wind vector]
(SCALAR) Displays contours of the magnitude of a wind vector in kilometers/hour (km/h) converted from meters/second. Typically, the required vector is one of WIND, GEOS, or AGEO.

SPML [wind vector]
(SCALAR) Displays contours of the magnitude of a wind vector in miles per hour (mph) converted from meters/second.

VKNT [vector]
(VECTOR) Converts the Vector" quantity from m/s to knots (kts). The commands VKNT WIND will display the total wind in knots without resetting the arrow or barb flags. See also VKPH and VMPH.

VKPH [vector]
(VECTOR) Converts the "vector" quantity from m/s to kilometers per hour (kph). See also VKNT and VMPH.

VMPH [vector]
(VECTOR) Converts the "vector" quantity from m/s to miles per hour (mph). See also VKNT and VKPH.

WDDF
(NUMERIC) Same as DDFF except no vector is specified and the total
wind direction and speed (in m/s) are displayed. WDDF is equivalent to the command sequence DDFF WIND.

WDDD
(NUMERIC) Displays digital values of the total wind direction (degrees). WDDD is equivalent to the command sequence "DATB DRCT WIND".

WDRC (SCALAR)
Contours values of the total wind direction in degrees. Same as issuing the commands "DRCT WIND".

WIND
(VECTOR) Displays a representation of the model total wind vector in units of meters/second (m/s) for the specified level and forecast hour centered at a grid point. If the wind display flag is set to AROW, then the length of the wind vector arrows is automatically scaled so that the maximum wind vector will be displayed as an arrow whose length is equal to one gridbox interval. If the BARB flag is set, then one full barb equals 10 m/s while a half barb equals 5 m/s.

WKNT
(VECTOR) Displays the model total wind in either arrow or barb format with wind speeds given in knots (kts). See WIND, WKPH, and WMPH.

WKPH
(VECTOR) Displays the model total wind in either arrow or barb from with wind speeds given in kilometers per hour (km/hr). See also WIND, WMPH and WKNT.

WMPH
(VECTOR) Displays the model total wind in either arrow or barb format with wind speeds given in miles per hour (MPH). See also WIND, WKNT, and WKPH.

WNDA
(VECTOR) Displays the total wind in arrow format using units of meters/second (m/s) and sets subsequent display of vectors in arrow format.

WIND COMMANDS (cont.)

WNDB
(VECTOR) Same as BWND. See BWND.

WSPD
(SCALAR) Displays contours of the magnitude of the total wind in meters/sec, i.e., isotachs in m/s. See SPED.

WSPK
(SCALAR) Displays contours of the magnitude of the total wind in knots, i.e., isotachs in knots. See also SPKT.

<u>- CROSS/TIME SECTION DISPLAYS</u>**

WINGRIDDS offers great flexibility in constructing vertical cross sections both in a spatial or temporal reference frame. It is often useful when assessing the state of the atmosphere to display meteorological parameters in a vertical cross section. WINGRIDDS allows one to switch back and forth between a vertical cross section view and a horizontal map, or "plan" view (see PLAN, CROS, TIME). In fact, using the overlay capability, one can overlay plan view maps onto a cross section or vice versa.

A spatial cross section represents a vertical slice through the atmosphere between any two geographical points at a given forecast hour.

The endpoints of the cross section are user-specified in terms of two latitude/longitude coordinate pairs which represent the left and right endpoints of the cross section, respectively. The command XSCT defines the endpoints of the spatial cross section. Spatial cross section endpoints are saved to a file (XSCT.INF) for future reference for use with the CROS command. A spatial cross section is labeled by running the command file "XLBL".

A temporal cross section represents the change in meteorological parameters occurring with time above a single geographical point

The TSCT command is used to define the lat/lon pair at a specific geographical point. The left and right endpoints of a temporal cross section are user-selectable forecast hours. The default temporal cross section will contour values every 12 hours from 00 through 48 hours (see TINC to change the time interval; see THRS to specify the forecast time endpoints). The geographical points specified with the TSCT command are also stored in a file (TSCT.INF) for use with the TIME command. A temporal cross section can be labeled by running the command file TLBL".

***CROSS/TIME SECTION COMMANDS

Any field which can be displayed in plan (i.e., horizontal) view can be displayed in either a spatial or temporal cross section. For example, you can contour the divergence of the wind in a spatial or temporal cross section by entering the cross section mode (typing one of: XSCT, CROS, TSCT or TIME) and typing "DVRG WIND". In this manner, one can investigate the old adage that wind convergence (indicated by negative values of divergence) in the lower levels of the atmosphere is usually beneath an area of upper level divergence. Also, you can simply type "WIND" while in a cross section mode to observe the "true" earth-relative wind directions (vs a "cross section-relative" wind) (see XREL).

CROSS/TIME SECTION COMMANDS (Cont.)

You can overlay as many fields on a cross section as you wish. WINGRIDDS contains several commands that are used to look at winds either normal to (see NORM, VNRM) or tangential to (see TANG, VTNG) the plane of the cross section. Also, WINGRIDDS has a useful command that combines the scalar vertical motion field (VVEL) with the tangential component of the ageostrophic wind (TANG AGEO) to produce a "vertical circulation" that is observed in the vicinity of jet streaks (see VCRC, VCR1).

WINGRIDDS also has commands to "rotate" wind vector into a cross section-relative sense (see XREL, GEOX, AGEX). To understand what is plotted you must first understand how the cross section is specified. Say you wanted a spatial cross section from 50N/100W to 35N/85W. If you specify the cross section with the command: XSCT 50 100 35 85, then the left side of the cross section is at 50N/100W and the right side ends at 35N/85W. Conversely, if the same two endpoints were specified in reverse order (i.e., XSCT 35 85 50 100), then the left side of the cross section would be at 35N/85W and the right side ends at 50N/100W.

When you "rotate" the winds, the winds are plotted in a sense of looking from the first specified cross section lat/long pair to the second specified lat/long pair. Hence, the following statements regarding rotated winds in a cross section are true:

A north wind represents a wind blowing into the cross section from left to right as viewed from the first defined endpoint looking toward the second defined endpoint.

A south wind represents a wind blowing into the cross section from right to left as viewed from the first defined endpoint looking toward the second defined endpoint.

An east wind represents a wind blowing towards the first defined endpoint.

A west wind represents a wind blowing away from the first defined endpoint.

Finally, the number of vertical levels displayed in a cross section can be specified by the user depending what vertical resolution is available in the gridded data. The command XLVL is used along with a 4-letter file name ending in ".LVL" (e.g., MAND.LVL) to change the vertical spacing. The format of the ".LVL" files is:

##xxx1xxx2xxx3xxx4 ... xxxN

where the left-most 2 digits (##) is the number of vertical levels followed immediately by this same number of vertical levels. The default is to use the lowest 10 mandatory levels (viz., 1000, 850, 700, 500, 400, 300, 250, 200, 150, and 100).

The following are the commands related to cross sections:

XSCT [Followed by left and right Lat/Lon pairs]
(SWITCHES TO SPATIAL VERTICAL CROSS SECTION MODE) Defines the two endpoints for a spatial cross section in the vertical. For instance, the command

XSCT 45 95 33 70

specifies the left portion of the cross section begins at 45N/90W and extends to the right to the point 33N/70W. Typing XSCT by itself (without lat/lon pairs) will cause the system to prompt the user for the two geographical endpoints. The lat/lon pair immediately to the right of XSCT is defined as left-most endpoint. After the cross section is defined, a straight line is drawn connecting the two endpoints on all subsequent maps (this line can be erased on future maps by entering: "XSCT 0 0 0 0".

NOTE: WINGRIDDS has the flexibility to define a spatial cross section so that the western-most point is either on the left or right side of the cross section. That is, the following command sequences define the same line:

XSCT 45 95 33 70
XSCT 33 70 45 95

but for the first case, the western-most point is on left side, while in the second case, the western-most point is on the right side. Be careful when interpreting wind directions in a cross sections where the western-most point is on the right side! See also PLAN, CROS, TIME.

TSCT [followed by one lat/long pair]
(SWITCH TO TIME/HEIGHT CROSS SECTION MODE) Defines the location for a time/height cross section, where time is given on the abscissa while height is the ordinate. The location of the time/height cross section is denoted on the map with a plus"+" sign. Once in time cross section mode, all subsequent commands are displayed in vertical cross section. See TINC to change the time interval; see THRS to specify the forecast time endpoints). See also PLAN, CROSS.

XREL [vector]
(VECTOR) Rotates the vector wind from an earth-relative to a cross section-relative frame of reference. To better understand what these winds mean, imagine that you are standing at the left side of the cross section looking toward the right side and you are interpreting the output of the command XREL BKNT. A north wind represents winds blowing into the cross section from left to right. A south wind represents winds blowing into the cross section from right to left. An east wind represents winds blowing in plane of the cross section towards you. A west wind represents winds blowing in the plane of the cross section away from you. See also WNDX.

AGEX
(VECTOR) Displays the ageostrophic wind rotated relative to the cross section (same as XREL AGEO). See also discussion for XREL

GEOX
(VECTOR) Displays the geostrophic wind rotated relative to the cross section. See also discussion for XREL Issuing the commands: XREL GEOS does the same thing.

WNDX
(VECTOR) Displays the total wind rotated relative to the cross section (same as XREL WIND). See discussion for XREL

TANG [vector]
(SCALAR) Finds cross section-relative tangential component of the vector. The tangential wind component is the wind blowing wholly in the plane of the cross section. If the wind is blowing perpendicular to the cross section, the tangential wind component is zero. Positive values of tangential winds represent winds blowing from left to right or away from the first defined (left-most) cross section endpoint. Negative values represent winds blowing from right to left or towards the first defined (left-most) cross section endpoint. See also VTNG and NORM.

VTNG [vector]
(VECTOR) Plots cross section-relative tangential wind component On vector form) for the vector specified. The vector of the tangential wind either point to the left or right. Tangential wind arrows pointing from left to right represent winds blowing away from the first defined (left-most) cross section endpoint while wind arrows pointing from right to left denote winds blowing towards the first defined (left-most) cross section endpoint. See TANG, VNRM.

NORM [vector]
(SCALAR) Finds cross-section relative normal wind component for the vector specified. The normal wind component is the component of the wind relative to the cross section that is blowing wholly perpendicular to the cross section. Positive values of the normal wind component represent winds blowing through the cross section from left to right as viewed if standing at the left-most portion of the cross section. Negative values of normal winds represent winds blowing through the cross section from right to left as viewed from the left-most portion of the cross section endpoint. See also VTNG and TANG.

VNRM [vector]
(VECTOR) Plots the cross-section relative normal wind component (in vector format) for the vector specified. The normal wind component is the wind component relative to the cross section that is blowing wholly perpendicular to the cross section. The normal wind vectors will either point straight up or down. A wind arrow pointing up (a "south" wind), denoting positive values of the normal wind component, represent winds blowing through the cross section from left to right as viewed if standing at the left-most portion of the cross section. A wind arrow pointing down (a "north" wind), denoting negative values, represent winds blowing through the cross section from right to left as viewed from the left-most portion of the cross section endpoint See also VTNG and TANG.

VCRC [vector]
(VECTOR) Plots a vector representing the vector tangential wind component (VTNG [vector]) scaled by the vertical motion field (WEL). This vector represents the "vertical circulation" in the plane of the cross section. It has useful applications in diagnosing thermally direct and indirect circulations as found in the entrance and exit regions of jets. See also ACRC, VCR2, GCRC, and WCRC.

VCR2 [vector]
(VECTOR) Plots a vector representing the vector tangential wind component scaled by the vertical motion. Same as VCRC except resultant vectors are "magnified" by 2. See VCRC.

VCR5 [vector]
(VECTOR) Plots a vector representing the vector tangential wind component scaled by the vertical motion. Same as VCRC except resultant vectors are "magnified" by 5. See VCRC.

ACRC
(VECTOR) Displays vertical/tangential circulations of the ageostrophic wind (in vector form). Same as entering "VCRC AGEO". See also VCRC.

GCRC
(VECTOR) Displays vertical/tangential circulations of the geostrophic wind On vector form). Same as entering "VCRC GEOS". See also VCRC.

WCRC
(VECTOR) Displays vertical/tangential circulations of the total wind vector form). Same as entering "VCRC WIND". See also VCRC.

CROS
(NO OUTPUT) Re-activates the spatial cross sectional display. The line denoting the activated cross section on the map background will be highlighted with a brighter white color. Subsequent commands will be processed in the spatial cross section mode until terminated with a return to plan view (PLAN) or time/height cross section mode (TIME). If the XSCT command has not been run during the active WINGRIDDS session and CROS is entered, then the file "XSCT.INP supplies the endpoints for the cross section.

PLAN (NO OUTPUT) Re-activates viewing maps in "plan" 0-e., horizontal) mode, usually issued to exit viewing parameters in a cross section mode. The line denoting the activated cross section or time/height location on the map background is de-emphasized in a dull shade of white. Subsequent commands will be processed in the plan view mode until terminated with a return to either a spatial cross section model (CROS) or time-height cross section model (TIME).

TIME (NO OUTPUT) Re-activates the time/height cross sectional display. A plus sign denotes the location of the activated time cross section, and is highlighted with a bright white color. Subsequent commands are processed in the time-height cross section mode until terminated with a return to plan view (PLAN) or spatial cross section mode (CROS). If the TSCT command has not been issued during the active WINGRIDDS session and TIME is entered, then the file TSCT.INF supplies the geographical location for the cross section.

TINC [##]
(NO OUTPUT) Changes the time increment for contouring display in time-height cross sections. The system default is to contour data every 12 hours (TINC 4). The time increment is set according to the following table:

COMMAND	INCREMENT
TINC 8	- every 24 hours
TINC 4	- every 12 hours
TINC 2	- every 6 hours
TINC 1	- every 3 hours

NOTE: at present, the time interval between gridded model data fields are either every 12 hours or every 6 hours. Hence, if you have 6-hourly interval grids, set TINC 2.

XLVL [Followed by 4 Character name]
Reads the file "xxxx.LVL", where "xxxx" is any 4 characters, to define both the spatial XSCT and/or temporal TSCT cross section vertical levels. The default is to use the lowest 10 mandatory levels (viz., 1000, 850, 700, 500, 400, 300, 250, 200,150, and 100). The xxxx.LVL file is in ASCII format (no word processing format codes please!). An example file, "MAND.LVL", is provided with each copy of WINGRIDDS. The format of all ".LVL" files is:

##xxx1xxx2xxx3xxx4 ... xxxN

where the left-most 2 digits (##) is the number of vertical levels followed immediately by this same number of vertical levels.

For example the following file • MAND.LVL - specifies 10 vertical levels at 1000, 850, 700, 500, 400, 300, 250, 200, 150, and 100 millibars:

101000 850 700 500 400 300 250 200 150 100

In fortran parlance, the format above is represented by "12,1014". The vertical levels need not all be pressure; they could be sigma level data (e.g., S896).

THRS [Followed by 4 Character name]
(NO OUTPUT) Reads the file —.LVL to define time-height cross section hours. Uses the same format as is used in reading the "xxxx.LVL" files.

**- MOISTURE COMMANDS

A host of moisture fields are available in WINGRIDDS. For example, to contour the 24-hour forecast of 850 mb mixing ratio, simply set the forecast hour to 24 (F24), the vertical level to 850 mb (850) and type "MIXR". WINGRIDDS will then contour mixing ratios at 850 mb forecast at 24 hours. The mixing ratio (MIXR) is available for most vertical levels and forecast hours (NOTE: for some levels specific humidity (SPFH) is available which is virtually identical to the mixing ratio). Other computed moisture parameters include relative humidity (RELH), saturated mixing ratio (SMIX), and the saturation deficit of mixing ratio - SDEF (which is simply the difference between the saturated and unsaturated mixing ratios).
Since moisture is a scalar, all of the scalar diagnostic commands can be used, e.g., moisture advection by the wind (ADVT MIXR WIND) or geostrophic moisture flux divergence (SDVR MIXR GEOS). Forecasts of model precipitable water are available (PWAT, PWAI).

DWPT
(SCALAR) Displays contours of dew point temperature for those vertical levels where mixing ratio and temperature are available. Contoured in units of degrees Celsius (C). A useful parameter is to compute the difference between the temperature and the dew point fields: SDIF TEMP DWPT - a field of dew point depressions. This field can be compared with observed upper air moisture data typically plotted as dew point depressions.

DWPK
(SCALAR) Displays contours of calculated dew point temperature
wherever mixing ratio and temperature are available in units of degrees Kelvin (K). See also DWPT.

MIXR
(SCALAR) Displays contours of mixing ratio in units of grams of water vapor per gram of dry air (i.e., g/g). The mixing ratio is the ratio of the mass of water vapor present to the mass of dry air containing the vapor. The mixing ratio can be displayed for any vertical level. See also SMIX, SPFH, and RELH.

(HINT: although the units for the mixing ratio are in grams/gram, a display of gridded mixing ratios might have contour labeled "8" or "14", which can be thought of in the more traditional mixing ratio units of grams H2O per kilogram (g/kg) of dry air. But for any diagnostic calculations, units of g/g will be used internally.)

MOISTURE COMMANDS (cont.)

PWAI
(SCALAR) Displays contours of model-based precipitable water fields. Units are in inches of liquid water equivalent. See also PWAT.

PWAT
(SCALAR) Displays contours of model-based precipitable water fields. Units are in millimeters of liquid water equivalent. See also PWAI.

RELH
(SCALAR) Displays contours of relative humidity (RH) in percent at any specified forecast hour and vertical level. The relative humidity is computed by dividing the mixing ratio MDCR by the saturated mixing ratio SMDC RH can be displayed for any vertical level that has either RELH or SPFH listed for that level in the data listing. Entering the command sequence: SDVD MDCR SMIX computes the RH just as if you typed in RELH for some vertical level.

RELH can also be displayed on an isentropic surface from the interpolated mixing ratio data for that surface. NOTE: the RH field computed on isentropic surfaces where the air is extremely dry will produce unrealistic values of RH greater than 100 percent. In these cases use the MIXR to see the value of moisture on that surface.

SDEF
(SCALAR) Displays contours of the mixing ratio saturation deficit in units of
grams of water vapor per gram of dry air (g/g) for forecast hours/vertical levels where mixing ratio or specific humidity are available. The field of SDEF is simply the scalar difference between the saturated and unsaturated mixing ratios (i.e., one could compute the same thing by entering the command: SDIF SMIX MIXR).
SMIX (SCALAR) Displays contours of saturated mixing ratio in units of grams of water vapor per gram of dry air (i.e., g/g). The saturated mixing ratio can be displayed for any vertical level. See also MDCR.

SPFH
(SCALAR) Displays contours of specific humidity in units of grams of water vapor per gram of dry air (i.e., g/g) and is virtually identical to MIXR. Specific humidity is only available for those levels where "SPFH" is explicitly listed in the gridded data listing.

<u>- PRECIPITATION FIELDS COMMANDS</u>**

Quantitative precipitation forecasts (QPFs) output from various models are displayable in WINGRIDDS using one of four commands: TPCI, TPCP, CPCI, and CPCP. The commands beginning with TP.." denote the Total precipitation field, while those beginning with "CP.." denote only that portion of the precipitation resulting from a model's particular Convective parameterization. The units of precipitation are available in either millimeters or inches.

The other important consideration when viewing precipitation fields is the time interval they represent, i.e., are you looking at 6-hourly or 12-hourly accumulated precipitation fields. Unfortunately, this information is not included in the grids themselves. However, in all instances, whenever precipitation output is displayed at any forecast hour that is an even multiple of 12 (e.g., FOO, F12, F24, F36, F48, F60, etc.), then the field displayed contains a 12-hour accumulated precipitation amount (ending at that forecast hour). For the NGM and mesoscale Eta model output, there are 6-hourly accumulated precipitation totals available at forecast hours: F06, F18, F30, and F42.

MODEL-FORECAST PRECIPITATION FIELDS (Cont.)

The precipitation commands are described below.

CPCI
(SCALAR) Displays contours of the portion of the total precipitation field based on the model's convective parameterization scheme in units of inches. The valid time interval for accumulation is either 6 or 12 hours. See also CPCP, TPCI, and TPCP.

CPCP
(SCALAR) Displays contours of the portion of the total precipitation field based on the model's convective parameterization scheme in units of millimeters. The valid time interval for accumulation is either 6 or 12 hours. See also CPCI, TPCI, and TPCP.

TPCI
(SCALAR) Displays contours of the total precipitation fields in units of inches. The valid time interval for accumulation is either 6 or 12 hours. See also TPCP, CPCI, and CPCP.

TPCP
(SCALAR) Displays contours of the total precipitation fields in units of millimeters. The valid time interval for accumulation is either 6 or 12 hours. See also TPCI, CPCI, and CPCP.

**- SCALAR and VECTOR DIAGNOSTIC COMMANDS

WINGRIDDS offers a variety of diagnostic commands to manipulate gridded data fields. Both scalar data (e.g., temperature, moisture fields) and vector quantities (e.g., wind) can be manipulated. Remember that in WINGRIDDS a 'scalar' data field is any contoured field (like temperature); a vector field is a plotted as arrows (or barbs). What is meant by "manipulate" is to perform some operation on one or more scalar and/or vector fields. Examples of gridded data manipulation include:

* adding two scalar fields together;
* determine the vector difference between the total wind and the geostropic component (i.e., compute ageostrophic winds);
* multiplying a scalar field by a constant;
* taking the negative of a scalar field;
* taking the square root of a field;
* multiply the x- and y-components of a vector by a constant;
* compute the Sine of the wind direction.

Although it may not be readily obvious, there are many benefits to manipulating the gridded fields. For example, if you want to compute a difference in mean sea level (MSL) pressures between two forecast times, this can be readily done (see TDIF or SDIF).

Another example is any WINGRIDDS user can (with some practice!) transform mathematical equations of meteorological quantities into displayable contoured (or vector) fields. For example, the equation to compute the quasi-geostrophic "Q-vectors" discussed in the meteorological literature can be coded into a command file. Invoking this command file will produce a grid of Q-vectors at a given vertical level (or layer). The command file "QVEC.CMD" included with WINGRIDDS does such a task. Other quantities, like scalar frontogenesis, various stability parameters such as the K-index, total-totals, and more esoteric quantities, like depicting kinematic deformation of the wind field in the form of the "axii of dilatation", can be all be "programmed" and put in command files for ready access (see the section on COMMAND FILES).

In this reference manual, the commands to manipulate scalar and vector fields will be discussed in two separate sections, although functionally, many of the commands do the same thing. Contrast computing the difference of two scalar fields (see SDIF) with taking the difference between two vectors (see VDIF). The first section after this introduction describes commands to manipulate and/or produce scalar fields. This first section includes those "scalar diagnostic" functions (e.g. computing advection or divergence) that result in scalar (i.e., contoured) fields. A following section describes those commands for manipulating and producing vector quantities. The second section includes those "vector diagnostic" commands that produce a field of vectors as a result.

**- SCALAR DIAGNOSTIC COMMANDS

A) Scalar Addition, Subtraction, Multiplication, Division

SADC [1-4 digit value, scalar]
(SCALAR) Add a constant value to the specified scalar field and display a contoured field of the resultant summation. For example, the commands "SADC 10 TEMP" will add a constant value of 10 to the scalar temperature field at a given level. The constant is optional; if it's not given the user is asked to enter one.

There are number of ways the constant for this command can be entered. The discussion given in this paragraph is applicable for all WINGRIDDS scalar diagnostic commands requiring constants and will not be repeated (see SMLC, SSBC, SDVC). The constant can be entered using one, two, three, or four digits, and a decimal can be used, but the constant cannot be longer than 4 digits!. Valid constants are: "2", "1000", "98.4". Negative values are entered with a leading minus sign (e.g., "-23"). Scientific notation can be entered with an exponent in "E-format. Examples of valid E-format constants are: "3E3", "1E+5", "5E-7" "52E5".
See also SSBC.

SAVR [Followed by 2 scalars]
(SCALAR) Calculates the arithmetic scalar grid average for the two scalar fields and display the resultant average as a contoured field. The arithmetic average method simply sums the two scalar fields together and divides by 2. For example, the command string to compute the average value of the 12- and 24-hour forecast temperature fields given by:

- SAVR TEMP F24 TEMP F12"

is identical to the command string:

- SDVC 2 SSUM TEMP F24 TEMP F12".

SDIF [scalar1 scalar2]
(SCALAR) Subtracts the "scalar2" field from the 'scalar1' field and displays the resulting difference as a contoured field. For example, the command string to compute the dew-point depression at some level is: "SDIF TEMP DWPT". The order that the two scalar fields is entered is important; the two scalar fields are NOT commutative. See also SSUM.

SCALAR DIAGNOSTIC COMMANDS (cont.)

SDVC [1-4 digit value, scalar]
(SCALAR) Divide the scalar field by a user-specified constant and display a contoured field of the resultant division. For example, the command line: "SDVC -2 TEMP" will divide the scalar temperature field at a given level by -2. Entering the constant is optional; if it's not given the user is asked to enter one. Refer to the discussion in SADC for possible ways to enter the constant to multiply by.

SDVD [scalar1 scalar2]
(SCALAR) Divides the "scalar1" grid field by the "scalar2" grid field and displays the resultant division as a contoured field. For example, the command line: "SDVD MDCR SMXR" will divide the mixing ratio (MIXR) by the saturated mixing ration (SMIX). If this result is then multiplied by 100 (e.g., "SMLC 100 LAST), the field of relative humidity is obtained.

SMLC [1-4 digit value, scalar]
(SCALAR) Multiply a constant value times the specified scalar field and display a contoured field of the resultant multiplication. For example, the command "SMLC .8 RELH" will multiply the constant value of 0.8 times the scalar relative humidity (RH) field at a given level; in essence, a way of taking 80 percent of the given RH field. The constant is optional; if it's not given, the user is asked to enter one. Refer to the discussion in SADC for possible ways to enter the multiplication constant

SMLT [Followed by 2 Scalars]
(SCALAR) Multiplies the two specified scalar grid fields together displaying the resultant multiplication as a contoured field.

SSBC [1-4 digit value, scalar]
(SCALAR) Subtract a specified constant from a scalar field and display a contoured field of the resulting difference field. For example, the command: "SSBC 1E-5 DVRG WIND" subtracts a constant value of 1 x 10"5 from the divergence of the total wind field. Refer to the discussion in SADC for possible ways to enter the constant to be subtracted.

SSUM [Followed by 2 Scalars]
(SCALAR) Sums the two specified scalar grid fields and displays the resultant summation as a contoured field.

STND [Followed by 2 scalars]
(SCALAR) Calculates the time tendency for the two sealer grid fields. A time tendency is simply the arithmetic average of the two scalar fields divided by the time interval specified between FHR1 and FHR2, in inverse seconds. For example, the scalar time tendency of the 12- and 24-hour temperature fields at some vertical level is given by:

STND TEMP F24 TEMP F12

which is exactly equivalent to the command: TEMP TTND SFHS 12 24

The units for both of the above expressions would be in degrees Celsius per sec. The "per sec" units can be converted to "per hour" using HRLY or to "per 24-hour day" using DALY. See also TTND, VTND, HRLY, DALY, SFHS, FHR1, FHR2.

SCALAR DIAGNOSTIC COMMANDS (cont.)

Miscellaneous Scalar Diagnostic Commands

ABSV [Scalar]
(SCALAR) Calculates the absolute value of scalar grid.

INV1 [Scalar]
(SCALAR) Finds the inverse of a scalar quantity up to a maximum of 1. See INVS.

INVS [Scalar]
(SCALAR) Finds the inverse of a scalar quantity. The inverse is simply one divided by that quantity. See also INV1.

SNEG [Followed by Scalar]
(SCALAR) Finds the negative of a scalar grid. It is equivalent to multiplying a scalar grid by-1.

B. Trigonometric Scalar Functions

There are six trigonometric functions defined in mathematics. They are referred to as the sine, cosine, tangent, cotangent, secant, and cosecant functions. Three of these functions are available in WINGRIDDS to compute the sine (SINE), cosine (COSN), and tangent (TNGT) from a scalar grid assumed to be degrees. These three basic "trig" functions can be combined using the fundamental trigonometric identities to give the other trigonometric functions (secant, cosecant, and cotangent), as given by:

cosecant = 1 / sine
secant = 1 / cosine
cotangent = 1 /tangent

COSN [Scalar]
Calculates the trigonometric cosine of a scalar grid. The scalar grid must be in degrees. See also, SINE, TNGT, WDRC.

SINE [Scalar]
(SCALAR) Calculates the trigonometric cosine of a scalar grid. The scalar grid must be in degrees. See also, COSN, TNGT, WDRC.

TNGT [Scalar]
(SCALAR) Calculates the trigonometric tangent of a scalar grid. The scalar grid must be in degrees. See also, SINE, COSN, WDRC.

C. Other Scalar Mathematical Functions

Several miscellaneous (but useful) functions that act on scalar grid fields are available in WINGRIDDS. These are the gradient or "del" operator (GRAD, MGRD, NGRD), and the horizontal gradient operators DSDX and DSDY. These functions are quite useful in computing several meteorological diagnostic quantities such as advection (see ADVT)

SCALAR DIAGNOSTIC COMMANDS (cont.)

DSDX [Scalar]
(SCALAR) Calculates the gradient of the scalar field in the X (i.e., east-west) direction using second order finite differencing. An example is DSDX TEMP which, in essence, is the partial derivative of the temperature field with respect to the X direction, or mathematically:

dT dX

DSDY [Scalar]
(SCALAR) Calculates the gradient of the scalar field in the Y (i.e., north-south) direction using second order finite differencing. An example is DSDY MIXR which, in essence, is the partial derivative of the moisture field with respect to the Y direction, or mathematically:

dY

GRAD [Scalar]
(VECTOR) Computes the two-dimensional (X,Y) horizontal gradient of the specified scalar field and outputs the result as a vector field. The definition of the gradient or "del" operator is fin the horizontal plane):

8X dY

where / and / refer to the positive X and Y directions, respectively. Geometrically, GRAD yields the horizontal "ascendent" vector; a vector at right angles to the horizontal isopleths of the scalar quantity and directed (pointing) toward higher values of the scalar. The WINGRIDDS function NGRD (see NGRD) operating on a scalar field yields a vector at right angles to the contours but directed toward lower values of the scalar, which is mathematically equivalent to the "descendent" vector. NGRD is also called the "negative ascendent" in some texts.

The length of each vector produced by GRAD is proportional to the magnitude of the gradient of the scalar. In other words, the longest vector occurs in places where there is a close packing of contour lines gradient. See also MGRD, NGRD, DSDX, DSDY.

MGRD [scalar]
(SCALAR) Computes the magnitude of the gradient of any scalar field and displays the resultant magnitude as contours. The closer the contours are packed together, the larger the value of the magnitude of the gradient. For example, MGRD TEMP contours the magnitude of the gradient of the scalar temperature field. An equivalent field would be given by the commands "MAGN GRAD TEMP". Units of the magnitude of the gradient of a scalar are in the units of the scalar divided by distance (meters). See also GRAD, NGRD, MAGN.

NGRD [scalar]
(VECTOR) Displays in vector form the negative gradient of a scalar field. For example, the command "NGRD TEMP" displays a field of vectors at right angles to the contours of the scalar but directed toward lower values, mathematically equivalent to the "descendent" vector. NGRD is also called the "negative ascendent". Another way to produce this vector is to precede the GRAD command with the command VNEG, as in "VNEG GRAD TEMP". See also GRAD, MGRD, VNEG.

****- VECTOR DIAGNOSTIC COMMANDS**

A vector is a quantity that has attributes of magnitude and direction. The most common vector in meteorology is the wind which is composed of a direction attribute and a speed or velocity attribute. A knowledge of vectors and how they are manipulated in meteorology is fundamental to understanding the kinematics of the atmosphere.

WINGRIDDS offers a host of commands to manipulate vectors and to combine vectors and scalars into useful diagnostics (e.g., moisture convergence, temperature advection, etc.). This section documents the following WINGRIDDS commands that manipulate vectors. These commands include vector addition (VSUM), subtraction (VDIF), multiplication (VMLT), division (VDVD), advection (ADVT), divergence (DVRG) and scalar flux divergence (SDVR), the dot product (DOTP) and cross product (CROS), both absolute vorticity (VORT) and relative vorticity (RVRT), etc.

A. Vector Addition, Subtraction, Multiplication, Division

VADC [1-4 digit value, vector]
(VECTOR) Add a constant value to the specified vector field and displays a vector field of the resultant summation. For example, the command "VADC 5 GEOS" adds a value of 5 m/s to both the X- and Y-components of the geostrophic wind at a given level. Hence, if the geostrophic wind at a gridpoint was 270 degrees at 10 m/s, the new geostrophic wind would be west-southwesterly (251 degrees) at about 15.8 m/s (Remember: the constant is added to BOTH the X- and Y- wind components). Entering the constant immediately after the command is optional; if it's not given the user is asked to enter one.

NOTE: adding a constant value to a vector WILL change the direction of that vector!

There are number of ways the constant for this command can be entered. The discussion given in this paragraph is applicable for all WINGRIDDS vector diagnostic commands requiring constants and will not be repeated (see also VMLC, VSBC, VDVC). The constant can be entered using one, two, three, or four digits, and a decimal can be used, but the constant cannot be longer than 4 digits I. Valid constants are: "2", "1000", "98.4". Negative values are entered with a leading minus sign (e.g., "-23"). Scientific notation can be entered with an exponent in "E-format". Examples of valid E-format constants are: "3E3", "1E+5", "5E-7 52E5".

VAVR [Followed by 2 vectors]
(VECTOR) Calculates the arithmetic vector grid average for the two vector fields and display the resultant average as a contoured field. The arithmetic average method first sums the X- and Y-components of the vector fields together and divides these by 2. For example, the command string to compute the average value of the 1000 mb and 500 mb forecast wind fields given by:

"VAVR WIND 1000 WIND 500"

is identical to the command sequence:

"CONT SDVC 2 SSUM YCMP WIND 1000 YCMP WIND 500
VDVC 2 SSUM XMCP WIND 1000 XCMP WIND 500"

VECTOR DIAGNOSTIC COMMANDS (cont.)

VDIF [vector1 vector2]
(VECTOR) Vectorially subtracts "vector2" from "vector1" and displays the resulting difference as a new vector. For example, the command string to compute the vector difference between the 1000 mb geostrophic wind and the 500 mb geostrophic wind (i.e., the thermal wind) is:

"VDIF GEOS 500 GEOS 1000".

Note in the above command string that the second vector (GEOS 1000) is subtracted from the first vector (GEOS 500). An equivalent form of the above command is GEOS LDIF. Also, the order that the two vectors are entered JS important Taking the difference of two vector fields is NOT commutative. See also VSUM.

VDVC [1-4 digit value, vector]
(VECTOR) Divide the vector field by a user-specified constant and displays the resultant vector field. For example, the command line: "VDVC 3 WIND" divides each X- and Y- component of the wind field at a given level by 3. Entering the constant immediately next to the command is optional; If it's not given the user is asked to enter one. Refer to the discussion in VADC for possible ways to enter the multiplication constant.

VDVD [vector1 vector2]
(VECTOR) Divides the “vector1” X- and Y- components by the "vector2" X- and Y- components and displays the resultant division as a new vector. See also VMLT, VDVC.

VMLC [1-4 digit value, vector]
(VECTOR) Multiply a constant value times the specified vector field and displays the resultant vector field. Multiplying the vector by a positive scalar value simply multiplies the length of the vector without affecting the direction. The command "VMLC .5 WIND" multiplies both the X- and Y-components of the total wind by 0.5 (1/2) at a given level. This results in a wind field having the same direction as before but only half the magnitude (See MAGN). If the scalar constant is negative, then not only is the vector's magnitude affected, but the vectors are reversed in direction. The constant is optional; if it's not given, the user is asked to enter one. Refer to discussion in VADC for possible ways to enter the constant. See also VDVC, VMLT.

VMLT [vector1 vector2]
(VECTOR) Multiplies the two specified vector fields together and displays the resultant multiplication as a new vector. The X- and Y-components are multiplied to together to create this new vector. See also VDIF, VMLC.

VSBC [1-4 digit value, vector]
(VECTOR) Subtract the specified constant from both the X- and Y- components of the vector field and displays a vector of the resulting difference field. For example, the command: "VSBC 5 WIND" subtracts a constant value of 5 from both the X- and Y- components of the vector total wind. The resultant vector will have a new direction. Refer to the discussion in VADC for possible ways to enter the constant to be subtracted. See also VDIF.

VSUM [vector1 vector2]
(VECTOR) Vectorially sums the two specified vectors grid fields and displays the resultant vector summation. The scalar X- components of vector1 and vector2 are summed followed by a similar summation of the Y- components, with the resultant X- and Y- scalar components placed on the data stack to create the new summed vector. For example, if vector1 represents a wind of 20 knots from the

west (270°) and vector2 represents a wind of 30 knot also from the west, then the result of "VSUM" of these two winds results in a new wind of 50 knots from the west. See also VADC.

VTND [vector1 vector2]
(VECTOR) Calculates the time tendency for the two vector fields. A vector time tendency is vector average of the two vector fields divided by the time interval specified between FHR1 and FHR2, in inverse seconds. For example, the vector time tendency of the 12- and 24-hour wind fields at some vertical level is given by:

VTND WIND F24 WIND F12

which is exactly equivalent to the command:

WIND TTND SFHS 12 24

The units for both of the above expressions would be in meters/sec per sec. The "per sec" units can be converted to "per hour" using HRLY or to "per 24-hour day" using DALY. See TTND, STND, HRLY, DALY, SFHS, FHR1, FHR2.

B. Other vector functions

CRSP [Followed by 2 Vectors]
(SCALAR) Calculates and displays the magnitude of the vector cross product of the two specified vectors. The cross product is defined as the magnitude of the first vector times the magnitude of the second vector and multiplied by the cosine of the angle between the two vectors:

A x B - \A\ \B\ Sine*

DOTP [Followed by 2 Vectors]
(SCALAR) Calculates and displays the scalar "dot" product of the two specified vectors. Since the dot product operation is commutative, the vectors can be given in either order. The scalar dot product has no direction. The scalar dot product is defined as the magnitude of the first vector times the magnitude of the second vector and multiplied by the sine of the angle between the two vectors:

A-B- \A\ \B\ cosa

See also ADVT, CRSP, DVRG.

DVRG [vector]
(SCALAR) Calculates the mathematical divergence of the vector quantity defined as the dot product of the gradient operator dotted with the vector quantity:

Divergence « V • [vector]

Positive values indicate divergence of the vector; negative values indicate convergence. The command "DVRG WIND" displays contours of the divergence of the wind at a given forecast level and hour. Consult a dynamic meteorological textbook (e.g., Bluestein, 1992) for a more complete explanation of divergence.

See also DOTP, GRAD, SDVR, WDVR.

VECTOR DIAGNOSTIC COMMANDS (cont.)

GVRT
(SCALAR) Generates the absolute vorticity using the geostrophic wind displaying the resultant field in contoured form. The GVRT command is equivalent to the commands: VORT GEOS. For a more complete treatment of vorticity, refer to the discussion for the VORT command.

See also GEOS, VORT, WVRT.

WDVR
(SCALR) Calculates the divergence of the total wind field and displays the result as contours of the divergence of the wind at a given forecast level and hour. Positive values indicate divergence of the wind; negative values indicate convergence. The command "DVRG WIND" does the same thing as WDVR. See also the discussion on divergence in DVRG.

C. Combined vector/scalar functions

ADVT [Followed by Scalar and Vector]
(SCALAR) Calculates the advection of the scalar quantity by the vector quantity. There are two ways the command can be entered: either normal or functional. Using temperature advection by the total wind as an example, the commands can be entered in the normal manner like:

    ADVT TEMP WIND

or in a functional format:

    ADVT [TEMP,WIND]

Both forms produce identical results for temperature advection. The mathematical equation that is computed for advection (using temperature as the quantity advected) is:

Advection=-V*7T

As an example, an equivalent sequence of WINGRIDDS commands for computing temperature advection by the total wind is:

    SNEG DOTP WIND GRAD TEMP

which mathematically is the negative of the scalar dot product of the total wind "dotted" with the gradient of temperature. For the adventuresome, another way to codify in WINGRIDDS the temperature advection by the total wind is:

    SNEG SSUM SMLT XCMP WIND DSDX TEMP SMLT YCMP WIND DSDY TEMP

There are several "pre-programmed" advection functions to advect various quantities by the total wind: temperature (TADV), mixing ratio (QADV), and pressure (PADV).

VECTOR DIAGNOSTIC COMMANDS (cont.)

PADV
(SCALAR) Displays contours of the field of pressure advection using the total wind. See discussion for ADVT.

QADV
(SCALAR) Displays contours of the field of mixing ratio advection using the total wind. See discussion for ADVT.

SDVR [Followed by Scalar and Vector]
(SCALAR) Calculates the flux divergence of the scalar and vector quantities. The mathematical scalar flux divergence of the vector quantity is defined as the dot product of the gradient operator dotted with the scalar-vector quantity:

Scalar Divergence «= V • [scalar x vector]

Positive values of scalar flux divergence occur where the wind field acting on the gradient of the scalar is tending to decrease the scalar quantity; negative values occur where winds are tending to increase the scalar quantity. The scalar flux divergence command combines the advective portion of wind and the divergent/convergent portion of the wind acting on the scalar quantity. Mathematically, scalar divergence can be written as the sum of the two aforementioned factors (i.e., advective part and divergent/convergent part) as:

Scalar Divergence -   (V -V q) + q (V • V)

See also DOTP, DVRG, FLUX.

TADV (SCALAR) Displays contours of the field of temperature advection using the total wind. See discussion for ADVT.

FLUX [Followed by a Scalar and a Vector]
(VECTOR) Displays a vector representation of the product of a scalar and the input vector. These vectors, referred to as "flux" vectors, have the same direction as the input vector. However, the original vector's magnitude has been multipled by the scalar value at that point. A "flux" can be viewed as the amount of some quantity (e.g., moisture) transported by the vector (say, wind) across a given area. The FLUX command also resets the wind display to AROW format.

As an example, the moisture flux at 1000 mb is computed using the command "FLUX MDCR WIND 1000". This produces a field of vectors whose direction are everywhere the same as the wind at 1000 mb but whose length is proportional to the amount of 1000 mb moisture at a grid point. Assuming that the 1000 mb moisture can vary by an order of magnitude (i.e., dry -1 gr/kg vs wet -10 gram/kg air), while the 1000 mb wind varies by less than an order of magnitude (i.e., <1 m/s to 25 m/s), then the scaling effect from moisture will surpass that due to the magnitude of the wind. Hence, the 1000 mb moisture flux vectors in areas of high moisture content air but relatively weak winds will generally be longer relative to those flux vectors in low moisture content air but either weak (pi strong) winds. (NOTE: taking the divergence of the moisture flux (at any level) yields the often-desired field of moisture flux divergence (i.e., DVRG FLUX MDCR WIND), which, equivalently can be computed by "SDVR MIXR WIND".) See also AROW DVRG, SDVR.

VECTOR DIAGNOSTIC COMMANDS (cont.)

MAGN [Vector]
(SCALAR) Calculates the magnitude of the vector displaying the result as a contoured scalar field. If the vector is a wind vector, than the wind magnitude is equivalent to the field of isotachs. The vector does not have to be a wind. See also MGRD, SPED, SPKT, WSPD, WSPK.

RVRT [vector]
(SCALAR) Calculates the horizontal relative vorticity of the specified vector. The vector given is usually a wind vector (e.g., WIND, GEOS, etc.). The relative vorticity of the total wind is given by the command "RVRT WIND". The units of relative vorticity are in inverse seconds, with typical values on the order of 10-5 sec-1.

The actual mathematical quantity calculated via a first order finite difference technique is:

Relative Vorticity
f dv eiM
(dX~ BY)

The term in parentheses is defined as the relative vorticity of the vector wind, where U and V wind components are in the east-west and north-south directions, respectively. An equivalent way in WINGRIDDS to compute the relative vorticity of the total wind by computing the actual finite difference of the U- and V- wind components is:

SDIF DSDX VGRD DSDY UGRD

See also VORT.

VNEG [vector]
(VECTOR) Displays the "negative" of a vector field. The negative of a vector is a vector having a direction 180 degrees opposite of the specified vector, but having the same magnitude. For example, if a wind vector at some gridpoint points from south to north (i.e., a south wind) then command VNEG WIND results in a vector that points from north to south (i.e., a north wind). See also MAGN.

VORT [vector]
(SCALAR) Calculates the horizontal absolute vorticity of the specified vector. The vector given is usually a wind vector (e.g., WIND, GEOS, etc.). The absolute vorticity of the total wind (i.e. what's plotted on the AFOS and DIFAX 500 mb graphics) is given by the command "VORT WIND". The units of absolute vorticity are in inverse seconds, with typical values on the order of 10-5 sec-1.

The actual mathematical quantity calculated via a first order finite difference technique is:

Abs.Vorticity = | -^-

The first term on the right (in parentheses) is the relative vorticity (see RVRT) of the vector wind, where U and V wind components are in the east-west and north-south directions, respectively. The second term on the right (f) is the coriolis parameter (see FFFF). An equivalent way in WINGRIDDS to display the absolute vorticity of the total wind is to sum the relative vorticity with the coriolis force:

SSUM RVRT WIND FFFF

See also GVRT, RVRT, FFFF, WVRT.

VECTOR DIAGNOSTIC COMMANDS (cont.)

WVRT
(SCALAR) Calculates the horizontal absolute vorticity of the specified vector. The vector given is usually a wind vector (e.g., WIND, GEOS, etc.). WVRT is equivalent to the absolute vorticity of the total wind as given by the command "VORT WIND'. The units of absolute vorticity are in inverse seconds, with typical values on the order of 10-5 sec-1. See discussion in VORT for more details on vorticity. See also GVRT, RVRT.

**- COMMANDS for LAYER AND TIME VALUES

This section documents commands within WINGRIDDS to display or compute quantities involving either the specified layer pair (see LVL1, LVL2) or time pair (see FHR1, FHR2). For example, computing a contoured 1000-500 mb thickness field of geopotential height involves setting the layer values LVL1 and LVL2 to 1000 and 500 mb, respectively (i.e., the command: SLYR 1000 500 does this) and then typing HGHT LDIF at the command line.

Similarly, computations involving the time pair are accomplished by specifying values for FHR1 and FHR2 using the SFHS command and using an appropriate time command (TDIF, TTOT). For example, to compute a contoured time difference field of 500 mb temperature between the 12 and 24 hour forecasts, first set the time pair variables (SFHS 12 24) and then enter the commands TEMP TDIF 500.

A time tendency, as defined in WINGRIDDS, is the arithmetic average (see TAVE) of a scalar or vector quantity taken between the time pairs FHR1, FHR2, and divided by the time interval (in seconds) between FHR1 and FHR2 (see TTND). The default time interval used for time tendencies is (sec'1). This interval can be modified to other units (e.g., hourly - HRLY; daily - DALY; etc.), or any other user-specified value. A time tendency for both scalar and vector fields is available (see STND, VTND, respectively).

Section A describes commands that use the time pair. Section B describes commands involving layer computations.

A. Time pair

TAVE [proceeded by variable]
(SCALAR or VECTOR) Calculates the time average of a variable to the left of the command using the time pairs FHR1 and FHR2. The variable can either be a scalar or vector quantity. If a scalar variable is used, the arithematic average is computed by dividing the sum of the scalar at times FHR2 and FHR1 by two. If a vector variable is specified, a new vector field is created with each new vector being the arithmetic sum of the u- and v- components at the two specified time pair hours (FHR1, FHR2) divided by two.

The time pairs are set with the command SFHS and default to the initial values specified in the INITGRID.SPC file. The values of FHR1 and FHR2 are found on the default parameters line (the line immediately below the command line).

COMMANDS for LAYER/TIME VALUES (cont.)

TTOT [proceeded by variable]
(SCALAR or VECTOR) Calculates the time total or sum of a variable to the left of the command using the time pairs FHR1 and FHR2. The variable can either be a scalar or vector quantity. If a scalar variable is used, the arithmatic sum is computed by simply summing the scalar at times FHR2 and FHR1. For example, the command MIXR TTOT contours the sum of the mixing ratios at the forecast hours FHR1 and FHR2.. If the variable specified is a vector, then a new vector field is created where each new vector represents the arithmetic sum of the u-and v- vector components at the two specified time pair hours FHR1 and FHR2 divided by two. See also TDIF.

TDIF [proceeded by variable]
(SCALAR or VECTOR) Calculates the time difference of a variable to the left of the command using the time pairs FHR1 and FHR2. The variable can either be a scalar or vector quantity. If a scalar variable is used, the arithmatic sum is computed by simply summing the scalar at times FHR2 and FHR1. For example, the command TEMP TDIF contours the resulting difference field between the temperature at the specified level between FHR1 and FHR2. The sense of the difference computed is: [FHR2 • FHR1]. If the variable specified is a vector, then a new vector field is created where each new vector represents the arithmetic sum of the u- and v- vector components at the two specified time pair hours FHR1 and FHR2 divided by two. See also TTOT.

TTND [proceeded by variable]
(SCALAR/VECTOR) Calculates the time tendency for variable specifed. A time tendency is the arithmetic average of the variable field at times FHR1 and FHR2 divided by the time interval specified between these two times. For example, the time tendency of the 24- and 36-hour dew point fields at some vertical level is given by:

DWPT TTND SFHS 24 36

which is exactly equivalent to the command:

STND DWPT F24 TEMP F36

The units for both of the above expressions would be in °C per sec. The "per sec" units can be converted to "per hour using HRLY or to "per 24-hour day" using DALY. See also STND, VTND, TAVE, HRLY, DALY, SFHS, FHR1, FHR2.

B. Layer Pairs

LAVE [proceeded by variable(s)]
LYAV
(SCALAR or VECTOR) Calculates the layer average of a variable to the left of the command using the layer pairs LVL1 and LVL2. The variable can either be a scalar or vector quantity. If a scalar variable is used, the layer average is computed by dividing the sum of the scalar at the levels LVL1 and LVL2 by two. If a vector variable is specified, a new vector field is created with each new vector being the arithmetic sum of the u- and v- components at the two specified layer levels (LVL1, LVL2) divided by two.

For example, the command RELH LAVE computes the arithematic average of the relative humidity at layer levels LVL1 and LVL2. This is not the same as a true mean relative humidity between these two levels typically depicted on standard AFOS and facsimile graphics. A true "mean" RH is calculated by summing up the individual RH's at every vertical level between the LVL1 and LVL2 layers and then taking a pressure-weighted average of this sum.

The layer pairs are set with the command SLYR and default to the initial values specified in the INITGRID.SPC file. The values of LVL1 and LVL2 are found on the default parameters line (the line immediately below the command line).

See also SLYR, LVL1, LVL2.

LSUM [proceeded by variable(s)]
LADD
LYSM
(SCALAR or VECTOR) Calculates the layer sum of a variable (or variables) to the left of the command using the layer levels LVL1 and LVL2. The variable can either be a scalar or vector quantity. If a scalar variable is used, the sum is computed by summing the scalar at layer levels LVL1 and LVL2. For example, the command SMIX LSUM contours the sum of the saturated mixing ratios at the layer levels LVL1 and LVL2. If the variable specified is a vector, then a new vector field is created where each new vector represents the arithmetic sum of the u-and v- vector components at the two specified levels LVL1 and LVL2.

See also SLYR, LVL1, LVL2, LAVE, LDIF.

LDIF [preceded by varlable(s)]
LYDF
(SCALAR or VECTOR) Calculates the layer difference of the variable (or variables) to the left of the command using the layer levels LVL1 and LVL2. The variable can either be a scalar or vector quantity. If a scalar variable is used, the difference is computed by subtracting the scalar at layer level LVL1 from that at LVL2. For example, the command TEMP LDIF contours the difference between the temperature at layer LVL2 minus the temperature at LVL1. If the variable specified is a vector, then a new vector field is created where each new vector represents the arithmetic difference of the u- and v- vector components at the two specified levels LVL1 and LVL2.

See also SLYR, LVL1, LVL2, LSUM, LAVE.

**- COMMANDS RELATED TO LIFTING OF LAYERS

WINGRIDDS offers several commands that deal with "lifting". A common example of "lifting" used in forecasting is computing the lifted index. In WINGRIDDS, one can specify the two layers that are used in computing the lifted index and issue a command (LNDX) that computes this temperature difference. In addition, the lifted index is commonly included with the basic gridded data from the model. Typing LIFT displays contours of the model "best" lifted index, which tends to depict the most unstable (i.e., most negative) of the lifted indicies. Consult NWS Technical Procedures Bulletin No. 207 for details on the "best" lifted index.

COMMANDS RELATED TO LIFTING OF LAYERS (Cont.)

Other commands allow for computing the temperature and pressure of the lifted condensation level (LCL) of parcels originating from some user-specified level (TLCL and PLCL, respectively). In addition, a layer's "pressure deficit" can be computed -that is, the difference between the pressure of the layer and the pressure at which that layer's LCL is reached (see PDEF). Consult a meteorological textbook for definitions of LCL and explanation of parcel theory.

The vertical levels used for lifting can be specified at constant pressure (e.g., 850 mb), sigma or boundary layer level (e.g., S982, B015), or even an isentropic surface (see SLVL, I###, S###, and B###).

LIFT |UFX| > Provides Lifted Index fields without resetting LEVeL

LNDX
(SCALAR) Calculates the "lifted index" (U) between LVL1 and LVL2 and displays the results as a contoured field in units of degrees Celsius. WINGRIDDS uses the standard definition of U, viz., the temperature difference between the temperature a parcel obtains when lifted from some lower level (i.e., LVL1) dry adiabatically until it reaches saturation, then moist adiabatically to some specified upper level (e.g., LVL2 set equal to 500 mb), with the observed (or forecast) ambient mb temperature at the upper level (assuming no mixing or entrainment of environmental air into the parcel)- For example to compute the surface-based U similar to the NGM surface U on AFOS (PIL NMCGPH02L, 04L, etc.), you first set the bottom layer to the lowest sigma layer (S982) and the upper level to 500 mb (500) using the command "SLYR S982 500", then type in LNDX.

See also LIFT, PLCL, TTHE.

PLCL
(SCALAR) Calculates the pressure of the lifted condensation level (LCL) using temperature, moisture, and pressure values taken from the current vertical level (LVL) and displays a contoured field In units of millibars (mb). The LCL Is the level at which saturation of an initially unsaturated parcel occurs. See also PDEF, TLCL, TTHE.

PDEF > Calculates the Pressure lift needed for saturation form the LCL

TLCL
(SCALAR) Calculates the temperature at the lifted condensation level (LCL) of parcels having characteristic temperature, moisture, and pressure values taken from the current vertical level (LVL) and displays a contoured field in units of degrees Celsius (°C). The LCL is the level at which saturation of an initially unsaturated parcel occurs. See also PDEF, TLCL, TTHE.

TTHE > Calculates temperature of parcel lifted from bottom to top of layer

**- COMMANDS TO ALTER APPEARANCE OF DISPUTABLE FIELDS AND DATA

A. COLOR

The color of contour lines or alphanumeric data (see DATA) are based on the color palette line and the number of overlays. When the first field is displayed after the screen erases, it will use color 1, which is the lefthand-most color on the color bar at the bottom of the screen. Subsequent overlays of fields increment the color by one for each overlay. For example, the command "BKNT/TEMP/HGHT will display the height field first in color one, then the temperature field is overlaid in color 2, followed by the wind barbs in color 3. (NOTE: sometimes this scheme for contour coloring does not work - there is a known bug in the software that cause multiple overlays to be displayed in the same color - normally color 2. Hopefully, a future software will have this bug corrected).

Commands are available to override the default contour colors. They all begin with "CLR" and followed by either a single digit number (1-9, inclusive) or a single alphabetic letter (A-Z, inclusive). The numbers and letters represent color as depicted in the thin color palette line at the bottom of all WINGRIDDS graphic displays. Solid contours are displayed for all single digit numbers (1-9) and the letters: A, B, C, E, F, G. Dashed contours can be displayed by using the letters "H" through "W, inclusive, as in CLRH. Dotted contours can be displayed by using the letters X, Y, or Z.

Note that the command "CLRD" has special meaning in that it is the same color as the map background (i.e., black). When CLRD is used to display a field, it will appear in the background color (i.e., black) and you won't see it. However, if CLRD is used to overlay a field that has previously been displayed, that field will be erased without disturbing the rest of the display area.

Remember that the color palette can be changed by changing the values within the default file PALETTE.CLR.

Solid lines...

CLR1 Override default and use color 1 in palette (Solid).

CLR2 Override default and use color 2 in palette (Solid).
•**
CLR9 Override default and use color 9 in palette (Solid).

CLRA Override default and use color 10 in palette (Solid).
• ••
CLRG Override default and use color 16 in palette (Solid).

Dashed lines...

Note: the commands CLRH, CLRI,... through CLRW, inclusive all plot dashed lines -the only difference being in color plotted.

CLRH Override default and use color 1 in palette (Dashed).

CLRI Override default and use color 2 in palette (Dashed).
• •*
CLRW Override default and use color 16 in palette (Dashed).

DASH Sets display mode to plot dashed lines for parameter specified either to
the right or left. For example, the commands "DASH TEMP" and TEMP DASH" do exactly the same thing; i.e., they plot the temperature contours as dashed lines. See also DNEG, DPOS.

COMMANDS TO ALTER APPEARANCE OF DISPLAY FIELDS AND DATA (cont.)

Dotted lines...

CLRX Override default and use color 14 in palette (Dotted).

CLRY Override default and use color 15 in palette (Dotted). CLRZ Override default and use color 16 in palette (Dotted).

B. CONTOUR AND DATA SMOOTHING

CNSM |KSMO| [Followed by integer value] > Changes smoothing (1) on Contours

SMTH > Applies a binomial smoother to the active gridded data

SMOO > Applies a light smoother to the active gridded data

DALY |PRDY| > Converts diagnostic command results from /sec to /day

HRLY |PRHR| > Converts diagnostic command results from /sec to /hour

STON > Stops display of grid statistics.

STOF > Starts display of grid statistics.

WINGRIDDS Automatic Mode

The following discussions describe the operation of WINGRIDDS in *Automatic Mode*.

WINGRIDDS can be run in an automatic mode. Within a batch file or if you are at a Windows Command prompt, you can enter WINGRIDDS followed by a listing of up to 35 PCG Data files followed by a single Command Macro file name. WINGRIDDS will startup, load all the data files in the order they were listed and will execute the command macro file and will then quit. This process is useful for generating WINGRIDDS graphics (a screen save operation) without needing to have a user do it by hand. The screen save commands (SAVS) must be included in the command macro and the command macros cannot require any user intervention or the system will pause waiting for the user to enter the required data.

Remember, if WINGRIDDS is in 4PNL mode and all 4 windows are to be saved as one image, enter the command **ALWN** just before the **SAVS** command.

-- Automatic Starting WINGRIDDS

Use the following example to initiate a WINGRIDDS session in *Automatic Mode*:

1. From the MS command line within the WINGRIDDS directory or within a batch file, enter:
   c:\ WINGRIDDS > WINGRIDDS JL030312.ETA211 TEST.CMD

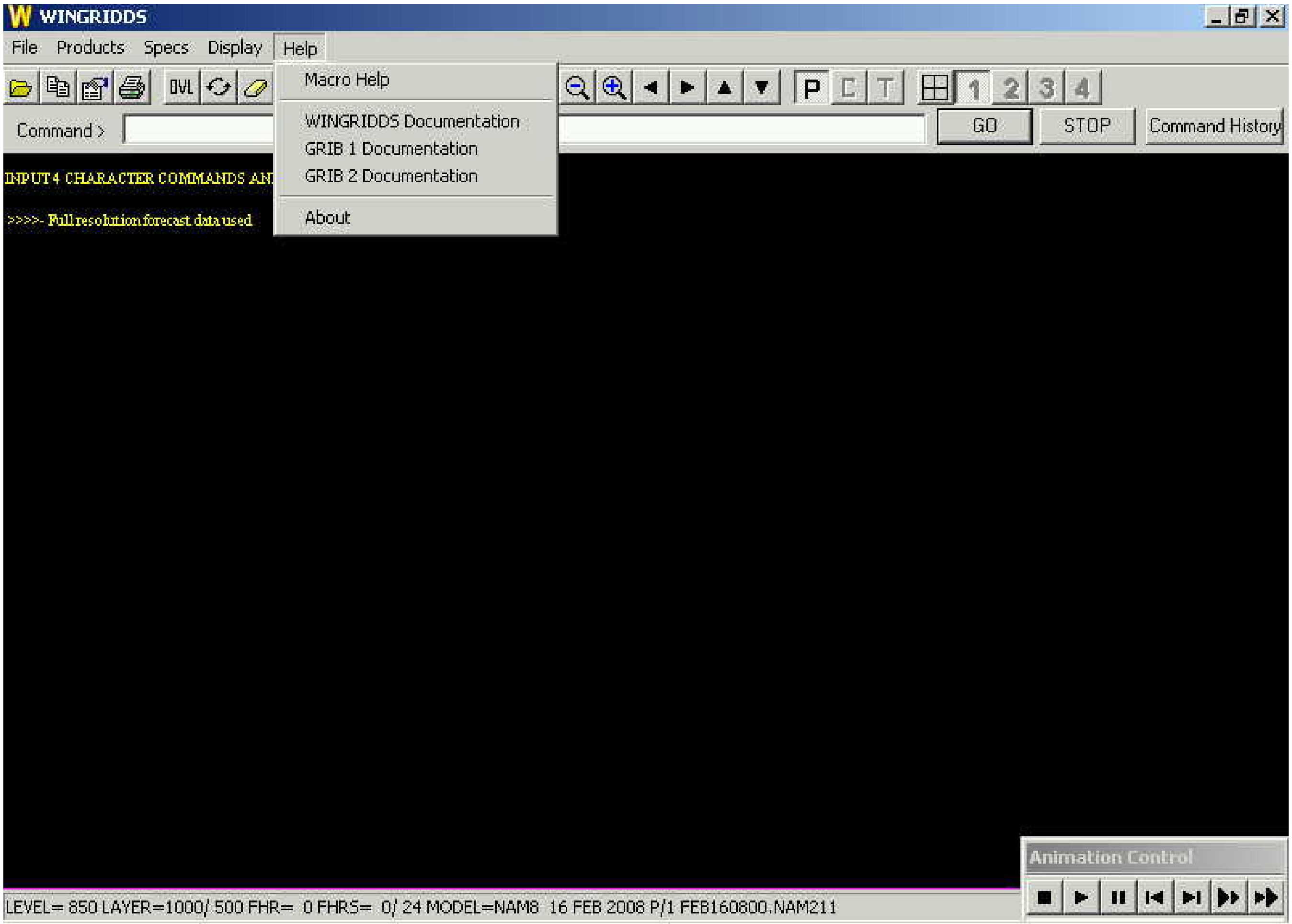
All commands are separated by spaces and the last entry **MUST** be the name of a single command macro file name with the .CMD extension.

Online Help

There are four (4) different types of help functions within WINGRIDDS for the user to utilize in the operation of WINGRIDDS.

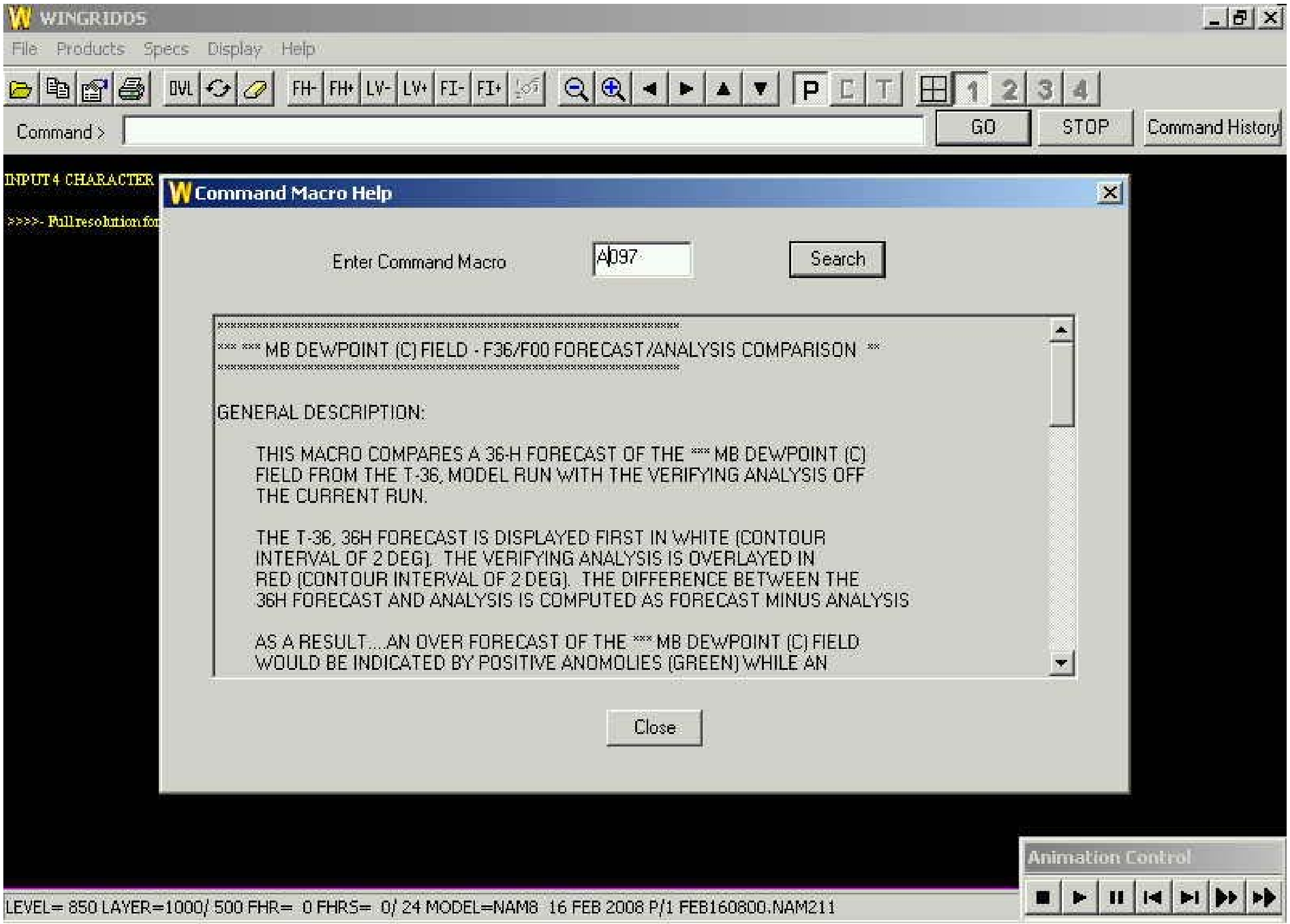
-- Help Menus

This menu option shows the Macro Help and WINGRIDDS and GRIB documentation.



-- Macro Help

All Command Macro files ***should*** have a help created to go along with the macro to explain in detail what the macro is doing and what data and input it expects. See the figure below:



With the Macro Help dialog, the user enters the 4-character name of the help file (which should be the same as the macro name) and click '**Search**' or hit the **[Enter]** key. The program will search for that macro help file name and, if found, display the contents. If no file is found, the user will be notified.

These macro help files are stored in the 'Help' directory of the WINGRIDDS program and are simple text files with the file name extension '**.hlp**'. If any user creates a new command macro, they are encouraged to create a corresponding help file for other users to use.

-- WINGRIDDS Documentation
Opens up the WINGRIDDS User Guide within Adobe Acrobat Reader or other PDF file viewer.

-- GRIB1 & GRIB2 Documentation
Opens the GRIB 1 or GRIB 2 Documentation with the default HTML viewer.

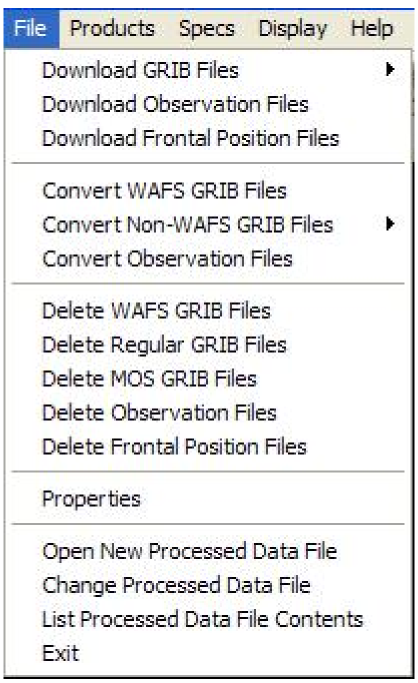
Customizing the WINGRIDDS System

You can customize the basic operation of WINGRIDDS by modifying the files in the **\WINGRIDDS\USER** directory. Unless otherwise specified, all files discussed in this section reside in the **\WINGRIDDS\USER** directory. Many files contain internal documentation that describes each item and its range of acceptable values. It is ***IMPERATIVE*** that you make the data entries at the specified line and column of the file.

Note: The documented files identify a line number and an entry number for each data entry. The line position of an entry should not be changed.

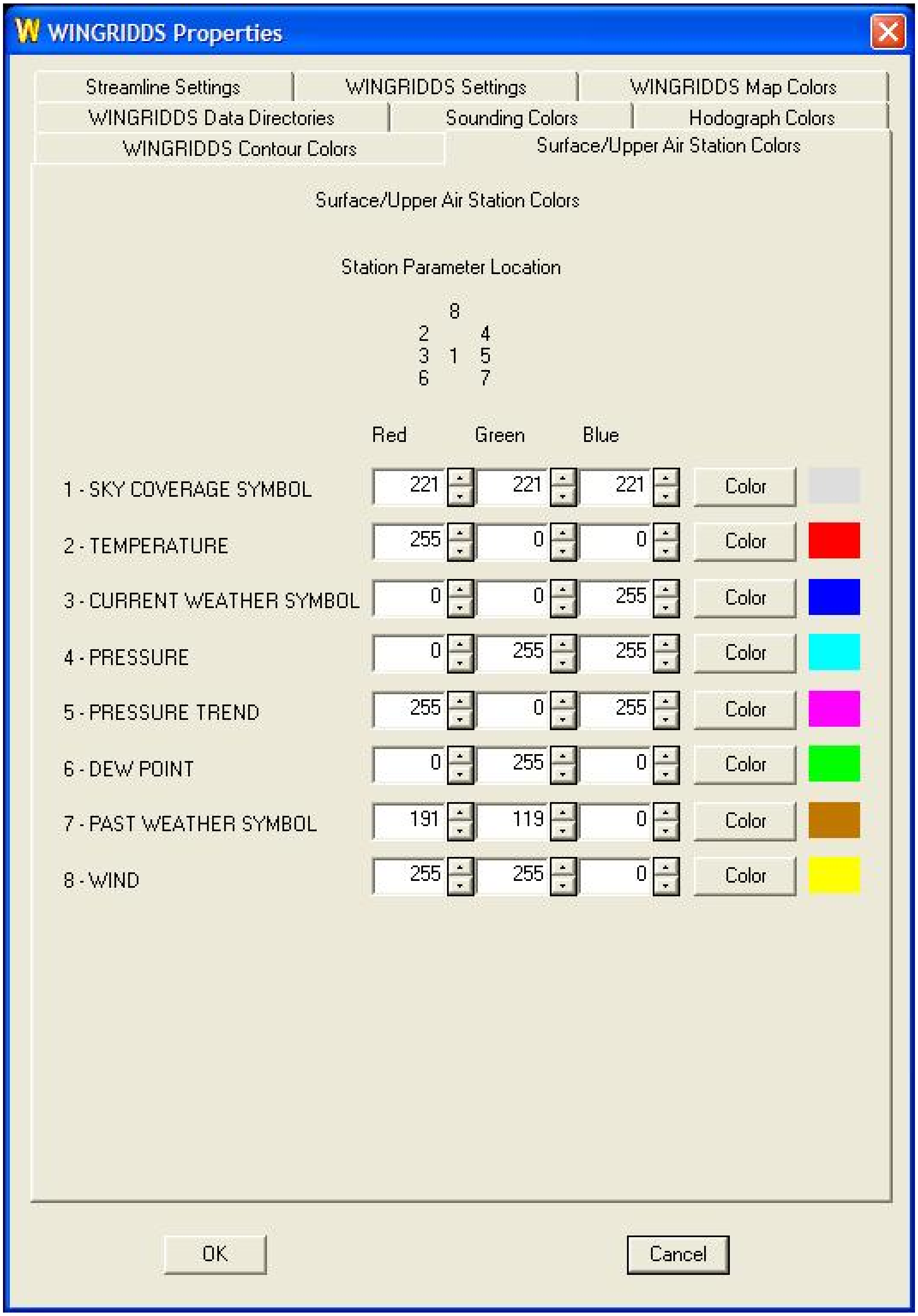
-- WINGRIDDS Configuration

Many new improvements have been added to this version of WINGRIDDS and several underlying details have been changed in how this version of WINGRIDDS stores configuration data verses how WINGRIDDS v2.0 did. The **WINGMODE.DAT** file is now no longer used and has been replaced by **WINGCFG.DAT**. However, **WINGCFG.DAT** is not meant to be directly modified by the WINGRIDDS user as it was with WINGCFG. Now, within WINGRIDDS, a '*Properties*' menu and dialog has been created for the user to manage the look-and-feel of WINGRIDDS. The new menu entry looks like this:

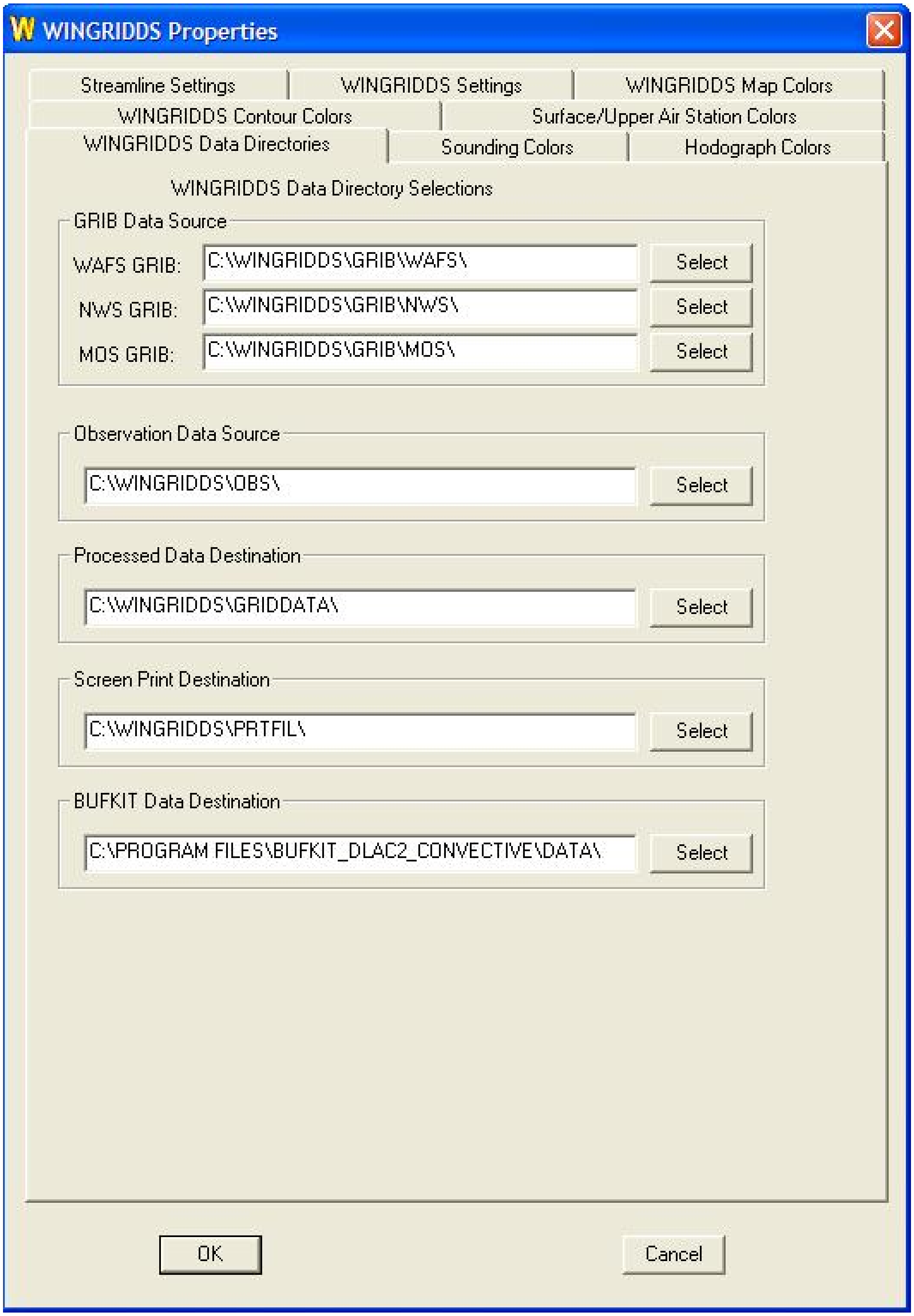


The '*Properties*' dialog is a tabbed dialog with eight (8) different sections which will control the way WINGRIDDS looks and operates. These sections will be covered in detail below.

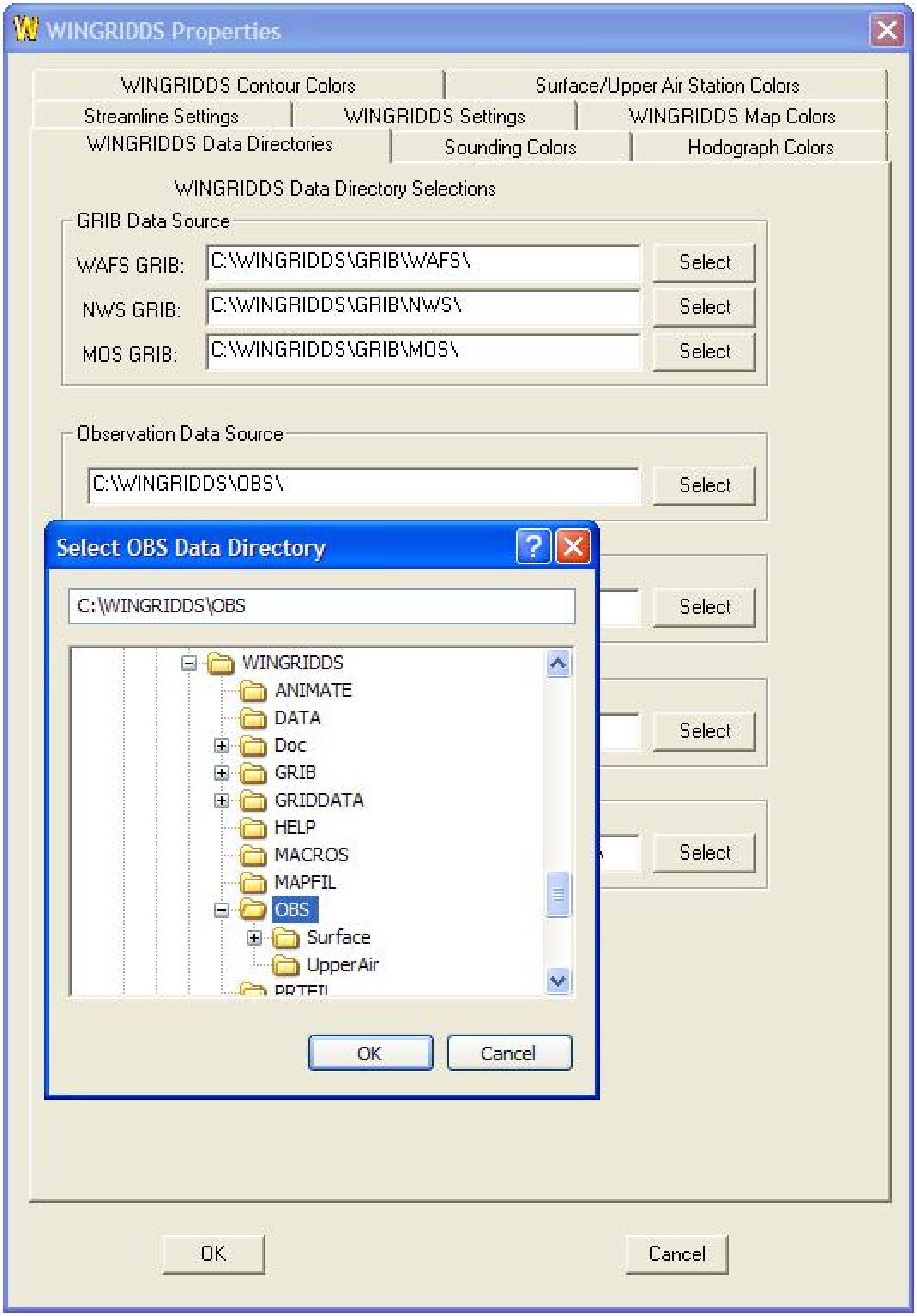
This WINGRIDDS Contour Color tab controls the colors of the individual contour colors which are shown across the bottom of the screen. The individual Red-Green-Blue (RGB) values are adjustable between 0-255 either through the Up/Down arrows or typing directly in each window. The color patch on the right is dynamic and will reflect the current RGB values. The 'Color' buttons open a color select dialog which will be covered later.



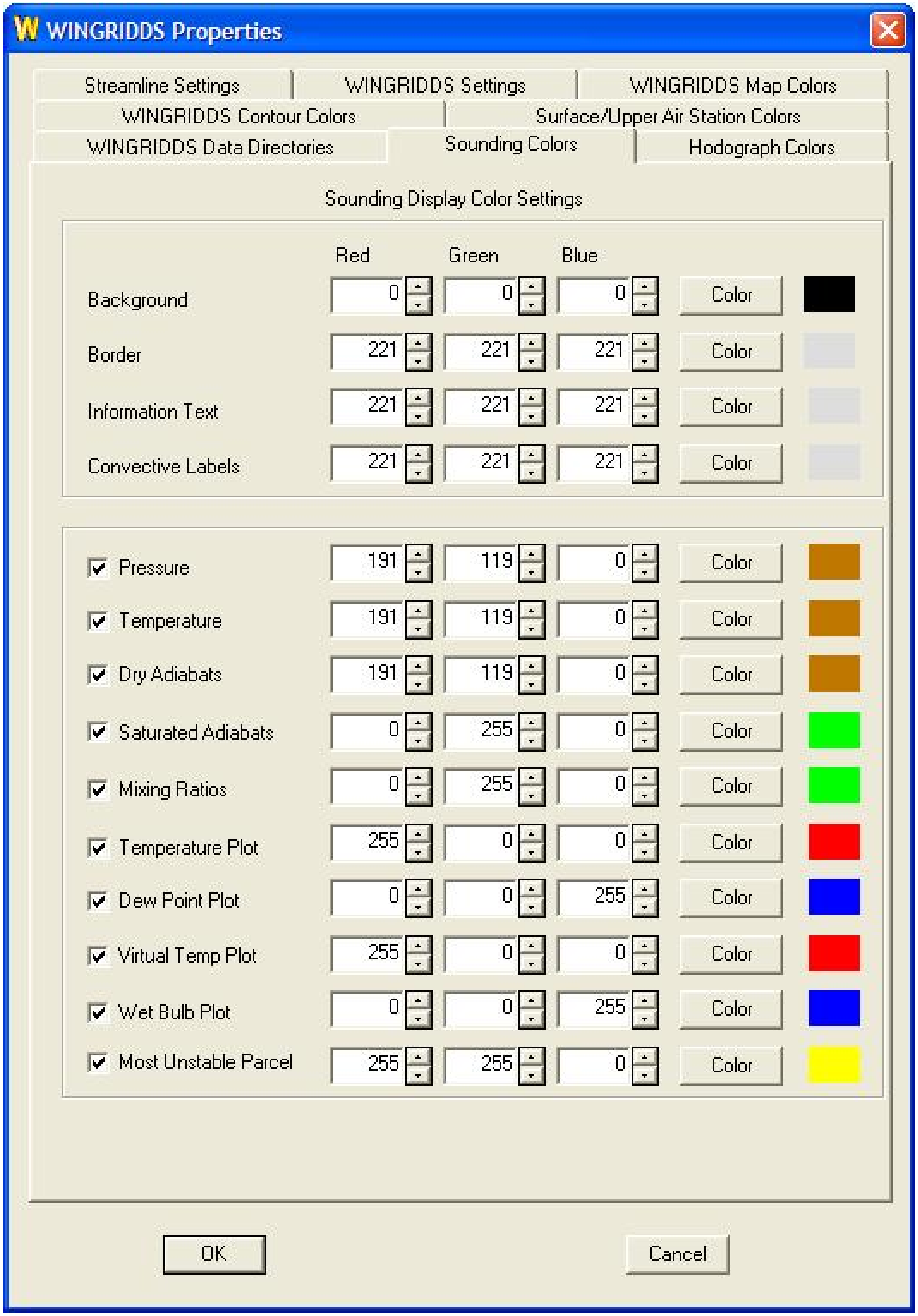
The WINGRIDDS Surface/Upper Air Station Colors dialog controls the way the surface and upper-air station plots look. The numbers to the left of the parameters are associated with the parameter locations when plotted. The color selection is as explained before.



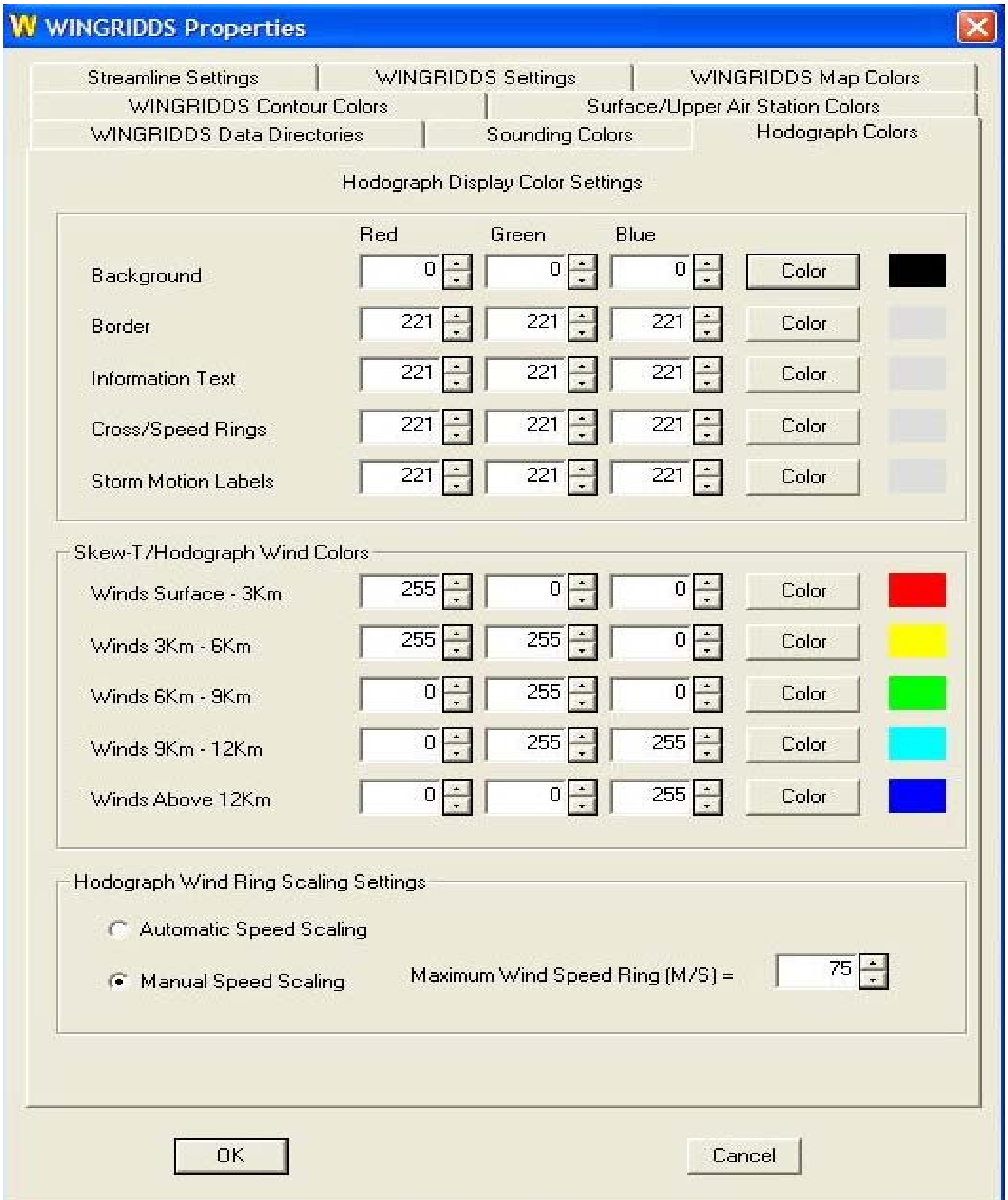
The WINGRIDDS Data Directories dialog allows the user to manage where raw and processed data is stored. The user can either type directly in the individual windows or click the 'Select' button which opens a graphical directories dialog which is shown below.



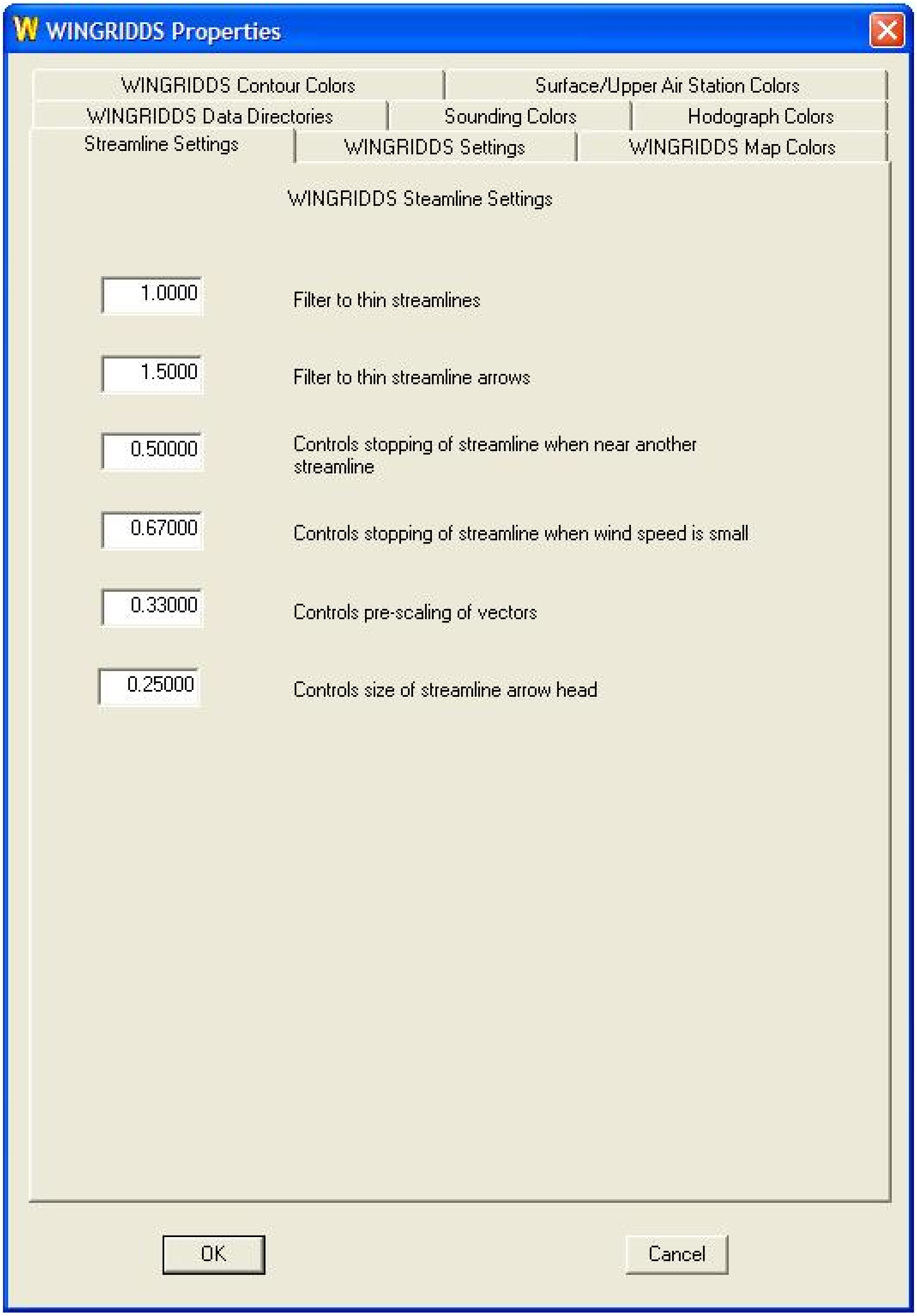
This Directories Dialog pops up whenever the user clicks a ‘Select’ button. This allows the user to graphically roam and select the desired directory.



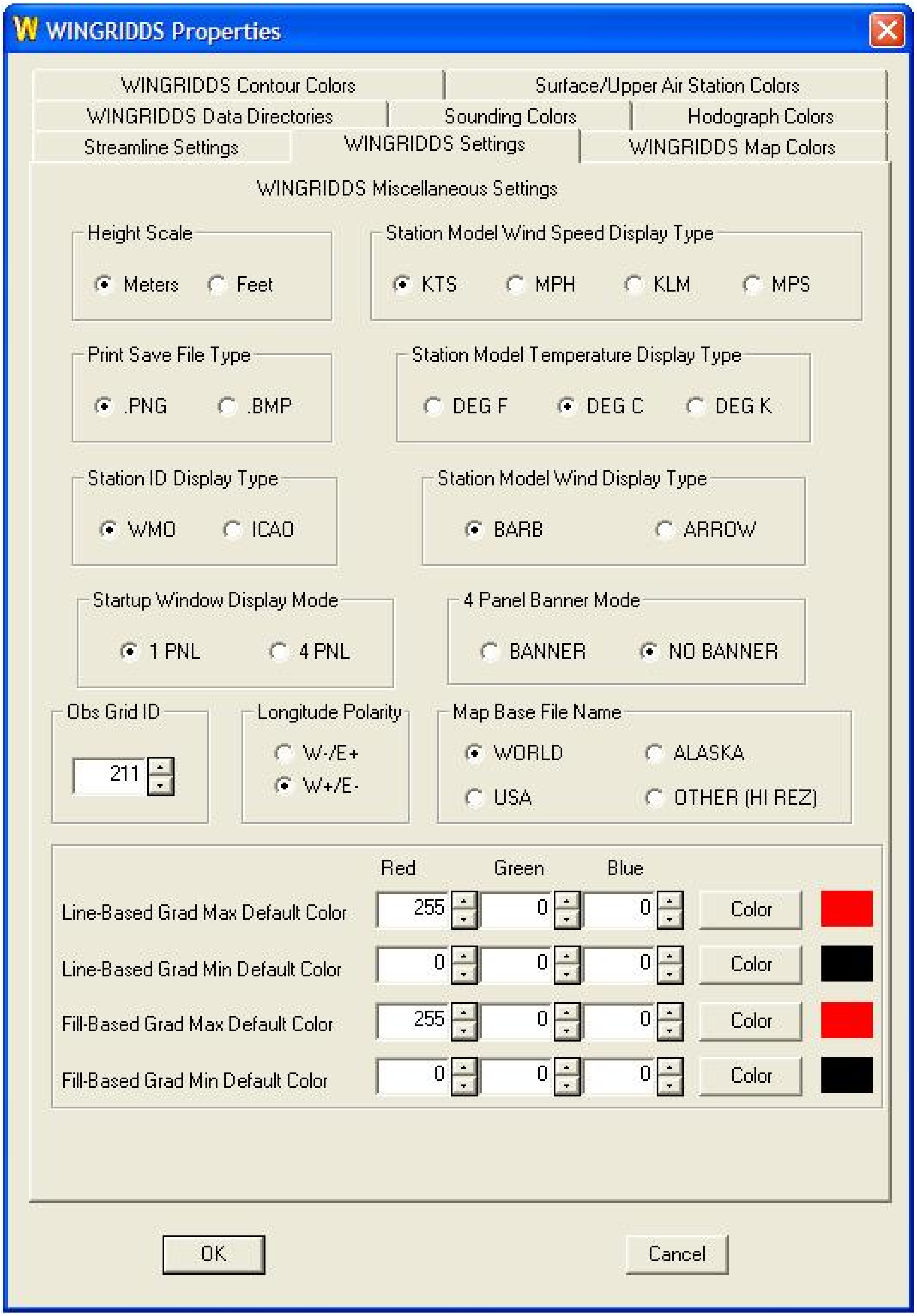
This dialog controls the look and feel of all of the sounding displays. The colors are controlled as with the other color selections. The Check-boxes down the left side either enable or disable the individual parameters as to whether they are displayed on the screen. The colors of the Wind Barbs/Arrows are controlled in the Hodograph Colors dialog shown next.



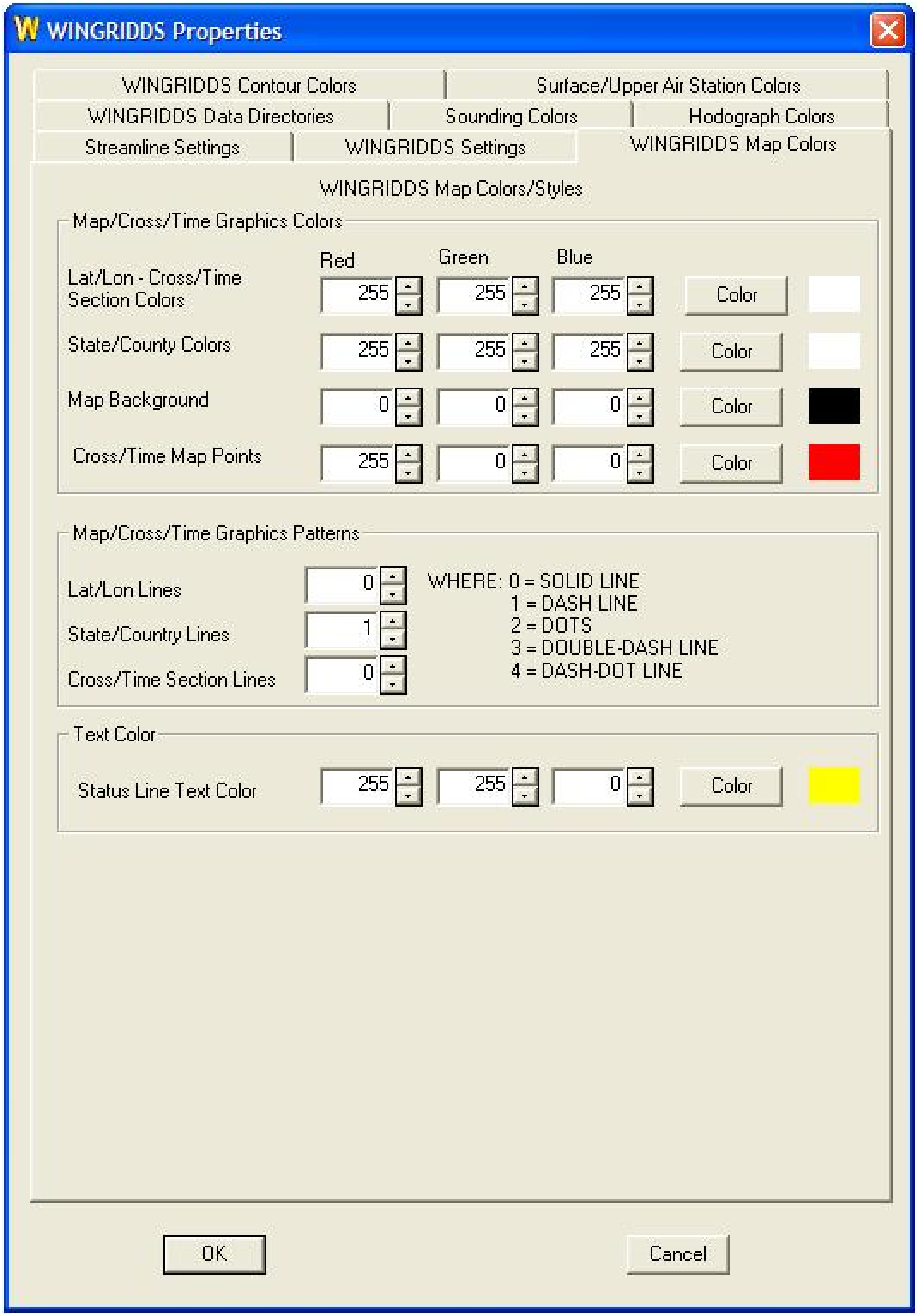
This dialog controls the look and feel of the Hodograph display. The colors are controlled as with the other color selections. The Wind colors are also reflected on the Sounding displays. The 'Hodograph Wind Ring Settings' section define whether the rings on a Hodograph are automatically adjusted to the maximum wind speed on a specific display or if the wind rings are fixed regardless of the maximum wind speeds. When the Hodograph is animated, the rings could change with every forecast hour causing the display appearance to jump around. Now, if the win speed scaling is set to 'Manual' the speed rings will be fixed to the setting within the window which is in meters-per-second. If there are wind speeds greater than the fixed setting, they will be drawn beyond the hodograph border & will not be seen.



This dialog controls the look and feel of all of the Streamline displays.

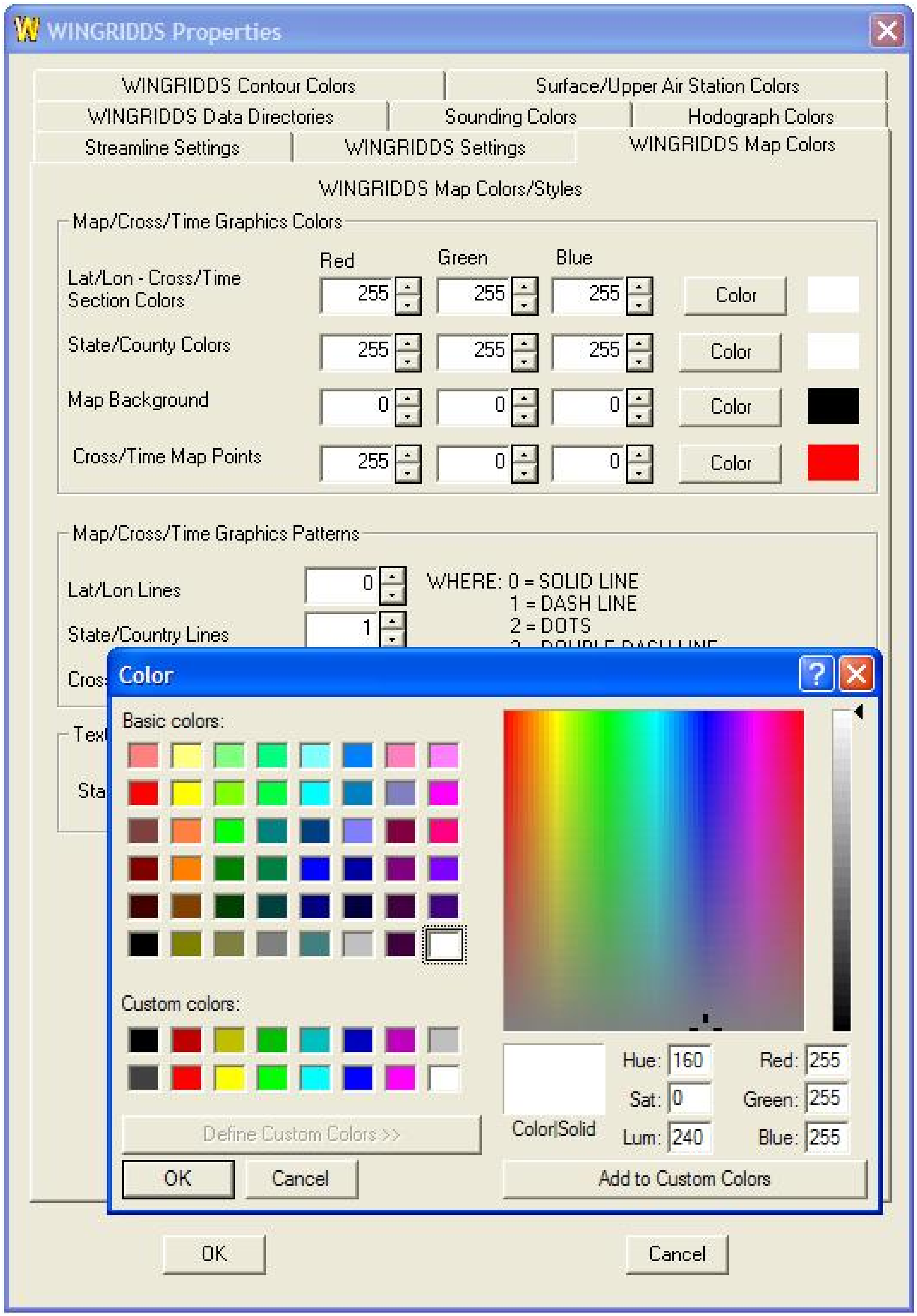


This dialog controls the default behavior of other WINGRIDDS display issues. The colors are controlled as with the other color selections. The buttons within each border show that only one of the selections can be selected. The colors at the bottom control the default maximum/minimum color values associated with the gradient displays.



This dialog controls the look and feel of all of the WINGRIDDS Map and Cross/Time Section displays. The colors are controlled as with the other color selections.

Custom Color Selection



Whenever a 'Color' button is pressed, the Color dialog is displayed and the user can select a customized color for the specific parameter through either selecting a 'Basic' color, 'Custom' color or dragging the mouse in the rainbow window or typing the specific RGB values or Hue-Saturation-Luminance values. Press ‘OK’ to accept or ‘Cancel’ to reject any selection.

-- Model Origination and Flight Levels for Labels

The file, **WINGLBL.USR**, provides information that WINGRIDDS uses to customize the labels which describe output from the products (refer to *'Defining Products'*). The file contains the model and plot origination for the **LFO#** label command. It also contains a corresponding list of pressure levels (hPa) and flight levels for the **LFL#** label command. Refer to the file for a description of each item and its acceptable values. A sample file is shown below.

```
................ Begin file WINGLBL.USR ..............................
'DOC/NOAA/NWS    WAFC-WASHINGTON'
LINE 1 (Entry 1)  MODEL AND PLOT ORIGINATION
                      THE TEXT IS DISPLAYED IN THE PLOT LABEL WHEN THE LFO#
                      COMMAND IS USED.  THE TEXT MUST BE ENCLOSED IN
                      QUOTES.
*********************************************************************
850,700,500,400,300,250,200,150,100, 70,  -1,-1,-1,-1,-1
050,100,180,240,300,340,390,450,530,450,  -1,-1,-1,-1,-1
LINE 7 (Entry 2)  LIST OF PRESSURE LEVELS (UNITS=hPa).
LINE 8 (Entry 3)  LIST OF FLIGHT LEVELS THAT CORRESPOND TO THE PRESSURE LEVELS
                  IN LINE 7.
                      THE TEXT IS DISPLAYED IN THE PLOT LABEL WHEN THE LFL#
                      COMMAND IS USED.  EACH VALUE MUST BE SEPARATED BY A
                      COMMA.  VALUES FOR ALL 15 LEVELS MUST BE ENTERED.  A
                      VALUE OF -1 INDICATES THAT NO VALUE IS DEFINED FOR THAT
                      POSITION.  ALL THE UNDEFINED POSITIONS MUST BE AT THE
                      END OF THE LIST AND MUST CONTAIN -1.
............... End file WINGLBL.USR .................................
```

-- Initial Pressure Levels and Forecast Hours

When WINGRIDDS starts, the level and time specifications are set to the default values defined in the file **INITGRID.SPC**.

Line 1 Pressure level, vertical layer, forecast hour, and time range are defined on line 1 of the file. Each of the 6 fields has a length of 4 characters.

Line 2 The pressure levels used for time-section and cross-section plots are defined on line 2 of the file. A maximum of 19 pressure levels can be entered. The number of pressure levels entered (field 1) has a length of 2 characters and can have a value between 1 and 19. Each of the pressure level fields has a length of 4 characters. The number of pressure level fields you actually enter must agree with the number of levels you specify in field 1.

Line 3 The forecast hours used for time-section plots are defined on line 3 of the file. A total of 19 forecast hours MUST be entered. If you wish to define fewer hours, the remaining values must be set to zero. The number of hours defined (field 1) has a length of 2 characters. Each of the hour values (fields 2-20) has a length of 4 characters. The increment between selected hour fields (field 21) has a length of 2 characters. This increment determines which of the defined hour fields will actually be used by WINGRIDDS for time-section plots. Refer to '*Changing Forecast Hours for Time-section Plots*' for a discussion of the effect these values have on the plot display.

Each line of the file must begin in column 1. Values must be right justified within their field. There are no spaces between the fields. Numerical values are expressed as integers with no decimal point.

Below is a sample **INITGRID.SPC** file. The lines are formatted as described above.

```
 2501000 500  12   0  24
101000 850 700 500 400 300 250 200 150 100
13  36  33  30  27  24  21  18  15  12  09  06  03  00  00  00  00  00  00  00 2
```

This second example contains the same data as the previous sample file, but with the field positions indicated below each line for clarity. The lines are grouped into pairs. The first line is the file entry. The second line indicates the field positions for reference, but is not actually entered into the file.

```
 2501000 500  12   0  24
111122223333444455556666
101000 850 700 500 400 300 250 200 150 100
112222333344445555666677778888999900001111
13  36  33  30  27  24  21  18  15  12  09  06  03  00  00  00  00  00  00  00 2
11222233334444555566667777888899990000111122223333444455556666777788889999000011
```

This example defines the following initial specifications:

Pressure level:	250 hPa
Vertical layer:	1000 hPa-500 hPa
Forecast hour:	12
Time range:	0-24
10 Pressure levels:	1000 850 700 500 400 300 250 200 150 100
13 Forecast hours:	36 33 30 27 24 21 18 15 12 09 06 03 00
	The field increment of 2 selects 7 hours: 36 30 24 18 12 6 0

-- Changing Width of a Cross-section Plot

By default, cross-sections are displayed in proportion to the vertical height. As a result, very narrow cross-sections may cover a small portion of the screen width. To control the width of the cross-section display while the program is in execution, you can use one of the following commands:

XNRO Displays the cross-section in proportion to vertical height

XWID Displays the cross-section in proportion to the vertical height

Both of these commands must be entered in PLAN view.

-- Changing Pressure Levels for Cross-section and Time-section Plots

WINGRIDDS initializes the pressure levels used for cross-section and time-section plots from the default set of values defined in the file **INITGRID.SPC**. The information specified in this file includes the number of levels defined and the level values. To change this default set of levels while the program is in execution, you can use the command '**XLVL** xxxx', where xxxx is a 4 character file name (**xxxx.LVL**). Once a set of pressure levels is defined, it will remain in effect until a new set is defined with the '**XLVL**' command.

MAND.LVL is a sample file that defines the values of the pressure levels used for time-section and cross-section plots using only mandatory pressure levels. The number of pressure levels entered and the value of each level are entered on line 1 of the file starting in column 1. A maximum of 19 pressure levels can be defined. The number of pressure levels entered (field 1) has a length of 2 characters while each of the pressure level fields has a length of 4 characters. The actual number of pressure level fields you enter must agree with the number of levels you specify in field 1. The values must be right justified within the field. There are no additional spaces between the fields. Numerical values are expressed as integers without decimal points.

In the example shown below, the first line is the actual file entry. The second line indicates the field positions for clarity, but is not actually entered into the file.

```
101000 850 700 500 400 300 250 200 150 100
112222333344445555666677778888999900001111
```

This example defines 10 pressure levels: 1000 850 700 500 400 300 250 200 150 100.

-- Changing Forecast Hours for Time-section Plots

WINGRIDDS initializes the forecast hours used to generate time-section plots with the default set of values defined in the file **INITGRID.SPC**. The information specified in this file includes the number of hours defined, the hour values and the time increment The time increment determines which of the defined hour fields will actually be used by WINGRIDDS for time-section plots. You can use the command '**THRS** xxxx', where xxxx is a 4 character file name (**xxxx.HRS**), to change the default set of hours while the program is executing. Once a set of hours is defined, it will remain in effect until a new set is defined with the '**THRS**' command. The time increment is defined in the **.HRS** file, but it can be changed independently with the '**TINC ####**' command, where #### is the time increment.

36HR.HRS is a sample file that defines the forecast hours used for time-section plots. The number of hours defined, the hour values and the time increment are entered on line 1 of the file starting in column 1. A total of 19 forecast hours MUST be entered. If you wish to define fewer hours, the remaining values must be set to zero. The number of hours defined (field 1) has a length of 2 characters. Each of the hour values (fields 2-20) has a length of 4 characters. The increment between selected hour fields (field 21) has a length of 2 characters. The values must be right justified within the field. There are no spaces between the fields. Numerical values are expressed as integers.

In the example shown below, the first line is the actual file entry. The second line indicates the field positions for clarity, but is not actually entered into the file. All the data must be entered on the first line of the file.

```
13  36  33  30  27  24  21  18  15  12  09  06  03  00  00  00  00  00  00  00 2
11222233334444555566667777888899990000111122223333444455556666777788889999000011
```

This example defines 13 times: 36 33 30 27 24 21 18 15 12 09 06 03 00. The time increment of 2 selects 7 times (36 30 24 18 12 6 0) that are actually used to create displays.

Note that the number of times *defined* is also used to control the width of the time-section screen displays. The time-section plot is scaled so that up to 19 times can be displayed across the full width of the screen. If you define fewer times, the display is centered but covers less of the screen width, as illustrated in the following examples.

Example 1: This file entry defines only 4 times (30,24,18,12). The time increment of 1 specifies all four hours for data selection. The data for hours 30,24,18,12 are displayed from the top to the bottom of the screen, but only across the center 4/19 of the horizontal screen width.

```
04  30  24  18  12  00  00  00  00  00  00  00  00  00  00  00  00  00  00  00 1
11222233334444555566667777888899990000111122223333444455556666777788889999000011
```

Example 2: This file entry defines 7 times (30,27,24,21,18,15,12). The time increment of 2 specifies only four of the times (30, 24,18,12) for data selection. The data used to create the displays come from the same hours as example 1 (30,24,18,12), but are now displayed across 7/19 of the screen because more hours were defined.

```
07  30  27  24  21  18  15  12  00  00  00  00  00  00  00  00  00  00  00  00 2
11222233334444555566667777888899990000111122223333444455556666777788889999000011
```

Example 3: This file entry defines 10 times (30,28,26,24,22,20,18,16,14,12). The time increment of 3 still specifies the same hours for data selection as Example 1 (30,24,18,12), but now the data are displayed across 10/19 of the screen.

```
10  30  28  26  24  22  20  18  16  14  12  00  00  00  00  00  00  00  00  00 3
11222233334444555566667777888899990000111122223333444455556666777788889999000011
```

Example 4: This file entry defines 10 times (12,14,16,18,20,22,24,26,28,30). The time increment of 3 still specifies the same hours for data selection as Example 1 (30,24,18,12), but now the data are displayed across 10/19 of the screen. Also, the time will increment from left-to-right.

```
10  12  14  16  18  20  22  24  26  28  30  00  00  00  00  00  00  00  00  00 3
11222233334444555566667777888899990000111122223333444455556666777788889999000011
```

-- Station ID Lists

The list of station id's used to define a display mode (refer to '*Display Menu*') is contained in the file, **\WINGRIDDS\DATA\STNID.DAT**. There is also a list of primary stations used for Observation Station plots called **STNID-PRIME.DAT**. This is a list of stations the user wants to be guaranteed to be plotted (if data is available). It is also in the **\WINGRIDDS\DATA** directory and has the same format as STNID.DAT. However, stations at the top of the list have priority to be plotted over other stations lower on the list.

If necessary, your system administrator can add additional station id's to the files. The following items must be entered for each station you add:

Station id	3 or 4 character id; a 3 character id must be contain a leading blank (e.g., _ADS). Use uppercase letters.
Latitude	Real number of the form ###.## (e.g., _35.23); North latitudes are positive; South latitudes are negative.
Longitude	Real number of the form ####.## (e.g., -101.70); East longitudes are positive; West longitudes are negative.

It is **imperative** that new entries be aligned with the current values in the file.

-- User Defined Alias Commands

WINGRIDDS performs computations using internally defined basic commands and combinations of these basic commands called alias commands. An alias command can be defined in terms of basic WINGRIDDS commands and other alias commands. It is useful to define alias commands when you repeatedly execute a group of WINGRIDDS commands or if you want to create a 4-letter command that is more appropriate to an international user.

Basic systems alias commands are defined in the file, **\WINGRIDDS\DATA\ALIAS.DAT**, and **SHOULD NOT BE MODIFIED**. You can expand the number of available alias commands by making an entry in the file, **ALIAS.USR**, in the **\WINGRIDDS\USER** directory. The format of the entry is

xxxx=aaaa bbbb cccc ... oooo

where 'xxxx' is the 4 character alias and 'aaaa bbbb cccc ... oooo' is the series of WINGRIDDS and other alias commands that define the new alias. **All entries must be in uppercase and have the exact format specified above.** The definition may contain a maximum of 15 commands/aliases and must be entered on one line of the file starting in column 1. An alias definition must not reference a macro (refer to *'Defining Products'*). It can, however, be used in a macro. An alias command must not duplicate a WINGRIDDS command name or system alias. Once an alias is entered into **ALIAS.USR**, it can be used like any WINGRIDDS command.

A sample alias command that plots the vector wind as barbs is shown below.

WNDB=BARB WIND

Alias commands can also be used to translate WINGRIDDS commands for international users.

VENT=WIND (French)
VNTO=WIND (Spanish/Portuguese)

-- GRIB Specifications for Data Ingest

The ingest process requires information relating GRIB identification values to convert model, grid, level, and parameter identifiers to the corresponding WINGRIDDS identifiers. Lists of these relationships are provided by the following set of files which reside in the **GRIB** directory. For most users, the default values contained in these files are sufficient. However, they may be modified if a required relationship was omitted.

GRIBMODL.DAT

This file is composed of entries containing a GRIB model value and its corresponding WINGRIDDS character model identifier. The GRIB model value is expressed as 3 numeric characters beginning in column 1. This is followed by the WINGRIDDS model id which consists of 3 alphanumeric characters beginning in column 5.

The WINGRIDDS model identifier has the following functions.

1. The model id followed by a 1 character grid id forms the 4 character WINGRIDDS model name which is used to reference information in the green area at the bottom of the screen while in Menu mode.

2. The first 2 characters of the WINGRIDDS model id followed by a 1 character grid id form the 3 character extension of the NWS and WAFS data file name.

Note: Some models, analyses, and/or forecasts from the same model run may be assigned different GRIB model values. To collate this data into a single WINGRIDDS data set, these different GRIB model values are given the same WINGRIDDS model identifier.

GRID.DAT

This file is composed of entries relating a GRIB grid identification value to a corresponding WINGRIDDS grid identifier. The WINGRIDDS grid identifier is used in conjunction with the WINGRIDDS model identifier as described above.

A portion of **GRID.DAT** is listed below. The first line indicates the field positions for clarity, but is not actually entered into the file. Note that there can be multiple entries for some GRIB grid identifiers. When this situation occurs, the first entry in the file for a given GRIB grid identifier is processed and the remaining entries (included only for historical purposes) are ignored.

```
111 2 ______________333333333333333333333333333333333
212 4               AWIPS 40KM FULL GRID
212 4               AWIPS 40KM SUBSETTED GRID
211 8               AWIPS 80KM FULL GRID
211 8               AWIPS 80KM SUBSETTED GRID
  6 L               LFM GRIDS
101 G               NGM 'OLD' C-GRID
104 S               NGM SUPER C-GRID
105 C               NGM '83' C-GRID
201 H               AWIPS NORTH HEMISPHERIC GRID
```

A sample entry (line 2 in the above sample file) and a description of each field in the entry is shown in the following table. Optional fields must be blank filled if they are not used.

Example	Field	Description	Start column	Number of characters	Character type
212	1	GRIB grid identification number	1	3	Numeric
4	2	WINGRIDDS grid identifier	5	1	Text
AWIPS 40KM SUBSETTED GRID	3	Grid description-optional	20	N/A	Text

GRIBPARM.DAT and MOSGRIBPARM.DAT

These files are composed of entries relating GRIB1 parameter identifiers to corresponding WINGRIDDS parameter names. The WINGRIDDS parameter name followed by the WINGRIDDS level identifier is then used to form the 8 character WINGRIDDS field name (e.g., TEMPB015). GRIBPARM.DAT is used for WAFS and NWS general GRIB1 file processing and MOSGRIBPARM.DAT is only used for MOS GRIB1 processing due to the different parameters which pertain to MOS data.

A portion of **GRIBPARM.DAT** is listed below. The first line indicates the field positions for clarity, but is not actually included in the file. The MOSGRIBPARM.DAT layout is similar.

```
111 2222 3333 444 5555555555555555555555
001 PRES       -2 PRESSURE
002 PRES  MSL  -2 MEAN SEA LEVEL PRESSURE
003 PTND       -2 PRESSURE TENDENCY
007 HGHT          HEIGHT - GEOPOTENTIAL
008 GHGT          HEIGHT - GEOMETRIC
010 OZON          TOTAL OZONE
011 TEMP          TEMPERATURE
```

A sample entry (line 2 in the above example) and a description of each field in the entry is shown in the following table. Optional fields must be blank filled if they are not used. The level override is used to set a standard level when there are potentially conflicting levels in the GRIB message. If a level override is given, that value is used in place of the WINGRIDDS level identifier. The ‘power of 10' scale factor is used to convert the data from the units used in the GRIB message to those desired for WINGRIDDS. It is the user’s responsibility to assure that the final scaled value is within the floating point range of -3.4E+38 to +3.4E+38.

Example	Field	Description	Start column	Number of characters	Character type
001	1	GRIB parameter identifier	1	3	Numeric
PRES	2	WINGRIDDS parameter name	5	4	Alphanumeric
MSL	3	Level override (optional)	10	4	Alphanumeric
-2	4	Power of ten scale factor (optional)	15	3	Signed integer
MEAN SEA LEVEL PRESSURE	5	Parameter description (optional)	19	N/A	Text

GRIB2PARM.DAT

With previous WINGRIDDS versions, the GRIB parameters within a GRIB2 message were translated to GRIB1 format and then decoded. While this technique allowed GRIB1 parameters to be decoded, as time went on and the GRIB2 messages were maturing, many of the new GRIB2 parameters were not decoded because there was no GRIB1 equivalent to translate to. With this version of WINGRIDDS, all GRIB2 messages will use a new parameter decode file called GRIB2PARM.DAT. This file will have similar functions to the GRIBPARM.DAT file which will still be used for any GRIB1 processing.

Due to the different parameter encoding scheme used in GRIB2 messages, the format of the GRIB2PARM.DAT file is different as well. See the example below:

```
111 222 333 4444 5555 666 7777777777777777777777777777777777777777777777777777
000 000 000 TEMP          TEMPerature (deg K converted to deg C by WINGRIDDS)
000 000 001 VTMP          Virtual TeMPerature (degree K)
000 000 002 THTA          potential temperature [THeTA] (degree K)
000 000 003 THTE          equivalent potential temperature [THeTa-E] (degree K)
000 001 000 SPFH          SPeciFic Humidity (g/g)
000 001 001 RELH          RELative Humidity (%)
000 001 002 MIXR          MIXing Ratio (g/g)
000 001 003 PWAT 0000  -1 Precipitable WATer (cm)
000 001 004 VPRS       -2 Vapor PReSsure (mb=hPa)
000 002 000 WNDD          WiND Direction (degree)
000 002 001 WNFF          WiNd speed (m/sec)
000 002 002 UGRD          GRiD relative U wind component (m/sec)
000 002 003 VGRD          GRiD relative V wind component (m/sec)
010 000 008 SWEL          significant SWELl wave height (m)
```

Example	Field	Description	Start column	Number of characters	Character type
000	1	GRIB2 Discipline from Section 0	1	3	Numeric
001	2	GRIB2 Category number	5	3	Numeric
003	3	GRIB2 Parameter number	9	3	Numeric
PWAT	4	WINGRIDDS parameter name	13	4	Alphanumeric
0000	5	Level override (optional)	18	4	Alphanumeric
-1	6	Power of ten scale factor (optional)	23	3	Signed integer
PRECIPITABLE WATER	7	Parameter description (optional)	27	N/A	Text

Within both the GRIB2PCG32 and NGRB2PCG32 debug output files, the GRIB2 Discipline, Category and Parameter numbers are listed for each GRIB2 message as follows:

```
GRIB2 Displn/Cat/Param =    0   1   29
```

With the appropriate numbers listed for the specific parameter. If the parameter is not listed within the GRIB2PARM.DAT file, the raw GRIB2 parameter name will be listed as well as follows:

```
RAW GRIB2 PARAMETER = ASNOW
```

So the user can go and add that parameter to the GRIB2PARM.DAT with the proper 4 alphanumeric for WINGRIDDS to use.

GRIB2ENSPROBPARM.DAT

For NGRB2PCG32 to process Ensemble Probability GRIB2 data, it must utilize its own GRIB-to-Parameter decoding file. This file is of similar structure to GRIB2PARM.DAT with the exception of the parameter name which is limited to 3 characters vs. 4 as in GRIB2PARM.DAT. See the example below:

```
111 222 333 444 5555 666 77777777777777777777777777777777777777777777777777
000 000 000 TMP          TEMPerature (deg K converted to deg C by WINGRIDDS)
000 000 002 THT          potential temperature [THeTA] (degree K)
000 001 001 RLH          RELative Humidity (%)
000 001 002 MXR          MIXing Ratio (g/g)
000 001 003 PWT 0000  -1 Precipitable WATer (cm)
000 001 004 VPR       -2 Vapor PReSsure (mb=hPa)
```

Example	Field	Description	Start column	Number of characters	Character type
000	1	GRIB2 Discipline from Section 0	1	3	Numeric
001	2	GRIB2 Category number	5	3	Numeric
003	3	GRIB2 Parameter number	9	3	Numeric
MXR	4	WINGRIDDS parameter name	13	3	Alphanumeric
0000	5	Level override (optional)	18	4	Alphanumeric
-1	6	Power of ten scale factor (optional)	23	3	Signed integer
MIXING RATIO	7	Parameter description (optional)	27	N/A	Text

GRIBLEVL.DAT

This file is composed of entries containing a numeric GRIB level value and its corresponding WINGRIDDS character level identifier. Only information for special levels is contained in this file. WINGRIDDS identifiers for other levels are described in the section '*Variables for Gridded Data Set*'. The WINGRIDDS parameter name followed by the WINGRIDDS level identifier form the 8 character WINGRIDDS field name.

The GRIB level value is expressed as 3 numeric characters beginning in column 1. This is followed by the WINGRIDDS level id which consists of 4 alphanumeric characters beginning in column 5. No WINGRIDDS level id can begin with zero except for the currently used values of 0000, 0DEG, 0DGX.

-- Map Type Specifications

The **MAPTYPE.DAT** file is obsolete in WINGRIDDS and is not required for the processing of the PCG Version 2 data files. **HOWEVER –** If you wish to display PCG Version 1 data files created with the DOS versions of PCGRIDDS, you **MUST** copy the MAPTYPE.DAT file from your PCGRIDDS program into WINGRIDDS for WINGRIDDS to accurately display the Version 1 files. Please refer to the DOS PCGRIDDS documentation concerning the explanation of the **MAPTYPE.DAT** file fields

-- Background Map Selection

WINGRIDDS has many high resolution map files with a variety of different features which can be used. A new file has been created in the \WINGRIDDS\USER directory called **MAPFILE.DAT**. The names of the new map files which the user wishes to display are listed in this file. The *'WINGRIDDS Settings'* tab of the *'WINGRIDDS Properties'* dialog contain the selection to use the Hi Rez maps and that option under 'Map Base File Name' must be selected for WINGRIDDS to read the **MAPFILE.DAT** file.

In the **MAPFILE.DAT**, you list the new map file names you wish to display. You can list multiple files for display. Below is a list of the new map files and what they display:

AFRICABOUND – Africa boundaries and lakes
AFRICARIVER – Africa rivers
ASIABOUND – Asia, Australia and Pacific Islands boundaries
ASIARIVER – Asia and Australia rivers
COUNTY – US Counties
COUNTY2 – US Counties
EUROPEBOUND – Europe boundaries and lakes
EUROPERIVER – Europe lakes
HRWO – Hi-Resolution World Outlines
HRWOB – Hi-Resolution World Outlines
HRUSS – Hi-Resolution US Streams
LRUSR – Lo-Resolution US Rivers
MRUSR – Med-Resolution US Rivers
NOAM1-BDY – US-Canada boarder
NOAM2-CIV – North America Outer Boundaries & Lakes
NOAM3-STATE – North America State Boundaries
NOAM4-RIV – North America Rivers
NOAM – North America and Mexico Borders and boundaries
NARR – North America Rural Roads
NAIH – North America Interstate Highways
NASH – North America State Highways
NASR – North America State Roads
SOUTHAMBOUND – South and Central America Boundaries and Lakes
SOUTHAMRIVER – South and Central America Rivers
STATES – US Hi Resolution State Boundaries

--Plan, Cross Section & Time Section Area Lookup Tables

The Area Setup menus for Plan View, Cross Section and Time Section views all have a button labeled ***'Lookup'*** which opens a window with a list of geographic areas or station IDs from which to choose from to configure the specific operation the user is trying to configure. The files to configure the Plan View, Cross Sections and Time Sections are AREA.DSP, CROS.DSP and TIME.DSP respectively and are located in the /DATA directory of WINGRIDDS. These files are simple text files and can be updated and modified by the user to add or change the listings. Each file's contents are a fixed format and are similar but different and will be covered below.

AREA.DSP – this file contains the area of coverage/station ID, latitude, longitude and latitude N/S distance for the viewable area. A portion of **AREA.DSP** is listed below. The first line indicates the field positions for clarity, but is not actually included in the file.

```
1111111111111111222222344444445666
AWIPS Grid 211   40.00N 100.00W 40
Great Plains     39.12N  94.60W 20
Gulf Coast       32.32N  90.08W 20
Mid-Atlantic     38.00N  80.00W 20
New England      42.75N  77.00W 20
```

Notice, the area in field one is ***Left*** justified and all the data areas are ***Right*** justified. Negative numbers are not needed to signify different hemispheres. That is shown in fields 3 & 5 with the N/S/E/W letters. The last line in this file is required to be the text *****DELETED*** . T**his signifies the end of the data area.

CROS.DSP – this file contains the area of coverage/station IDs, and latitude/ longitude pairs for the start/end points of the Cross Section.. A portion of **CROS.DSP** is listed below. The first line indicates the field positions for clarity, but is not actually included in the file.

```
1111111111111111222222344444445666666788888889
INL-ELP          48.57N  93.38W 31.80N 106.40W
INL-PHX          48.57N  93.38W 33.43N 112.02W
INL-TLH          48.57N  93.38W 30.38N  84.37W
{ 80 West}       55.00N  80.00W 25.00N  80.00W
{ 90 West}       55.00N  90.00W 25.00N  90.00W
```

Notice, the area in field one is ***Left*** justified and all the data areas are ***Right*** justified. Negative numbers are not needed to signify different hemispheres. That is shown in fields 3,5,7 & 9 with the N/S/E/W letters. The last line in this file is required to be the text *****DELETED*** . T**his signifies the end of the data area.

TIME.DSP – this file contains the area of coverage/station IDs, and latitude/ longitude pair for the location point of the Time Section. A portion of **TIME.DSP** is listed below. The first line indicates the field positions for clarity, but is not actually included in the file.

```
1111111111111111222222344444445
BOS              42.37N  71.03W
DEN              39.50N 104.40W
ORD              41.98N  87.90W
```

Notice, the area in field one is ***Left*** justified and all the data areas are ***Right*** justified. Negative numbers are not needed to signify different hemispheres. That is shown in fields 3 & 5 with the N/S/E/W letters. The last line in this file is required to be the text *****DELETED*** . T**his signifies the end of the data area.

Setting and Reading Default Contour Color-Fill Colors

Within WINGRIDDS V2.0, the default Contour Color-Fill Colors were part of the WINGMODE.DAT file. There was no graceful way of including those parameters within the new WINGRIDDS V3.0 Properties dialog. Therefore, a new file WINGCONTFILLDEF.DAT within the USER/ directory contains the default listings of colors to be used whenever the command CTFC is used without a following reference to a file name containing specific color listings. The format of the WINGCONTFILLDEF.DAT file included with WINGRIDDS is as follows:

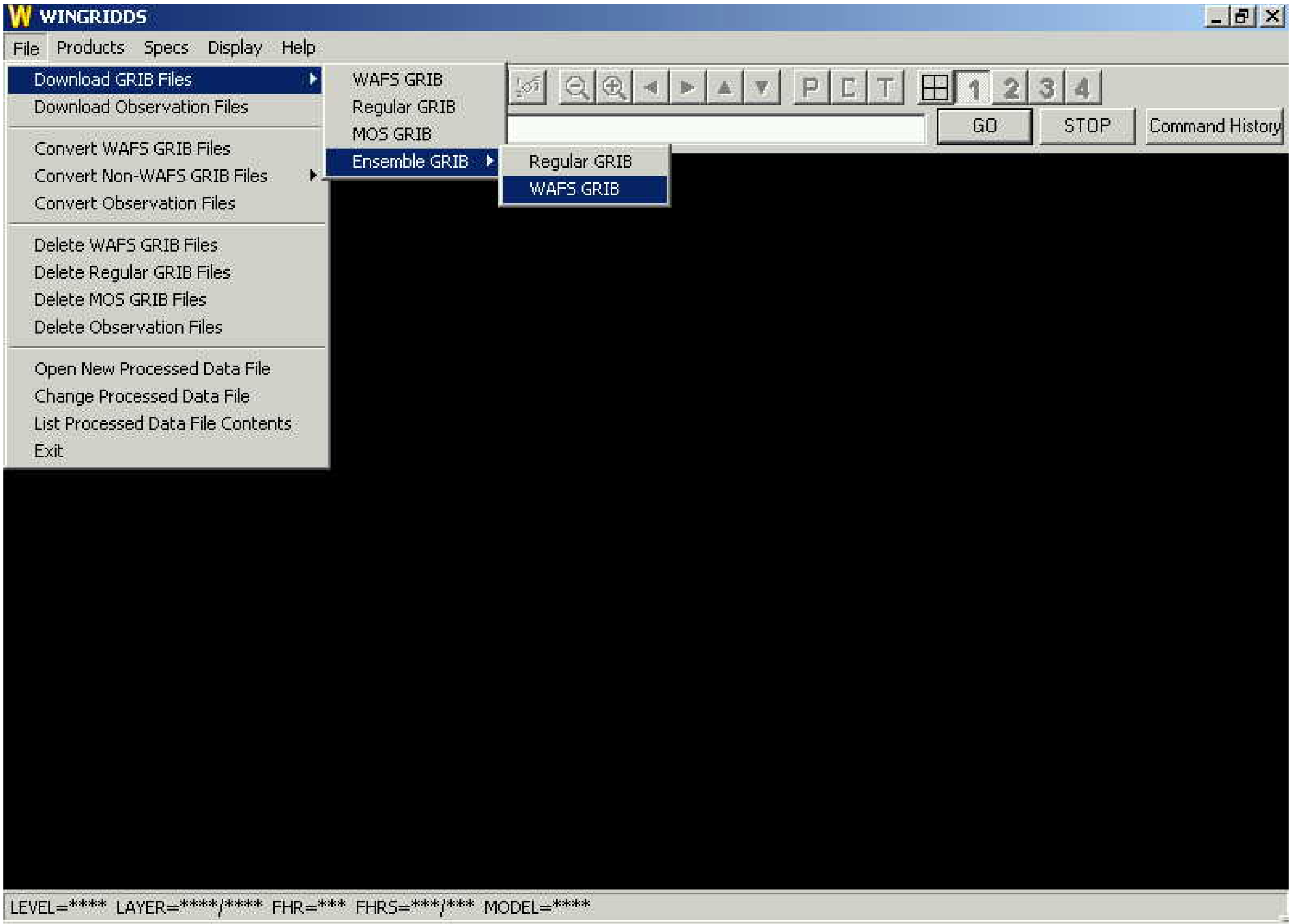
```
10
148 0 211
0 0 255
0 255 0
255 255 0
255 0 0
191 119   0
0 0 150
0 150 0
```

```
150 150 0
150 0 0
```

Line 1 – number of Red-Green-Blue (RGB) colors to follow. These range from 2 to 50.
Lines 2-10 – the individual RGB values from 0-255 (0=black, 255 = bright)

Since WINGRIDDS contouring algorithms default to have a consistent number of 9 contour lines on a display, it is best to have a minimum of 9 colors listed in the WINGCONTFILLDEF.DAT file to ensure all contours are assigned a color.

Customizing Data Downloading



WINGRIDDS now has GRIB-file and Observation-file downloading capability which comprises of two utility functions, a batch file and, with the WINGRIDDS distribution, over 1800 data files which can be modified by the user to customize or add to any data file downloads the user wishes to add. This section will describe how the system works and how it can be modified or updated.

The GRIB/Observation download data files use the same book/chapter model of files that the 'Product Menu'/'Command Window' models use. In the figure above, the GRIB downloads are broken down into five fixed categories and each category has it's own reference file which are located in the **WINGRIDDS/GRIB/USER** directory. The Observation download has it's own section but uses the same paradigm as the GRIB download.

GRIB/Observation Download Category file

Name The entries for each *Download Category* menu are stored in the files,

Download Category	Reference File
WAFS GRIB	WAFSGDL.LST
Regular GRIB	REGGDL.LST
MOS GRIB	MOSGDL.LST
Ensemble-Regular GRIB	EREGGDL.LST
Ensemble-WAFS GRIB	EWAFSGDL.LST
Observation Data	OBSDL.LST

Format These files can be modified using a standard text editor. Each line in the file defines a specific download category. A maximum of 72 characters can be entered on a line. The lines are displayed sequentially.

WINGRIDDS automatically 'numbers' the order of appearance for each entry on the menu page. All other characters displayed for the entry lines must be contained in the menu file. All lines in the menu must contain text. If you wish to leave an empty line for clarity, add dashes as shown in the example below.

NOTICE - All Reference files in the WINGRIDDS GRIB Download system follow the similar arrangements and usage. Only one category is used for this example.

The file contents for the first screen of the default *' Ensemble-WAFS GRIB'* menu are listed below.

```
............... Begin file EWAFSGDL.LST ............................
---    NCEP Server I - ENSEMBLE WAFS GRIB
00Z WAFS  (ALL OCTANTS)
06Z WAFS  (ALL OCTANTS)
12Z WAFS  (ALL OCTANTS)
18Z WAFS  (ALL OCTANTS)
---
---    NCEP Server II - ENSEMBLE WAFS GRIB
00Z WAFS  (ALL OCTANTS)
06Z WAFS  (ALL OCTANTS)
12Z WAFS  (ALL OCTANTS)
18Z WAFS  (ALL OCTANTS)
............... End page EWAFSGDL.LST ................................
```

Download List file

Name All the files for the *'Ensemble-WAFS GRIB'* menus have the name **EWAFSGDL**. The line number of the entry in the *' Ensemble-WAFS GRIB '* file (**EWAFSGDL.LST**) determines the extension of the file (**EWAFSGDL.###**) that provides the information for the corresponding *'Ensemble-WAFS GRIB '* menu. For example, if you select the entry '00Z WAFS (ALL OCTANTS)' which is on line 2 of the *'Ensemble-WAFS GRIB '* file, the product list contained in the file, **EWAFSGDL.002**, is displayed.

Format This file can be modified using a standard text editor. Each line in the file describes a specific product. The lines are displayed sequentially.

A maximum of 72 characters can be entered on a line. The first 4 characters of each line in a *'Ensemble-WAFS GRIB List'* file must be the name of the macro file that corresponds to the selected entry. For example, if you select entry 11, '*AREA between 30W to 60E and 0N to 90N '* from **EWAFSGDL.002** (listed below), the data file name, **EWFI1003.DAT**, is used as the argument for the utility GETGRIB.EXE.

WINGRIDDS automatically 'numbers' the order of appearance for each entry on the menu page. All other characters displayed for the entry lines must be contained in the menu file. In the example below, some entries are left blank for clarity. If the user selects a blank entry, WINGRIDDS return to the menu.

The contents for the first screen of the default *'Ensemble-WAFS GRIB List'* file, **EWAFSGDL.002**, are listed below.

```
............. Begin file EWAFSGDL.002 ................................
                          --- Global Coverage ---
EWAFG003   GLOBE Centered on Greenwich                      (Octants=OPMNKLIJ)
                         --- Hemisphere Coverage ---
EWNHG003   NORTHERN HEMISPHERE Centered on Greenwich       (Octants=KLIJ)
EWSHG003   SOUTHERN HEMISPHERE Centered on Greenwich       (Octants=OPMN)
                            --- Selected Areas ---
EWPL2003   The Caribbean and the Americas                   (Octants=PL)
EWOK4003   The Pacific and the Americas                     (Octants=OPKL)
EWMI4003   Europe,Africa and Western Asia                   (Octants=MNIJ)
                  --***-- Northern Hemispheric Areas --***--
EWFI1003   AREA between  30W to  60E and  0N to 90N    (Octants=I)
EWFI2003   AREA between  30W to 150E and  0N to 90N    (Octants=IJ)
EWFI3003   AREA between  30W to 120W and  0N to 90N    (Octants=IJK)
EWFJ1003   AREA between  60E to 150E and  0N to 90N    (Octants=J)
EWFJ2003   AREA between  60E to 120W and  0N to 90N    (Octants=JK)
EWFJ3003   AREA between  60E to  30W and  0N to 90N    (Octants=JKL)
EWFK1003   AREA between 150E to 120W and  0N to 90N    (Octants=K)
EWFK2003   AREA between 150E to  30W and  0N to 90N    (Octants=KL)
EWFK3003   AREA between 150E to  60E and  0N to 90N    (Octants=KLI)
EWFL1003   AREA between 120W to  30W and  0N to 90N    (Octants=L)
EWFL2003   AREA between 120W to  60E and  0N to 90N    (Octants=LI)
EWFL3003   AREA between 120W to 150E and  0N to 90N    (Octants=LIJ)
                  --***-- Southern Hemispheric Areas --***--
EWFM1003   AREA between  30W to  60E and 90S to  0N    (Octants=M)
EWFM2003   AREA between  30W to 150E and 90S to  0N    (Octants=MN)
EWFM3003   AREA between  30W to 120W and 90S to  0N    (Octants=MNO)
```

```
EWFN1003   AREA between  60E to 150E and 90S to  0N    (Octants=N)
EWFN2003   AREA between  60E to 120W and 90S to  0N    (Octants=NO)
EWFN3003   AREA between  60E to  30W and 90S to  0N    (Octants=NOP)
EWFO1003   AREA between 150E to 120W and 90S to  0N    (Octants=O)
EWFO2003   AREA between 150E to  30W and 90S to  0N    (Octants=OP)
EWFO3003   AREA between 150E to  60E and 90S to  0N    (Octants=OPM)
EWFP1003   AREA between 120W to  30W and 90S to  0N    (Octants=P)
EWFP2003   AREA between 120W to  60E and 90S to  0N    (Octants=PM)
EWFP3003   AREA between 120W to 150E and 90S to  0N    (Octants=PMN)
                --***-- Rectangular Pole-to-Pole Areas --***--
EWMI2003   AREA between  30W to  60E and 90S to 90N    (Octants=MI)
EWMI4003   AREA between  30W to 150E and 90S to 90N    (Octants=MNIJ)
EWMI6003   AREA between  30W to 120W and 90S to 90N    (Octants=MNOIJK)
EWNJ2003   AREA between  60E to 150E and 90S to 90N    (Octants=NJ)
EWNJ4003   AREA between  60E to 120W and 90S to 90N    (Octants=NOJK)
EWNJ6003   AREA between  60E to  30W and 90S to 90N    (Octants=NOPJKL)
EWOK2003   AREA between 150E to 120W and 90S to 90N    (Octants=OK)
EWOK4003   AREA between 150E to  30W and 90S to 90N    (Octants=OPKL)
EWOK6003   AREA between 150E to  60E and 90S to 90N    (Octants=OPMKLI)
EWPL2003   AREA between 120W to  30W and 90S to 90N    (Octants=PL)
EWPL4003   AREA between 120W to  60E and 90S to 90N    (Octants=PMLI)
.............. End page EWAFSGDL.002 ..................................
```

The naming of the *'Ensemble-WAFS GRIB List'* files (and all other GRIB Download data files) are not fixed in any set way and the user creating new data files are free to name them in any way they choose.

NOTICE – The List file names must not be longer than 8 alphanumeric characters long.

Each line entry in the data file (except line 1) are read by GETGRIB.EXE and passed to the FTPCMD.BAT file. The download data file format is explained below.

<u>Download Data file</u>

Name Each data file is a list of commands which are loaded into the **FTPCMD.BAT** file by the utility **GETGRIB.EXE.** The names of the files are assigned by the user.

Format This file can be modified using a standard text editor. Each line in the file describes a specific product. The lines are displayed sequentially.

There is no maximum number of characters to be entered on a line. The first 4 characters of each line in a *'Ensemble-WAFS GRIB List'* file must be the name of the macro file that corresponds to the selected entry. For example, if you select entry 11, '*AREA between 30W to 60E and 0N to 90N '* from **EWAFSGDL.002** (listed below), the data file name, **EWFI1003.DAT**, is used as the argument for the utility GETGRIB.EXE.

.... Begin file EWFI1003.DAT ....

```
00
@echo off
if "%4"=="" goto End
::
:: Begin Download
::
echo Please wait... This download may take a while...
::
::
cd \wingridds\grib\wafs\OctantI
echo Downloading ENSEMBLE WAFS OctantI GRIB 000
ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/gens/prod/gefs.%1%2%3/%4/wafs/wafs.37.t%4z.ens00 wafs.37.t%4z.ens00
```

<<<<< Sequence repeated to the end for each file to be downloaded >>>>>>>

```
::
:: All Done!!!
::
echo
echo Download Complete
goto :End
::
:End
```

.... End file EWFI1003.DAT ....

Download Data file – Format (Cont.)

Line 1 – (Required) “00” Signifies the hour of the model run.
All Other Lines (Note Required) Begin Batch File commands. These commands may be customized by the user for their requirements. Ensure the data transfers area delivered to the proper WINGRIDDS directories. For the explanation of the “**%1%2%3/%4”** batch file variables in the data files, refer to the GETGRIB.EXE Utility details.

The GETGRIB.EXE Utility is explained below.

Automated Data Download

When the user within WINGRIDDS clicks on a specific data file to be downloaded, the download process starts by WINGRIDDS executing the following command (using the above example):

GETGIRB EWFI1003.DAT

The same command can be executed in an automated batch file set up by the user. The use has to know which data file to use for the specific data to be downloaded and then schedule the download to retrieve the data once the model post-processing is complete.

GETGRIB Download Utility

When the user selects a specific download data file for GETGRIB to use, GETGRIB opens that file and reads the first line which should be a two digit number between 00-24. This signifies the hour of the specific model run. GETGRIB then open the file **FTPCMD.DAT.**

```
............. Begin file FTPCMD.DAT ................................
120
5
\WINGRIDDS\URL2FILE

*************** File Structure Documentation ************************
Line 1    Time to wait (MIN) after model run time before switching to new
        day's run

Line 2    Local GMT time offset (positive number: GMT is ahead of local
        time, negative number: GMT is behind local time)

Line 3    Command string for file download utility.  This is to include
        any configuration flags required for your local network setup.
         Refer to the section 'Get GRIB Data' in the WINGRIDDS User's
         Guide for a detailed explanation.

............. End file FTPCMD.DAT ................................
```

Using the data derived from FTPCMD.DAT, GETGRIB then checks the system time to get the year, month and day. If the Delay time and GMT offset sync well with the system time and the requested model run time read from the first line of the download data file, GETGIB then builds the FTPDATA.BAT file. The utility used to do the actual data transfer is **URL2FILE.EXE** and that utility is covered in detail in its own section below. Continuing the example shown above, the resultant FTPDATA.BAT created would look like this:

.... Begin file FTPDATA.BAT ....

```
@echo off
if "%4"=="" goto End
::
:: Begin Download
::
echo Please wait... This download may take a while...
::
::
cd \wingridds\grib\wafs\OctantI
echo Downloading ENSEMBLE WAFS OctantI GRIB 000
\WINGRIDDS\URL2FILE ftp://ftpprd.ncep.noaa.gov/pubdatanccf/com/gens/prod/gef.
%1%2%3%4.wafs/wafs/wafs.37.t%4z.ens00 wafs.37.t%4z.ens00
```

<<<<< Sequence repeated to the end for each file to be downloaded >>>>>>>

```
::
:: All Done!!!
::
echo
echo Download Complete
goto :End
::
:End
```

.... End file FTPDATA.BAT ....

NOTICE - Due to formatting restrictions of this word processor, the \WINGRIDDS\URL2FILE command line above is not shown in its proper form. Please ignore the 'word-wrap' effect shown above. The command line entry should be one long line.

NOTICE – To ensure the file is copied properly, notice the file name at the end of the URL2FILE command line is repeated twice. The first file name is the name of the file to be downloaded from the data server. The second file name is the name the file will be stored as within WINGRIDDS. The second file name does **NOT** have to be the same as what is downloaded.

GETGRIB then executes the FTPDATA.BAT with the following command:

FTPDATA "YYYY MM DD HH"

Where the YYYY MM DD HH is filled with the date-time-group.

The date-time-group is passed as arguments to the FTPDATA.BAT batch file and are used within the batch file in the following ways:

YYYY = %1
MM = %2
DD = %3
HH = %4

Therefore, the following line within the batch file;

gef. %1%2%3%4.wafs/wafs/wafs.37.t%4z.ens00

would actually be executed as, for example;

gef. 2006092600.wafs/wafs/wafs.37.t00z.ens00

URL2FILE Command Usage

URL2FILE is the freeware utility which is used in WINGRIDDS to perform the GRIB file transfers into the system. For most users, the command structure in place should work fine. However, if a user's network is behind a proxy server of firewall or a network site requires a special login, then the user must modify either the FTPCMD.DAT file or their individual download data files which contain the download commands. The following is the exhaustive list of commands which can be used with URL2FILE to satisfy any unique transfer requirements.

• **Basic usage:**

URL2File <URL> [<FileName>]

For example, to retrieve the web (HTTP) URL http://www.chami.com/url2file/test.htm and save its content to temp.htm, run the following command

(from the Command Prompt/DOS Prompt within Windows 95/98/NT for Intel compatible processors):

URL2File http://www.chami.com/url2file/test.htm temp.htm

To retrieve the file transfer protocol (FTP) URL ftp://ftp.chami.com/README and save its content to README.txt, run the following command:

URL2File ftp://ftp.chami.com/README README.txt

• **Advanced usage:**

```
URL2File <URL> [<FileName>]
    [-d] [-z] [-h] [-b] [-r <referring URL>]
    [-u <login user name>] [-p <login password>]
    [-x <proxy address>] [-y <proxy port>]
    [-s <proxy user name>] [-t <proxy password>]
    [-a <user agent string>] [-n <sender>]
    [-o <timeout in seconds>]
```

[HTTP] = Applies to web URLs; [FTP] = Applies to FTP URLs

URL : URL of the web page (HTTP) or file (FTP) to retrieve. Format of the URL:

protocol://[user[:password]@]server[:port]/path[/file]

URL2File URL

All following parameters are optional.

FileName : File name to use to save retrieved content.

URL2File URL output.htm

-d : [HTTP] [FTP] Enable debug mode -- display warnings and other miscellaneous information. This switch must be specified before other parameters.

URL2File -d URL

-z : [HTTP] [FTP] Suppress error messages -- won't display critical errors.

URL2File -z URL

-h : [HTTP] Display web server's response headers, such as content type/size, cookies, modified and expiration dates, HTTP protocol, web server type, etc.

URL2File -h URL

-b : [FTP] Retrieve the file using non binary transfer mode (also known as ASCII file transfer mode).

URL2File -b URL

-r : [HTTP] Specify a custom referring URL.

URL2File -r "ReferringURL" URL

-u : [HTTP] [FTP] Login user name (if required by the web server). A login password must also be specified.

The default user name for FTP URLs is "anonymous" It is blank for HTTP URLs.

-p : [HTTP] [FTP] Login password.

The default password for FTP URLs is "guest@unknown.org" It is blank for HTTP URLs.

URL2File URL -uYourName -p"pword"

-x : [HTTP] Proxy server address.

-y : [HTTP] Proxy server port.

URL2File URL -xPROXY -y3128

-s : [HTTP] Proxy server login user name. Proxy server address and port must also be specified.

-t : [HTTP] Proxy server login password.

URL2File URL -xPROXY -y3128 -sProxyUsername -tProxyPassword

-a : [HTTP] Custom user agent string.

URL2File URL -a "Mozilla"

-n : [HTTP] Specify a custom "From:" field in the web server request header.

URL2File URL -n "xyz"

-o : [HTTP] [FTP] Timeout value in seconds. Downloading will be aborted if not completed within the specified amount of time. The default value of 0 will disable the timeout function.

URL2File URL -o 30

Frequently Asked Questions

* Q: Some of my URLs contain spaces. How do I tell URL2File to treat it as a single continuing URL?

A: Use quotes around the URL if it contains special characters such as spaces, "^" or "|" i.e. "my page.htm"

Appendix A: Command Function Summary

****-   WINGRIDDS --- COMMAND SUMMARY**

General Commands: -- |NAME| indicates an alternative name --
-- [....] describes additional information needed
-- Ch. is an abbreviation for Character
-- ! following command name indicates system alias

ERAS |ERSN!,ERSC!| > ERASes current screen display
EXIT |X QUIT Q STOP S END or E| > Terminates the program

****- Gridded Data File Manipulation Commands:**

SFIL > Interactively resets active grid file

FIL1 > Changes active gridded data file to first file opened
FIL2 > Changes active gridded data file to second file opened
...
FIL9 > Changes active gridded data file to ninth file opened
FILA > Changes active gridded data file to tenth file opened
...
FILK > Changes active gridded data file to twentieth file opened

FI-# > Changes active gridded data file to #th file earlier on list
FI+# > Changes active gridded data file to #th file later on list

****- Setting Forecast Time Specifications for data requests:**
FHOR |SFHR| > Requests input of Forecast HOuR
FHRS |SFHS| > Requests input of PAIR OF Forecast HOuRs
SFHR [Followed by 1 integer time] > Changes default forecast time
SFHS [Followed by 2 integer times] > Change default fcst time pair
ANAL |F-1 , F-1| > Sets Forecast Hour to use analysis grids
GUES |F-3 , F-3| > Sets Forecast Hour to use analysis guess grids
GES6 |F-6 , F-6| > Sets Forecast Hour to use analysis 6 h guess grids
F### | F##| > Sets Forecast Hour to use ### hour forecast grids
FOO |INIT| > Sets Forecast Hour to use initialized grids
F12 | F12| > Sets Forecast Hour to use 12 hour forecast grids
F24 | F24| > Sets Forecast Hour to use 24 hour forecast grids
F36 | F36| > Sets Forecast Hour to use 36 hour forecast grids
F48 | F48| > Sets Forecast Hour to use 48 hour forecast grids
FHR1 > Gets data from first time of FHRS time pair for commands to left
FHR2 > Gets data from second time of FHRS time pair for commands to left

****- Setting Level/Layer specifications for data requests:**
SLVL [Followed by one 4 chtr level] > Specifies LeVeL for data selection
> |###| {3 or 4 digit integer} > Sets Level to numerical value

S### > Sets Level to Sigma level centered at ### mb
S### |S982,S943,S896,S844,S784| > Sets Level to bottom 5 sigma level of NGM
###M |0M, 2M, 10M| > Sets Level to ### Meters above ground (height<100m)
M### > Sets Level to ### hectometers above ground (height>=100m)
###Z > Sets Level to ### Meters above mean sea level (height<100m)
Z### > Sets Level to ### hectometers above mean sea level (height>=100m)
###U > Sets Level to ### centimeters below land surface (depth<1000cm)
U### > Sets Level to ### meters below land surface (depth>=1000cm)
B### > Sets Level to "Boundary" layer centered at ### mb above ground
I### > Sets Level to ### degree (K) Isentropic surface
L### > Sets Level to Flight Level ###
H### > Sets Level to ### feet or meters above sea level (x10)
Y### > Sets Level to ‘Hybrid-B’ level (010-500) (for Native RUC grids only)
MSL > Sets Level to Mean Sea Level
TROP > Sets Level to TROPopause
MAXW |WMAX!| > Sets Level to MAXimum Wind level
SFC |0000| > Sets Level to the Earth SurFaCe

****- Level/Layer specifications:**
SLYR |LAY=!,LAYR| [Followed by two 4 Ch. levels] > Change data LaYeR specs.

LV+# > Increments LeVel to next # higher level

SVLV > SaVes current LeVel specification
SVLY > SaVes current LaYer specification
RSLV > ReStores saved LeVel specification
RSLY > ReStores saved LaYer specification
LV-# > Increments LeVel to next # lower level

LS+# > Changes LeVel to # higher than current LVL (useful in XSCT processing)
LS-# > Changes LeVel to # lower than current LVL (useful in XSCT processing)
LVL0 > Return to originally defined LVL after completing LS+# or LS-# commands

LY+# > Changes LaYer Top (LVL2) to # higher than LVL
LY-# > Changes LaYer Bottom (LVL1) to # lower than LVL

****- Output specifications:**
AROW |VCTR!| > Sets display mode to plot winds as arrows (Default)
BARB > Sets display mode to plot winds as Barbs (m/s)
STRM > Sets display mode to plot winds IN STReaMline like presentation

DASH > Sets display mode to plot DASHed lines for this plot only
DOTS > Sets display mode to plot DOTTed lines for this plot only
DDSH > Sets display mode to plot DOTTED/DASHED dashed lines for this plot only
LDSH > Sets display mode to plot Long DaSHed lines for this plot only
DPOS > Dash POSitive contours
DNEG > Dash NEGative contours

DATA > Sets display mode to plot DATa values At grid points - no contours
DAT+ > Sets display mode to plot DATa values slightly above grid points
DAT- > Sets display mode to plot DATa values slightly below grid points
DATT > Sets display mode to plot DATa values on Top of grid points
DATB > Sets display mode to plot DATa values Below grid points
DATO > Sets display mode to plot DATa values Over grid points - Above DATT
DATU > Sets display mode to plot DATa values Under grid points - Below DATB
PMNS > Plots - in front of all negative numbers; positive numbers unsigned
PPLS > Plots + in front of all positive numbers; negative numbers unsigned

****- Output specifications:**
HILO > Plots H or L above data at local maximum/minimum (with contours)
HIIS > Plots H above data at local maximum (with contours)
HIID > Plots H above data at local maximum (without contours)
LOWS > Plots L above data at local minimum (with contours)
LOWD > Plots L above data at local minimum (without contours)

MXMN > Plots X or N above data at local maximum/minimum (with contours)
MAXS > Plots X above data at local maximum (with contours)
MAXD > Plots X above data at local maximum (without contours)
MINS > Plots N above data at local minimum (with contours)
MIND > Plots N above data at local minimum (without contours)

BOXS!> Plots boxes at grid points below the surface
BOX# > Plots a box at each grid point; # indicates box size

****- Output specifications:**
SCL# / DML# > Display labels with signed digits greater than or equal to 10**#
SCL0 / DML0 > Display labels with signed digits greater than or equal to 10**0 (1)
SCL1 / DML1 > Display labels with signed digits greater than or equal to 10**1 (10)
SC-# / DM-# > Display labels with signed digits greater than or equal to 10**-#
SC-1 / DM-1 > Display labels with signed digits greater than or equal to 10**-1 (.1)

MOD# > Display labels using Modulo of SCALED display value and 10**#

STON > Stops display of grid statistics at top of screen
STOF > Starts display of grid statistics at top of screen

CNSM |KSMO,KSM=!| [Followed by integer] > Sets CoNtour SMoothing (Default=1)

CNUM [Followed by integer] > Changes maximum number of contours to display

#DGT > Plot maximum # of digits on contour labels / data plots (default 4)

****- Layer/Time interval manipulations >>> For data in gridded data set <<<**
LAVE |LAVR!| > Calculate Layer AVErage of variables to LEFT in Command line
LSUM |LADD!| > Calculate Layer SUM of variables to LEFT in Command line
LDIF > Calculate Layer DIFference of variables to LEFT in Command line

LVL1 |LYR1,LY1=!| > Gets data from bottom of Layer for variables to LEFT
LVL2 |LYR2,LY2=!| > Gets data from top of Layer for variables to LEFT
LEVL > Overrides LVL1 and LVL2 and gets data from original level

TAVE > Calculate Time AVEerage of variables at LEFT using times FHR1 and FHR2
TTOT > Calculates Time TOTal of variables at LEFT using times FHR1 and FHR2
TDIF > Calculate Time DIFference of variables at LEFT between FHR1 and FHR2
TTND > Calculate Time TeNDency of variables at LEFT between FHR1 and FHR2

****- Layer/Time interval manipulations >>> For data in gridded data set <<<**

>>> For data grids or computed functions -- Appears right of last & <<<
LYSM > Calculates LaYer SuM of functions to RIGHT - One plot per line
LYAV > Calculates LaYer AVerage of functions to RIGHT - One plot per line
LYDF > Calculates LaYer DiFference of functions to RIGHT - One plot per line

TMSM > Calculates TiMe SuM of functions to RIGHT - One plot per line
TMAV > Calculates TiMe AVerage of functions to RIGHT - One plot per line
TMDF > Calculates TiMe DiFference of functions to RIGHT - One plot per line
TMTN > Calculates TiMe TeNdency of functions to RIGHT - One plot per line
HRLY |PRHR| > Converts diagnostic command results from /sec to /hour
DALY |PRDY| > Converts diagnostic command results from /sec to /day

****- Special Gridded Data Requests:**
MIXR > Calculates Mixing Ratio from available data fields
SPFH > calculates Specific Humidity from available data fields
RELH > Calculates Relative Humidity from available data fields
SMIX > Calculates Saturation Mixing Ratio from available data fields
SDEF > Calculates Mixing Ratio Saturation Deficit from available data fields
DWPT |DWPC!| Calculates DeW Point Temperature from available data fields (C)
DWPK!> Calculates DeW Point Temperature from available data fields (K)
DWPF!> Calculates DeW Point Temperature from available data fields (F)
PRES > Calculates Pressure from available data fields
TEMP |TMPC!| > Calculates temperature in degrees C
TMPK |TMPA!| > Calculates temperature in degrees K
TMPF!> Calculates temperature in degrees F
THTA > Calculates Potential Temperature from available data fields (K)
THTE > Calculates Equivalent Potential Temperature from data fields (K)
THTS > Calculates Saturated Equivalent Potential Temperature from data fields (K)
THCK |TKNS!| > Generates Thickness fields
WIND > Retrieves the total wind Vector in m/s
WKNT!> Retrieves the total wind Vector in knots
WMPH!> Retrieves the total wind Vector in mph
WKPH!> Retrieves the total wind Vector in kph
BWND!|WNDB!| > Retrieves the total wind Vector in m/s for display as wind barb
BKNT!> Retrieves the total wind Vector in knots and sets display as wind barb
BMPH!> Retrieves the total wind Vector in mph and sets display as wind barb
BKPH!> Retrieves the total wind Vector in kph and sets display as wind barb
WNDA!> Retrieves the total wind Vector in m/s and sets display as wind arrow
GEOS > Generates the Geostrophic wind Vector
AGEO!> Generates the Ageostrophic wind Vector
TWND |THWN!| > Generates Thermal Wind

WDFL [Followed by Min/Max Direction (0-360)] Wind Direction FiLter
WSFL [Followed by Min/Max Speed (M/S)] Wind Speed FiLter
ISAL > Computes the Isallobaric Wind
INAD > Computes the Inertial Advective Wind
JCBN [Followed by 2 Scalars] > Computes the Jacobian determinate of two scalars
FRTG [Followed by wind Vector] > Computes Frontogenesis of the wind
FVCT > Calculates F (Normal wind) Vectors
QVCT > Calculates Q (Geostrophic wind) Vectors

SPED![Followed by wind Vector] > Calculates magnitude of wind Vector (m/s)
SPKT![Followed by wind Vector] > Calculates magnitude of wind Vector (knots)
SPML![Followed by wind Vector] > Calculates magnitude of wind Vector (mph)
SPKM![Followed by wind Vector] > Calculates magnitude of wind Vector (kph)
DRCT [Followed by a Vector] > Contours values of DiReCTion of a Vector
DDFF [Followed by Vector] > Displays packed value of Vector Direction/speed
DDDD [Followed by a Vector] > Displays values of DiReCTion of a Vector
WSPD!> Generates isotachs for Total wind (m/s)
WSPK!> Provides total Wind SPeed in Knots
WDDF!> Displays packed value of Total Wind Direction/speed (m/s)
WDRC!> Contours value of Total Wind Direction (degrees)
WDDD!> Displays value of Total Wind Direction (degrees)
XCMP |UCMP [Followed by vector]| > Returns grid relative X CoMPonent of vector
YCMP |VCMP [Followed by vector]| > Returns grid relative Y CoMPonent of vector

LIFT |LIFX,LIFB| > Provides Lifted Index fields without resetting LEVeL
TTHE > Temperature of a parcel lifted from the bottom to the top of LAYeR
CNVT > Temperature needed for parcel from surface to lift freely to LEVeL

TPCP > Provides Total Precipitation fields without resetting LEVeL (cm)
CPCP > Provides Convective Precipitation fields without resetting LEVeL (cm)
LPCP > Provides Large-Scale Precipitation fields without resetting LEVeL (cm)
TPCI!> Provides Total Precipitation fields without resetting LEVeL (in)
CPCI!> Provides Convective Precipitation fields without resetting LEVeL (in)
LPCI!> Provides Large-Scale Precipitation fields without resetting LEVeL (in)

PMSL > Provides Mean Sea Level Pressure fields without resetting LEVeL
Note: If mean sea level pressure (GRIB ID=002) is not
available, then an attempt is made to retrieve the
RUC Reduction, the Eta Model Reduction, and the
Standard Atmosphere Reduction, in that order.
PMSS > Provides MSL Pressure fields (Std. atm. reduction) -- No LEVeL reset
PMSR > Provides MSL Pressure fields (RUC reduction) -- No LEVeL reset
PMSE > Provides MSL Pressure fields (ETA model reduction) -- No LEVeL reset
MMSL > MSL pressure for RUC (MPAS) surface analysis using MAPS reduction
NMSL > MSL pressure for RUC (MPAS) surface analysis using NMC reduction
PSFC > Provides Surface Pressure fields without resetting LEVeL
PWAT > Provides Precipitable Water fields without resetting LEVeL (mm)
PWAI!> Provides Precipitable Water fields without resetting LEVeL (in)
WVRT!> Generates vorticity of the Total wind
GVRT!> Generates vorticity of the Geostrophic wind
AVRT!> Calculates the absolute VoRTicity of Ageostrophic wind

WDVR!> Calculates DiVeRgence of the total Wind field
WSHD!> Calculates SHearing Deformation of total Wind
GSHD!> Calculates SHearing Deformation of Geostrophic Wind
ASHD!> Calculates SHearing Deformation of Ageostrophic Wind
WSTD!> Calculates STretching Deformation of total Wind
GSTD!> Calculates STretching Deformation of Geostrophic Wind
ASTD!> Calculates STretching Deformation of Ageostrophic Wind
TADV!> Generates Temperature Advection using the Total wind
QADV!> Generates Mixing Ratio Advection using the Total wind
PADV!> Generates Pressure Advection using the Total wind
STAB |STBL!| > Computes static stability in a layer
IMAS > Calculates Isentropic MASs (inverse static stability) in any layer
LNDX > Calculates 'Lifted Index' between LVL1 and LVL2
TLCL > Calculates the Temperature at the LCL from LEVeL data
PLCL > Calculates the Pressure of the LCL from LEVeL data
PDEF!> Calculates the Pressure DEFicit (lift) needed for saturation the LCL

INRI!>Calculates the INverse of the RIchardson number
IGRI!>Calculates the Inverse of the Geostrophic RIchardson number

FFFF |F! |> Provides coriolis parameter at each grid point
DMAP |MFTR!,MAPF!|> Provides map factor at each grid point
ALAT |LATT!,LAT! ,LATI!|> Latitude
ALON |LONG!,LON! |> Longitude
EDIR > DIRection of rotation from map standard North/South Earth longitude
CSLT > Cosine of Latitude
MSG0 > Produces grid with 1's at points with data and 0's at points without
MSG1 > Produces grid with 0's at points with data and 1's at points without
MSNG!> Produces grid with missing value flags at points without data
ZERO > Provides scalar grid of all zeros (Used to display wind components)
GMIN > Produces scalar Grid with values of MINimum of last grid
GMAX > Produces scalar Grid with values of MAXimum of last grid
GMEN > Produces scalar Grid with values of MEaN of last grid
GSDV > Produces scalar Grid with values of Standard DeViation of last grid
SCPY > Produces a CoPY of a Scalar field
VCPY > Produces a CoPY of a Vector field
SSWP > SWaPs locations of last 2 Scalar fields in memory
VSWP > SWaPs locations of last 2 Vector fields in memory
DUMP > Prints grid point values in file 'GRIDS.OUT'

SSUM [Followed by 2 Scalars] > Calculates Scalar grid sum
SAVR [Followed by 2 Scalars] > Calculates Scalar grid average
SDIF [Followed by 2 Scalars] > Calculates Scalar grid difference
STND [Followed by 2 Scalars] > Calculates Scalar grid time tendency
SMLT [Followed by 2 Scalars] > Multiplies two Scalar fields
SDVD [Followed by 2 Scalars] > Divides two Scalar fields
SADC [Followed by a 4 digit value] > Sum of Scalar & specified constant
SSBC [Followed by a 4 digit value] > Difference of Scalar & specified constant
SMLC [Followed by a 4 digit value] > Multiplies Scalar by specified constant
SDVC [Followed by a 4 digit value] > Divides Scalar by specified constant
INVS [Followed by a Scalar] > Finds INVerSe of a Scalar
INV1 [Followed by a Scalar]] > Finds INVerse of a Scalar with maximum of 1

ABSV [Followed by Scalar] > Calculates ABSolute Value of Scalar grid

****- Diagnostic Functions:**

SNEG![Followed by Scalar] > Finds the NEGative of a Scalar grid
SINE [Followed by Scalar] > Calculates the SINE of Scalar grid (e.g., WDRC)
COSN [Followed by Scalar] > Calculates the COSiNe of Scalar grid (e.g., WDRC)
TNGT [Followed by Scalar] > Calculates the TaNGenT of Scalar grid (e.g., WDRC)
ASIN [Followed by Scalar] > Calculates the ARC SINe of Scalar grid
ACOS [Followed by Scalar] > Calculates the ARC COSine of Scalar grid
ATAN [Followed by Scalar] > Calculates the ARC TANgenT of Scalar grid
ALOG [Followed by Scalar] > Calculates the LOG (Base e) of Scalar grid
LG10 [Followed by Scalar] > Calculates the LOG (Base 10) of Scalar grid
EXPP [Followed by Scalar] > Calculates the EXPonent (Base e) of Scalar grid
EX10 [Followed by Scalar] > Calculates the EXponent (Base 10) of Scalar grid
SQRT [Followed by scalar] > Return square root of absolute value of scalars

SKNT! [Followed by Scalar] > Converts Scalar from m/s to KNoTs
SMPH! [Followed by Scalar] > Converts Scalar from m/s to Miles Per Hour
SKPH! [Followed by Scalar] > Converts Scalar from m/s to Kilometers Per Hour
M2F=! [Followed by Scalar] > Converts Scalar from meters to feet
CM2I! [Followed by Scalar] > Converts Scalar from centimeters to inches

DSDX [Followed by Scalar] > Calculates X gradient of Scalar
DSDY [Followed by Scalar] > Calculates Y gradient of Scalar
GRAD [Followed by a Scalar] > Finds the GRADient of a Scalar field
MGRD![Followed by a Scalar] > Magnitude of the GRaDient of a Scalar field
NGRD![Followed by a Scalar] > Finds the Negative GRaDient of a Scalar field

DVDX [Followed by Vector] > Calculates X gradients of a Vector
DVDY [Followed by Vector] > Calculates Y gradients of a Vector
VADC [Followed by a 4 digit value] > Sum of Vector & specified constant
VSBC [Followed by a 4 digit value] > Difference of Vector & specified constant
VMLC [Followed by a 4 digit value] > Multiplies Vector by specified constant
VDVC [Followed by a 4 digit value] > Divides Vector by specified constant
VNEG![Followed by Vector] > Finds the NEGative of a Vector field
VSUM [Followed by 2 Vectors] > Calculates the Vector sum
VAVR [Followed by 2 Vectors] > Calculates the Vector average
VDIF [Followed by 2 Vectors] > Calculates the Vector difference
VTND [Followed by 2 Vectors] > Calculates the Vector time tendency
VMLT [Followed by 2 Vectors] > Multiplies two Vectors by components
DOTP [Followed by 2 Vectors] > Calculates the DOT Product of 2 Vectors
CRSP [Followed by 2 Vectors] > Calculates the CRoSs Product of two Vectors
VDVD [Followed by 2 Vectors] > Divides two Vectors by components

VKNT![Followed by a Vector] > Converts a Vector from m/s to KNoTs
VMPH![Followed by a Vector] > Converts a Vector from m/s to MPH
VKPH![Followed by a Vector] > Converts a Vector from m/s to KPH
MAGN |MSPC!| [Followed by a Vector] > Calculates MAGNitude of a Vector
KNOT![Followed by a Scalar] > Converts a Scalar (e.g., WSPD) from m/s to KNOTs
MLPH![Followed by a Scalar] > Converts a Scalar (e.g., WSPD) from m/s to MPH
KMPH![Followed by a Scalar] > Converts a Scalar (e.g., WSPD) from m/s to KPH

ADVT [Followed by Scalar and Vector] > Calculates advection
DVRG [Followed by a Vector] > Calculates divergence
FLUX [Followed by a Scalar & a Vector] > Produces a flux Vector
SDVR![Followed by Scalar and Vector] > Calculates flux divergence
RVRT [Followed by a Vector] > Calculates relative vorticity
VORT![Followed by a Vector] > Calculates absolute vorticity
IPVO > Isentropic Potential Vorticity calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to Theta levels.
IPVA > Isentropic Potential Vorticity Advection calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to Theta levels.
PVTA > Isobaric Potential Vorticity (Theta) calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to pressure levels.
PVTE > Isobaric Potential Vorticity (Theta-E) calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to pressure levels.
PVTS > Isobaric Potential Vorticity (Theta-S) calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to pressure levels.
PVAA > Isobaric Potential Vorticity (Theta) Advection calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to pressure levels.
PVEA > Isobaric Potential Vorticity (Theta-E) Advection calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to pressure levels.
PVSA > Isobaric Potential Vorticity (Theta-S) Advection calculated between LVL1 and LVL2 when LVL1 and LVL2 are set to pressure levels.
SHDF [Followed by vector] > Calculates SHearing DeFormation
STDF [Followed by vector] > Calculates STretching DeFormation
WGEO [Followed by scalar field] > Calculates Geostrophic Wind from Scalar field
DFCP [Followed by a vector] > Calculate the Deformation components (X COMP, Y COMP) of any vector
VRTV > Calculates the instantaneous Vertical Velocity approximation.
OMGA > Calculates the Vertical Velocity over the forecast period of time.

SMTH > Applies a binomial SMooTHer to the active scale data field
SMT# > Applies a binomial SMooTHer # times to the active scalar data field
SMOO > Applies a light SMOOther to the active scalar data field
VSMT > Applies a binomial sMooTHer to the active Vector field
VSM# > Applies a binomial sMooTHer # times to the active Vector field
RLTN [Followed by a 4 digit value] > Replaces values Less ThaN with that value
RGTN [Followed by a 4 digit value] > Replaces values Greater ThaN with value
MLTN [Followed by a 4 digit value] > Replaces values Less ThaN as Missing
MGTN [Followed by a 4 digit value] > Replaces values Greater ThaN as Missing
MSKS![Followed by a field] > Replaces values below the surface as missing
SMAX > Finds the MAXimum at each grid point of two Scalar fields
SMIN > Finds the MINimum at each grid point of two Scalar fields
ZNEG > Sets all NEGative values to Zero
ZPOS > Sets all POSitive values to Zero

FNTW > Calculates areas of frontal wave formations
FNSP > Calculates the speed/direction of frontal areas
RFGD [VECTOR] > Deformation Term of Rotational Frontogenesis
RFGT [VECTOR] > Tilting Term of Rotational Frontogenesis
RFGV [VECTOR] > Relative Vorticity Term of Rotational Frontogenesis
RFGN [VECTOR] > Rotational Frontogenesis (RFGD+RFGT+RFGV)

EFGD [VECTOR] > Deformation Term of Escalar Frontogenesis
EFGT [VECTOR] > Tilting Term of Escalar Frontogenesis
EFGG [VECTOR] > Divergence Term of Escalar Frontogenesis
EFGN [VECTOR] > Escalar Frontogenesis (EFGD+EFGT+EFGG)
ERPV > Ertel Potential Vorticity
BVFS > Brunt-Vaisala Frequency Squared
BVFQ > Brunt-Vaisala Frequency
BVFP > Brunt-Vaisala Frequency Period
DFRM [VECTOR] > Deformation of the wind
TRVC > Trof/Ridge Vector

****- Diagnostic Functions - Convection Control Flags**

VTMP > Virtual Temperature Correction

All convection parameters are calculated without virtual temperature correction by default. This flag enables that correction.

SBSI > Surface-Based Lifted Parcel Selected
MLSI > Mean-Layer Lifted Parcel Selected
MUSI > Most Unstable Lifted Parcel Selected
USSI > User-Selected Lifted Parcel Selected
If no Lifted Parcel method is selected, Surface-Based Lifted Parcel is default.

****- Diagnostic Functions - Convection Parameters**

CPOS [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Convective Positive Energy (CAPE)
CNEG [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Convective Negative Energy (CINH)
PLPL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Pressure Lifted Parcel Level
TLPL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Temperature Lifted Parcel Level
DLPL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Dew point Lifted Parcel Level
HLPL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Height Lifted Parcel Level
THLP [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Theta Lifted Parcel Level
TELP [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Theta-e Lifted Parcel Level
PLCL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Pressure Lifted Condensation Level
TLCL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Temperature p Lifted Condensation Level
MLCL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Mixing ratio Lifted Condensation Level
HLCL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Height Lifted Condensation Level
THLC [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Theta Lifted Condensation Level
TELC [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Theta-e Lifted Condensation Level
PLFC [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Pressure Level of Free Convection
TLFC [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Temperature Level of Free Convection
DLFC [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Dew point Level of Free Convection
HLFC [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Height Level of Free Convection
THLF [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Theta Level of Free Convection
TELF [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Theta-e Level of Free Convection
PCCL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Pressure Convective Condensation Level
TCCL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Temperature Convective Condensation Level
DCCL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Dew point Convective Condensation Level
HCCL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Height Convective Condensation Level
THCC [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Theta Convective Condensation Level
TECC [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Theta-e Convective Condensation Level
PEQL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Pressure Equilibrium Level

TEQL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Temperature Equilibrium Level
DEQL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Dew point Equilibrium Level
HEQL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Height Equilibrium Level
MPCL [(VTMP)(SBSI,MLSI,MUSI,USSI)] > Height Max Parcel Level
PWBZ > Pressure Wet-Bulb Zero Level
TWBZ > Temperature Wet-Bulb Zero Level
HWBZ > Height Wet-Bulb Zero Level
WBTF > Wet-Bulb Temperature degrees F
WBTC > Wet-Bulb Temperature degrees C
WBTK > Wet-Bulb Temperature degrees K
WBPT > Wet-Bulb Theta
SWPT > Saturated Wet-Bulb Theta-e
CNPR > Condensation Pressure Ratio
CNPD > Condensation Pressure Deficit
DPDP > Dew Point Depression
SVPR > Saturated Vapor Pressure
VAPR > Vapor Pressure
LVAP > Latent heat of vaporization

****- Diagnostic Functions - Shear Control Flags**

**KM – Defines the Lower/Upper bounding levels in Kilometers
The first * (0-9) defines the lower level to use and the second * (0-9) defines the upper level to use. Therefore, a command 14KM defines the 1km to 4km layer.

****- Diagnostic Functions - Shear Parameters**

UAVG (Scalar) > U-average wind through layer
VAVG (Scalar) > V-average wind through layer
WAVG (Vector) > Average Wind through layer
BLKS (Scalar) > Bulk Shear
BRCH (Scalar) > Bulk Richardson Number
TCHS (Scalar) > Total Cumulative Shear through layer
USHR (Scalar) > U-Shear between layer
VSHR (Scalar) > V-Shear between layer
TSHR (Vector) > Total Wind Shear between layer

The following supercell specific diagnostics are controlled with only the **KM flag except where noted. If the flag is omitted, 03KM is assumed. All calculations use the Bunkers Method algorithm.

RMSU (Scalar) > Supercell U-component, Right-moving (06KM)
RMSV (Scalar) > Supercell V-Component, Right-moving (06KM)
RMSS (Vector) > Supercell Motion, Right-moving (06KM)
RMSP (Scalar) > Supercell Speed, Right-moving (06KM)
RMDR (Scalar) > Supercell Direction, Right-moving (06KM)
LMSU (Scalar) > Supercell V-Component, Left-moving (06KM)
LMSV (Scalar) > Supercell V-Component, Left-moving (06KM)
LMSS (Vector) > Supercell Motion, Left-moving (06KM)
LMSP (Scalar) > Supercell Speed, Left-moving (06KM)
LMDR (Scalar) > Supercell Direction, Left-moving (06KM)
SHER (Scalar) > Storm-relative HElicity, Right moving

SHEL (Scalar) > Storm-relative HElicity, Left moving
SHOR (Scalar) > Storm-relative HOlicity, Right moving
SHOL (Scalar) > Storm-relative HOlicity, Left moving
CFDV (Scalar) > CorFiDi Vectors

****- Diagnostic Functions - Cross/Time Section Specific:**
XREL [Followed by Vector] > Rotates Vector from GRID to Cross Sector relative
EREL [Followed by Vector] > Rotates Vector from GRID to Earth relative (TSCT)
TANG [Followed by Vector] > Finds cross-section relative tangential component
VTNG [Followed by Vector] > Plots cross-section relative tangential component
VCRC [Followed by Vector] > Plots VTNG & VVEL
VCR2 [Followed by Vector] > Plots VTNG & VVEL scaled by 2
VCR5 [Followed by Vector] > Plots VTNG & VVEL scaled by 5
NORM [Followed by Vector] > Finds cross-section relative normal component
VNRM [Followed by Vector] > Plots cross-section relative normal component
DIST > Calculates DISTance from left end of cross section
MSFC!> Calculates constant Momentum SurFaCe (M-Surfaces)
WNDX!> Displays the total wind rotated relative to the cross section
GEOX!> Displays the geostrophic wind rotated relative to the cross section
AGEX!> Displays the ageostrophic wind rotated relative to the cross section
WCRC!> Displays vertical/tangential circulations of total wind
GCRC!> Displays vertical/tangential circulations of geostrophic wind
ACRC!> Displays vertical/tangential circulations of ageostrophic wind

****- Contour Specification:**
CINT > Displays Max and Min of field and requests user input

CISV > Sets mode where specified contour interval is retained for future plots
CINX > Returns to mode in which program selects contour interval for each plot

CIN# > Sets Contour Internal to # units
CIN1 > Sets Contour Interval to 1 unit
CIN2 > Sets Contour Interval to 2 units
...
CI#0 > Sets Contour Interval to # of tens of units
CI10 > Sets Contour Interval to 10 units
CI20 > Sets Contour Interval to 11 units
...
C#00 > Sets Contour Interval to # hundreds of units
C100 > Sets Contour Interval to 100 units
C200 > Sets Contour Interval to 200 units

C#+# > Sets Contour Interval to #*10**# units == C2+3 -> 2*10**3 = 2000
C1+3 > Sets Contour Interval to 1000 units --> 10**3
C2+3 > Sets Contour Interval to 2000 units --> 2*10**3
...

CI.# |C#-1| > Sets Contour Interval to .# units -->#*10**-1
CI.1 |C1-1| > Sets Contour Interval to .1 units
CI.2 |C2-1| > Sets Contour Interval to .2 units

...

C#+# > Sets Contour Interval to #*10**-# units == C2-3 -> 2*10**3 = .002
C2-2 > Sets Contour Interval to .02 units
C5-3 > Sets Contour Interval to .005 units

CTLN > Line-based Contouring
CTLG > [optional CLN*(1-9,A-Z)] Line Based Contouring with Graduated Color
CTFP > [optional CFP*(1-9,A-Z)] Fill Based Contouring with Selected Pattern
CTFC > [optional CFC*(1-9,A-Z)] Fill Based Contouring with Selected Color
CTFG > [optional CFG*(1-9,A-Z)] Fill Based Contouring with Graduated Color
GRTN [Followed by a 4 digit value] > Displays contours greater than the value
LSTN [Followed by a 4 digit value] > Displays contours less than the value
GT## |GT00!|> Displays contours greater than the value ##
LT## |LT00!|> Displays contours less than the value ##
GTNE [Followed by a 4 digit value] > Displays contours greater than or equal to the value
LTHE [Followed by a 4 digit value] > Displays contours less than or equal to the value

****- Graphical Display Setup Commands:**
AREA [Optionally followed by center Lat/Lon&N-S Lat.Dist MAP*] > Specify Map area
XSCT [Followed by left and right Lat/Lon pairs] > Defines Cross-Section path
TSCT [Followed by Lat/Lon] > Defines Time-Section location
ASTN [Followed by center Station ID and N-S Lat.Dist.] > Specify Map area
XSTN [Followed by left and right Station IDs] > Defines Cross-Section path
TSTN [Followed by Station ID] > Defines Time-Section location
XSCI [Followed by left and right Lat/Lon pairs] > Defines Isentropic Cross-Section path
XSTI [Followed by left and right Station IDs] > Defines Isentropic Cross-Section path
XSCH [Followed by left and right Lat/Lon pairs] > Defines Height Surfaces Cross-Section path
XSTH [Followed by left and right Station IDs] > Defines Height Surfaces Cross-Section path
TSCI [Followed by Lat/Lon] > Defines Isentropic Time-Section location
TSTI [Followed by Station ID] > Defines Isentropic Time-Section location
TSCH [Followed by Lat/Lon] > Defines Height Surfaces Time-Section location
TSTH [Followed by Station ID] > Defines Height Surfaces Time-Section location
NS## > Sets default North-to-South distance for ASTN to ## degrees
XWID > Display Cross-Section across full width of screen--Set in PLAN view
XNRO > Display Cross-Section in proportion to vertical height--Set in PLAN
ALVL > Use all available pressure levels in Cross or Time section
ATIM > Use all available forecast hours in Time section

XLVL [Followed by 4 Ch. name] > Reads file ----.LVL to define TSCT/XSCT levels
THRS [Followed by 4 Ch. name] > Reads file ----.LVL to define TSCT hours
TINC [Followed by integer] > Changes time increments for time section
THN# > THiN computation grid to use every #th grid point-CAN OVERFLOW PROGRAM
THN0 > Display current display mode and grid thinning factor
FULG > Displays grid data at full grid resolution
NRMG > Displays grid data at normal thinning

****- Graphics Commands:**
PLAN > Re-activates PLAN view display
CROS > Re-activates CROSs-sectional display
TIME > Re-activates TIME-sectional display

XLBL > Plots values of left most column of cross/time section along left side
XLBB > Plots values of bottom row of cross/time section along bottom
XLTN > Calculates Latitude locations along a cross section
XLNT > Calculates Longitude locations along a cross section
HOUR > Places forecast hour into time section array
NCLB > Draws contours without labels for current request only
NLBL > Prevents plot label (top of screen) from being overwritten

SAVE [Followed by 4 Chtr NAME] > SAVEs graphics commands to file NAME
ENDS > Stops SAVEing graphics commands
REST [Followed by 4 Chtr NAME] > RESTores graphics in file NAME
; [____;, ";" preceded by 4 Chtr NAME] > RESTores graphics in file NAME
SAVS [Followed by 4 Chtr NAME] > SAVes Screen contents to BMP file NAME
ALWN > If in 4PNL mode, flag to include all 4 windows in either Animation or SAVS operations.

PRSC!|BKWT| > Converts screen colors for printing using 'PRint SCreen' key

POPT > List current print option and select a new print option
PRNT [Followed by optional 4 Ch. name] > Print screen contents to default Printer
LSVG > List files containing a set of saved graphics commands

MAP > Redraws map background with no data
EMAP > Erases screen and draws map background with no data

SVMP > Save, list, or delete map plot files

& |or / | > Overlays output on previous graphics
OLAY |CNTR!| > Overlays output on previous graphics -- First command in a line

CLR1 > Override default and use color 1 in palette (Solid)
CLR2 > Override default and use color 2 in palette (Solid)
...
CLR9 > Override default and use color 9 in palette (Solid)
CLRA > Override default and use color 10 in palette (Solid)
...
CLRG > Override default and use color 16 in palette (BLACK - ERASES LINES)

CLRH > Override default and use color 1 in palette (Dashed)
CLRI > Override default and use color 2 in palette (Dashed)
...
CLRX > Override default and use color 14 in palette (Dotted)
CLRY > Override default and use color 15 in palette (Dotted)
CLRZ > Override default and use color 16 in palette (Dotted)

SCLR > Save current CoLoR order from palette
RCLR > Return to saved CoLoR order on palette

ANIM > Animates a display of data using all forecast hours (PLAN or CROSS).
Must be first command.
ANMA > Animates a Command Macro

ANFA > Animates specific forecast hours
ENDA > Ends the Animation build process.

1PNL > If WINGRIDDS is in 4 Panel Mode, changes to 1 Panel mode
4PNL > If WINGRIDDS is in 1 Panel Mode, changes to 4 Panel mode
WIN1 > If WINGRIDDS is in 4 Panel Mode, selects Window 1 (default in 1PNL mode)
WIN2 > If WINGRIDDS is in 4 Panel Mode, selects Window 2 (not available in 1PNL mode)
WIN3 > If WINGRIDDS is in 4 Panel Mode, selects Window 3 (not available in 1PNL mode)
WIN4 > If WINGRIDDS is in 4 Panel Mode, selects Window 4 (not available in 1PNL mode)
ALWN > Use ‘All Windows’ when Printing, Screen Saving or Animation

STWX > Plots the station model on the screen for the level selected
STID > Plots station ID information (WMO or ICAO) at the geographic location.

**- Command Manipulations:
CMDS |LCMD| > Lists the previous 21 commands lines

CMD1 > Lists last CoMmanD given (without erasing screen)
CMD2 > Lists 2nd previous CoMmanD given (without erasing screen)
...
CMD9 > Lists 9th previous CoMmanD given (without erasing screen)
CMDA > Lists 10th previous CoMmanD given (without erasing screen)
...
CMDL > Lists 21st previous CoMmanD given (without erasing screen)

RPT1 > RePeaTs last command given
RPT2 > RePeaTs 2nd previous command given
...
RPT9 > RePeaTs 9th previous command given
RPTA > RePeaTs 10th previous command given
...
RPTL > RePeaTs 21st previous command given

**- Special COMMAND FILE (.CMD Files) Commands:
. {Preceded by 4 Ch. Name} > Executes Named command (script) file
: {Preceded by 4 Ch. Name} > Overlays Named command file on existing plot

LOOP > All following commands will be executed without keyboard prompts
ENDL > Ends LOOP in .CMD file

#SEC > Wait # secondS before executing next request
1SEC > Wait 1 second before executing next request
2SEC > Wait 2 seconds before executing next request
...
9SEC > Wait 9 seconds before executing next request

^ > Repeat last macro for current time
< > Repeat last macro for time equals current time - increment set by DELT
> > Repeat last macro for time equals current time + increment set by DELT

BEGT [Followed by integer] > Set begin limit of time sequence for macro repeat
ENDT [Followed by integer] > Set end limit of time sequence for macro repeat
DELT [Followed by integer] > Set increment of time sequence for macro repeat
PMSV > Save parameters (eg, LVL) in macro as permanent settings

****- Special LABELING Commands:**
TXT# [Followed by line of text] > Writes TeXT on line # from top of screen
TXT1 |TEXT,TUTR| > Writes text on TOP line of screen
TXT2 > Writes text on 2nd line of screen
...
LTM# > Write forecast hour or TiMe range on line sequence # of label set
LPL# > Write Pressure Level or layer on line sequence # of Label set
LFL# > Write Flight Level or layer on line sequence # of Label set
LDN# > Write Data file Name on line sequence # of Label set
LFD# > Write Forecast model Date on line sequence # of Label set
LMN# > Write forecast Model Name on line sequence # of Label set
LFO# > Write Forecast model Origination on line sequence # of Label set
LLN# > Write forecast LeNgth on line sequence # of Label set
LLL# > Write Latitude/Longitude on line sequence # of Label set (tsct/xsct)
LSN# > Write StatioN identifier on line sequence # of Label set (tsct/xsct)
LTX# [Followed by line of text] > Write TeXt on line sequence # of Label set
LNDF > Stop display of DeFault Labels (applies to current plot and overlays)
LDEF > Start display of DEFault Labels (applies to current plot and overlays)
LWT# > Begin WriTing current Label set on line # from top of screen

****- --- To String Commands from One Line to the Next ---**

CONT {LEFTMOST position} > Save fields for next command line, without plotting

LAST |LSTS!,LSTV!,LST#| {RIGHTMOST command} > Returns data to work array
-- NOTE: LSTS |LST1,KEPS!| retrieves last 1 Scalar array only --
-- NOTE: LSTV |LST2,KEPV!| retrieves last 2 scalar arrays (Vector) only
-- NOTE: LST# retrieve last # scalar arrays back to work array --
----
** NOTE: LAST,etc. should be used ONLY for redisplay in XSCT or TSCT
** NOTE: LSTS,LSTV can NOT be used in COMMAND (.CMD) files
** NOTE: LAST is not needed if CONT was in previous line --

Appendix B: Listing of Basic Grid Fields

**- WINGRIDDS --- BASIC GRIDDED DATA FIELDS

****** Basic ICAO-Required Fields ******

TEMP > TEMPerature (degree C)
WIND > WIND (m/s)
WKNT > Wind (KNoTs)

UGRD > West-to East Wind Component (m/s)
VGRD > South-to-North Wind Component (m/s)

HGHT > HeiGHT (Geopotential Meters)
MAXW |WMAX!| > Data from MAXimum Wind level
TROP > Data From TROPopause level

- **** Additional Meteorological Fields ******

HGHT > Geopotential HeiGHT (meters)
PRES > Pressure (mb)
MIXR > MIXing Ratio (g/kg)
VVEL > Vertical VELocity (Microbars/sec)

PMSL > Mean Sea Level Pressure fields, obtained without resetting LEVeL

Note: If mean sea level pressure (GRIB ID=002) is not available, then an attempt is made to retrieve the RUC Reduction, the Eta Model Reduction, and the Standard Atmosphere Reduction, in that order.

PRSS > Mean sea level PReSsure (Std. atm. reduction) -- Set level first
PRSR > Mean sea level PReSsure (Ruc reduction) -- Set level first
PRSE > Mean sea level PReSsure (Eta model reduction) -- Set level first

TPCP > Total Precipitation fields, obtained without resetting LEVeL (cm)
CPCP > Convective Precipitation fields, obtained without resetting LEVeL (cm)

TPCI > Total Precipitation fields, obtained without resetting LEVeL (in)
CPCI > Convective Precipitation fields, obtained without resetting LEVeL (in)

NOTE: TPCx/CPCx attempt to retrieve a 12 hour accumulation. If this is not possible, then they try to obtain the longest accumulation (6,3,2,1) available.

TPC# > Total Precipitation fields in cm (#=hour accumulation)--no level reset
CPC# > Convective Precipitation field in cm(#=hour accumulation)-no level reset

****- ****** Automatically Derived Scalar Parameters ********

THTA > Potential Temperature - THeTA(degree K)
RELH > Relative Humidity (%)
DWPT > DeW Point Temperature (degree C)
TMPK > TeMPerature (degrees K)
TMPF > TeMPerature (degrees F)
THTE > Equivalent Potential Temperature - THeTa/E (degree K)

******** Automatically Derived Vector Parameters ********

GEOS > GEOStrophic wind vector (m/sec)
WSPD > Total Wind Speed (m/sec)
WDDF > Packed value of Wind Direction/speed (tens of degrees and m/sec)
WDRC > Wind DiRCtion (degrees)
BWND > WiND Barbs (m/sec)
BKNT > Wind Barbs (KNoTs)

****- ****** Isobaric Level Specifications ********

100 > 100 hPA level data --> FL-530 (ICAO-Required)
150 > 150 hPa level data --> FL-450 (ICAO-Required)
200 > 200 hPa level data --> FL-390 (ICAO-Required)
250 > 250 hPa level data --> FL-350 (ICAO-Required)
300 > 300 hPa level data --> FL-300 (ICAO-Required)
400 > 400 hPa level data --> FL-240 (ICAO-Required)
500 > 500 hPa level data --> FL-180 (ICAO-Required)
700 > 700 hPa level data --> FL-100 (ICAO-Required)
850 > 850 hPa level data --> FL-050 (ICAO-Required)
1000 > 1000 hPa level data

****- ****** Special Level Specifications ********
TROP > TROPopause level data (ICAO-Required)
MAXW |WMAX!| > MAXimum Wind level data (ICAO-Required)
SFC > Earth's SurFaCe data
MSL > Mean Sea Level data
CBAS > Cloud BASe level data
CTOP > Cloud TOP level data
0DEG > First freezing level above ground
CLVL > Adiabatic Condensation LeVeL data (parcel lifted from surface)
0DGX > Top freezing level
LCDB > Low ClouD Bottom level data
LCDT > Low ClouD Top level data
LCDL > Low ClouD Layer data
MCDB > Middle ClouD Bottom level data
MCDT > Middle ClouD Top level data
MCDL > Middle ClouD Layer data

HCDB > High ClouD Bottom level data
HCDT > High ClouD Top level data
HCDL > High ClouD Layer data

NOTE: No special level can begin with 0 except 0DEG, 0DGX, 0000

****- ****** Additional Level/Layer Specifications ********

###Z > Height above mean sea level in m (<100m)
Z### > Height above mean sea level in hm (>=100m)

###M > Height above ground in m (<100m)
M### > Height above ground in hm (>=100m)

###U > Depth below land surface in cm (<1000cm)
U### > Depth below land surface in m (>=1000cm)

S### > Sigma level number
H### > Height above sea level (x10)
I### > Isentropic level in degrees K
B### > Boundary layer in hPa (mb) above surface at the center

****- ****** Time Specifications ********

F06 > 6 hour forecast data
F12 > 12 hour forecast data (ICAO-Required)
F18 > 18 hour forecast data (ICAO-Required)
F24 > 24 hour forecast data (ICAO-Required)
F30 > 30 hour forecast data (ICAO-Required)
F36 > 36 hour forecast data

****- ****** Special Optional Gridded Data Fields ********

LIFT > LIFTed Index, obtained without resetting LEVeL
PWAT > Precipitable Water fields, obtained without resetting LEVeL (mm)
PWAI > Precipitable Water fields, obtained without resetting LEVeL (in)

THCK > Generates Thickness fields between LVL1 and LVL2
THWN > Generates Thermal Wind between LVL1 and LVL2

****- ****** Other Parameters commonly in GRIB data sets: ********

TEMP > TEMPerature (degree C)
WIND > WIND (m/s)
WKNT > Wind (KnoTs)

PRES > PRESsure (mb, .1hPa)
PTND > Pressure TeNDency (mb/hr, .1hPa/hr)
HGHT > geopotential HeiGHT (m)
GHGT > Geometric HeiGhT (m)
OZON > Total OZONe
TEMP > TEMPerature (degree C)
VTMP > Virtual TeMPerature (degree K)
THTA > potential temperature [TheTA] (degree K)
THTE > equivalent potential temperature [TheTa-E] (degree K)
DWPT > DeWPoinT temperature (degree C)
DPTD > DeWPoint temperature Depression (degree C)
WNDD > WiND Direction (degree)
WNFF > WIND SPEED (m/sec)
UGRD > GRiD relative U wind component (m/sec)
VGRD > GRiD relative V wind component (m/sec)

SFTN > Stream FuNcTion (m**2/sec)
PSYM > montgomery stream function [PSYM] (m**2/sec**2)
VVEL > Vertical VELocity (micro-bars/sec)
VTCY > absolute VorTiCitY (1/sec)
SPFH > SPeciFic Humidity (g/g)
RELH > RELative Humidity (%)
MIXR > MIXing Ratio (g/g)
PWAT > Precipitable WATer (cm)
VCRS > Vapor pressure (mb, .1hPa)
DEF. > Saturation DEFicit (mb, .1hPa)
PCRT > PreCipitation RaTe (cm/sec)
TPCP > Total PreCiPitation (cm)
LPCP > Large-scale (stable) PreCiPitation (cm)
CPCP > Convective PreCiPitation (cm)
SWAT > WATer equivalent Snow depth (cm)
SNDP > Snow DePth (cm)

TCLD > Total Cloud percent (%)
CCLD > Convective ClouD percent (%)
LCLD > Low CLouD percent (%)
MCLD > Middle ClouD percent (%)
HCLD > High CLouD percent (%)
CH2O > Cloud water [H2O] (cm)
PCON > CONdensation Pressure (mb, .1hPa)
WTMP > Water TeMPerature (degree K)
TSOL > SOiL Temperature (degree K)
SWEL > significant SWELl wave height (m)
SWVR > net Short WaVe Radiation at surface (W/m**2)
LWVR > net Long WaVe Radiation at surface (W/m**2)
PRSS > mean sea level Pressure - Standard atmosphere reduction (mb, .1hPa)
PRSR > mean sea level Pressure - RUC reduction (mb, .1hPa)
PRSE > mean sea level Pressure - Eta reduction (mb, .1hPa)
LIFT > "Surface " LIFTed index (degree K)
LFTX > "best" LiFTed index (degree K)
LFTB > "Boundary layer" LiFTed index (degree K)
KNDX > K iNDeX (degree K)

SWET > SWEeT index (degree K)

HQDV > Horizontal moisture [Q] DiVergence (g/g/sec)
VSSH > Vertical wind Speed Shear (1/sec)
PTN3 > 3 hour interval Pressure TeNdency (mb/sec)
CRAN > Categorical RaiN (1/0 = Yes/No)
CZRN > Categorical freeZing RaiN (1/0 =Yes/No)
CPEL > Categorical ice PELlets (1/0 = Yes/No)
CSNO > Categorical SNOw (1/0 = Yes/No)
CWTR > Cloud WaTeR (cm)
CINH > Convective INHibition (J/kg)
CAPE > Convective Available Potential Energy (J/kg)
TKEN > Turbulent KENetic energy (J/kg)
THTV > Virtual potential temperature [TheTa-V] (degree K)
HLCY > storm relative HeLiCitY

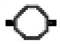
POPP > Probability Of PreciPitation (%)
POZP > Probability Of froZen Precipitation (%)
POFP > Probability Of Freezing Precipitation (%)
USTM > U-component of STorM relative motion (m/sec)
VSTM > V-component of STorM relative motion (m/sec)
PSNC > Percent SNow Cover (%)

Appendix C: Observation Station Weather Symbols

Current Weather Symbols:

0 -  Cloud Development NOT observed or NOT observable during past hour

1–  Clouds generally dissolving or becoming less developed during past hour

2 -  State of sky on the whole unchanged during past hour

3 -  Clouds generally forming or developing during past hour

4 -  Visibility reduced by smoke

5 -  Haze

6 -  Widespread dust in suspension in the air, NOT raised by wind, at time of observation

7 -  Dust or sand raised by wind, at time of observation

8 -  Well developed dust devil(s) within past hour

9 -  Dust storm or sand storm within sight of or at station during past hour

10 -  Light fog

11 -  Patches of shallow fog at station, NOT deeper than 6 feet on land

12 -  More or less continuous shallow fog at station, NOT deeper than 6 feet on land

13 -  Lighting visible, no thunder heard

14 -  Precipitation within sight, but NOT reaching the ground

15 -  Precipitation within sight, reaching the ground, but distant from station

16 -  Precipitation within sight, reaching the ground, near to but NOT at station

17 -  Thunder heard, but no precipitation at the station

18 -  Squall(s) within sight during past hour

19 -  Funnel cloud(s) within sight during past hour

20 –  Drizzle (NOT freezing and NOT falling as showers) during past hour, but NOT at time of observations

21–  Rain (NOT freezing and NOT falling as showers) during past hour, but NOT at time of observations

22 -  Snow (NOT falling as showers) during past hour, but NOT at time of observation

Current Weather Symbols (cont.):

23 –  Rain and snow (NOT falling as showers) during past hour, but NOT at time of observation

24 -  Freezing drizzle or freezing rain (NOT falling as showers) during past hour, but NOT at time of observation

25 -  Showers of rain during past hour, but NOT at time of observation

26 -  Showers of snow, or of rain and snow, during past hour, but NOT at time of observation

27 -  Showers of hail, or of hail and rain, during past hour, but NOT at time of observation

28 -  Fog during past hour, but NOT at time of observation

29 -  Thunderstorm (with or without precipitation) during past hour, but NOT at time of observation

30 -  Slight or moderate dust storm or sand storm, has decreased during past hour

31 -  Slight or moderate dust storm or sand storm, no appreciable change during past hour

32 -  Slight or moderate dust storm or sand storm, has increased during past hour

33 -  Severe dust storm or sand storm, has decreased during past hour

34 -  Severe dust storm or sand storm, no appreciable change during past hour

35 -  Severe dust storm or sand storm, has increased during past hour

36 -  Slight or moderate drifting snow, generally low

37 -  Heavy drifting snow, generally low

38 -  Slight or moderate drifting snow, generally high

39 -  Heavy drifting snow, generally high

40 -  Fog at distance at time of observation, but NOT at station during past hour

41 -  Fog in patches

42 -  Fog, sky discernible, has become thinner during past hour

43 -  Fog, sky NOT discernible, has become thinner during the past hour

44 -  Fog, sky discernible, no appreciable change during past hour

45 -  Fog, sky NOT discernible, no appreciable change during past hour

46 -  Fog, sky discernible, has begun or become thicker during past hour

Current Weather Symbols (cont.):

47 -  Fog, sky NOT discernible, has begun or become thicker during past hour

48 -  Fog, depositing rime, sky discernible

49 -  Fog, depositing rime, sky NOT discernible

50 -  Intermittent drizzle (NOT freezing) slight at time of observation

51 -  Continuous drizzle (NOT freezing) slight at time of observation

52 - Intermittent drizzle (NOT freezing moderate at time of observation

53 -  Continuous drizzle (NOT freezing), moderate at time of observation

54 -  Intermittent drizzle (NOT freezing), thick at time of observation

55 -  Continuous drizzle (NOT freezing), thick at time of observation

56 -  Slight freezing drizzle

57 -  Moderate or thick freezing drizzle

58 -  Drizzle and rain, slight

59 -  Drizzle and rain, moderate or heavy

60 - Intermittent rain (NOT freezing), slight at time of observation

61 - Continuous rain (NOT freezing), slight at time of observation

62 - Intermittent rain (NOT freezing) moderate at time of observation

63 -  Continuous drizzle (NOT freezing), moderate at time of observation

64 -  Intermittent rain (NOT freezing), heavy at time of observation

65 -  Continuous rain (NOT freezing), heavy at time of observation

66 -  Slight freezing rain

67 -  Moderate or heavy freezing rain

68 -  Rain or drizzle and snow, slight

69 -  Rain or drizzle and snow, moderate or heavy

70 - Intermittent fall of snowflakes, moderate at time of observation

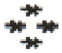
71 - Continuous fall of snowflakes, slight at time of observation

72 -  Intermittent fall of snowflakes, moderate at time of observation

Current Weather Symbols (cont.):

73 -  Continuous fall of snowflakes, moderate at time of observation

74 -  Intermittent fall of snowflakes, heavy at time of observation

75 -  Continuous fall of snowflakes, heavy at time of observation

76 -  Ice needles (with or without fog)

77 -  Granular snow (with or without fog)

78 - Isolated star like snow crystals (with or without fog)

79 -  Ice pellets (sleet, U. S. definition)

80 -  Slight rain shower(s)

81 -  Moderate or heavy rain showers(s)

82 -  Violent rain shower(s)

83 -  Slight shower(s) of rain and snow mixed

84 -  Moderate or heavy shower(s) of rain and snow mixed

85 -  Slight snow shower(s)

86 -  Moderate or heavy snow shower(s)

87 -  Slight shower(s) of soft or small hail with or without rain, or rain and snow mixed

88 -  Moderate or heavy shower(s) of soft or small hail with or without rain, or rain and snow mixed

89 -  Slight shower(s) of hail, with or without rain or rain and snow mixed, not associated with thunder

90 -  Moderate or heavy shower(s) of hail, with or without rain or rain and snow mixed, not associated with thunder

91 -  Slight rain at time of observation; thunderstorm during past hour, but NOT at time of observation

92 -  Moderate or heavy rain at time of observation; thunderstorm during past hour, but NOT at time of observation

Current Weather Symbols (cont.):

93 -  Slight snow or rain and snow mixed or hail at time of observation; thunderstorm during past hour, but not at time observation

94 -  Moderate or heavy snow, or rain and snow mixed or hail at time of observation; thunderstorm during past hour, but NOT at time of observation

95 -  Slight or moderate thunderstorm without hail, but with rain and/or snow at time of observation

96 -  Slight or moderate thunderstorm, with hail at time of observation

97 -  Heavy thunderstorm, without hail, but with rain and/or snow at time of observation

98 -  Thunderstorm combined with dust storm or sand storm at time of observation

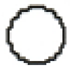
99 -  Heavy thunderstorm with hail at time of observation

201 -  Volcanic ash

202 -  Blowing spray

203 -  Unknown precipitation from an automatic station

Sky Cover Symbols:

0 -  No clouds

1 -  Less than one-tenth or one-tenth

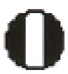
2 -  Two-tenths or three-tenths

3 -  Four-tenths

4 -  Five-tenths

5 -  Six-tenths

6 -  Seven-tenths or eight-tenths

7 -  Nine-tenths or overcast with openings

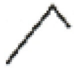
8 -  Completely overcast

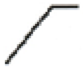
9 -  Sky obscured

10 - 

Missing

Pressure Tendency Symbols:

0 -  Rising, the falling

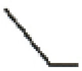
1 -  Rising, then steady; or rising, the rising more slowly

2 -  Rising steadily, or unsteadily

3 -  Falling or steady, then rising; or rising, then rising more quickly

4 - Steady, same as 3 hours ago

5 -  Falling, then rising, same or lower than 3 hours ago

6 -  Falling, then steady; or falling, then falling more slowly

7 -  Falling steadily, or unsteadily

8 -  Steady or rising, then falling; or falling, then falling more quickly

Past Weather Symbols:

0 - Clear or Few Clouds

1 - Partly cloudy (scattered) or variable sky

2 - Cloudy (broken) or overcast

3 -  Sandstorm or dust storm, or drifting or blowing snow

4 -  Fog, or smoke, or thick dust haze

5 -  Drizzle

6 -  Rain

7 -  Snow, or rain and snow mixed, or ice pellets (sleet)

8 -  Shower(s)

9 -  Thunderstorm, with or without precipitation

Appendix D: Common Color Tables

Basic Colors	RED	GREEN	BLUE	
RED	255	0	0	red
GREEN	0	255	0	green
BLUE	0	0	255	blue
YELLOW	255	255	0	yellow
CYAN	0	255	255	cyan
MAGENTA	255	0	255	magenta
WHITE	255	255	255	white
BLACK	0	0	0	black
GRAY	127	127	127	gray
VANILLA	255	228	220	bisque
Oranges				
ORANGE	255	127	0	DarkOrange
DKORANGE	205	133	0	orange
CORAL	255	130	71	sienna
Browns				
BROWN	139	71	38	sienna
BEIGE	255	127	36	chocolate
SAND	205	133	63	tan
MUD	139	69	19	chocolate
Blues				
SKY	0	178	238	DeepSkyBlue
LTBLUE	30	144	255	DodgerBlue
GRPBLUE	16	78	139	DodgerBlue
MDCYAN	0	238	238	cyan
AQUA	0	205	205	cyan
NAVY	0	0	139	blue
DKBLUE	0	0	205	blue
INDIGO	148	0	211	DarkViolet
Greens				
LWNGRN	127	255	0	chartreuse
MDGREEN	0	205	0	green
DKGREEN	0	139	0	green
LTGREEN	124	252	0	lawn green
AVOCADO	107	142	35	olive drab
FOGREEN	0	100	0	dark green
Yellows				
GOLD	255	215	0	gold
DKYELLOW	238	238	0	yellow
BLOND	238	180	34	goldenrod
Reds				

PINK	255	174	185	LightPink
DKPINK	255	106	106	IndianRed
MAROON	139	0	0	red
APRICOT	255	165	79	tan
VIOLET	137	104	205	MediumPurple
MDVIOLET	238	44	44	firebrick
PURPLE	145	44	238	purple
PLUM	139	0	139	magenta
FIREBRIC	205	0	0	red
ORRED	238	64	0	OrangeRed

Grays

G99	252	252	252	gray99
G98	250	250	250	gray98
G97	247	247	247	gray97
G96	245	245	245	gray96
G95	242	242	242	gray95
G94	240	240	240	gray94
G93	237	237	237	gray93
G92	235	235	235	gray92
G91	232	232	232	gray91
G90	230	230	230	gray90
G89	227	227	227	gray89
G88	224	224	224	gray88
G87	222	222	222	gray87
G86	219	219	219	gray86
G85	217	217	217	gray85
G84	214	214	214	gray84
G83	212	212	212	gray83
G82	209	209	209	gray82
G81	207	207	207	gray81
G80	204	204	204	gray80
G79	201	201	201	gray79
G78	199	199	199	gray78
G77	196	196	196	gray77
G76	194	194	194	gray76
G75	191	191	191	gray75
G74	189	189	189	gray74
G73	186	186	186	gray73
G72	184	184	184	gray72
G71	181	181	181	gray71
G70	179	179	179	gray70
G69	176	176	176	gray69
G68	173	173	173	gray68
G67	171	171	171	gray67
G66	168	168	168	gray66
G65	166	166	166	gray65
G64	163	163	163	gray64
G63	161	161	161	gray63
G62	158	158	158	gray62
G61	156	156	156	gray61
G60	153	153	153	gray60
G59	150	150	150	gray59

G58	148	148	148	gray58
G57	145	145	145	gray57

Grays (cont.)

G56	143	143	143	gray56
G55	140	140	140	gray55
G54	138	138	138	gray54
G53	135	135	135	gray53
G52	133	133	133	gray52
G51	130	130	130	gray51
G50	128	128	128	gray50
G49	125	125	125	gray49
G48	122	122	122	gray48
G47	120	120	120	gray47
G46	117	117	117	gray46
G45	115	115	115	gray45
G44	112	112	112	gray44
G43	110	110	110	gray43
G42	107	107	107	gray42
G41	105	105	105	gray41
G40	102	102	102	gray40
G39	99	99	99	gray39
G38	97	97	97	gray38
G37	94	94	94	gray37
G36	92	92	92	gray36
G35	89	89	89	gray35
G34	87	87	87	gray34
G33	84	84	84	gray33
G32	82	82	82	gray32
G31	79	79	79	gray31
G30	77	77	77	gray30
G29	74	74	74	gray29
G28	71	71	71	gray28
G27	69	69	69	gray27
G26	66	66	66	gray26
G25	64	64	64	gray25
G24	61	61	61	gray24
G23	59	59	59	gray23
G22	56	56	56	gray22
G21	54	54	54	gray21
G20	51	51	51	gray20
G19	48	48	48	gray19
G18	46	46	46	gray18
G17	43	43	43	gray17
G16	41	41	41	gray16
G15	38	38	38	gray15
G14	36	36	36	gray14
G13	33	33	33	gray13
G12	31	31	31	gray12
G11	28	28	28	gray11
G10	26	26	26	gray10
G09	23	23	23	gray9
G08	20	20	20	gray8

G07	18	18	18	gray7
G06	15	15	15	gray6

Grays (cont.)

G05	13	13	13	gray5
G04	10	10	10	gray4
G03	8	8	8	gray3
G02	5	5	5	gray2
G01	3	3	3	gray1

Appendix E: Assorted Diagnostic Formulas

Helicity/Holicity Information –

Many meteorologists are familiar with the term 'Helicity' but they may not have heard of 'Holicity'. Below is an explanation of the two functions.

Helicity: integrated "streamwise component" of horizontal vorticity flux.
Holicity: integrated "crosswise component" of horizontal vorticity flux.

Holicity calculation is based on code developed by Erik Rasmussen (1990-1991)

The Holicity function computes the integrated "crosswise component" of horizontal vorticity flux. This parameter is similar to helicity and is discussed in Davies-Jones, JAS 41, p. 2991- (1984).

```
HELICITY = INTEGRAL [ (u-c_u) * dv/dz - (v-c_v) * du/dz] Dz
HOLICITY = INTEGRAL [ (u-c_u) * du/dz - (v-c_v) * dv/dz] Dz
```

Note that holicity is the same as helicity but with the vertical derivative terms reversed.

It is possible that comparisons of crosswise (holicity) vs. streamwise (helicity) integrated vorticity may lead to intriguing new techniques to forecast storm type or motion.

New Frontogenesis Formulas –

Rotational Frontogenesis and its sub functions use the following formula:

```
RFGV = 0.5*MAG(GRAD(THTA))*(DDX(VGRD)-DDY(UGRD))
RFGD = (0.5/MAG(GRAD(THTA))*(2.*DDX(THTA)*DDY(THTA)*Est+
      (DDX(THTA)*DDX(THTA)-DDY(THTA)*DDY(THTA))*Esh)
RFGT = (1./MAG(GRAD(THTA))*thetap*(DDX(OMEGA)*DDY(THTA)
       +DDY(OMEGA)*DDX(THTA))
RFGN = (RFGV+RFGD+RFGT)*1.E9

WHERE: Esh = DDX(VGRD)+DDY(UGRD)
           Est = DDX(UGRD)-DDY(VGRD)
       Thetap = ((PRES(LVL)-PRES(LVL+1))*(THETA(LVL-1)-
       THETA(LVL))/(PRES(LVL-1)-PRES(LVL))+(PRES(LVL-1)-PRES(LVL))*
      (THETA(LVL)-THETA(LVL+1))/(PRES(LVL)-PRES(LVL+1)))/
      (PRES(LVL-1)-PRES(LVL+1))
```

Escalar Frontogenesis and its sub functions use the following formula:

```
EFGG = -0.5*MAG(GRAD(THTA))*(DDX(UGRD)+DDY(VGRD))
EFGD = -(0.5/MAG(GRAD(THTA))*(2.*DDX(THTA)*DDY(THTA)*Esh+
        (DDX(THTA)*DDX(THTA)-DDY(THTA)*DDY(THTA))*Est)
EFGT = -(1./MAG(GRAD(THTA))*thetap*(DDX(OMEGA)*DDX(THTA)
         +DDY(OMEGA)*DDY(THTA))
EFGN = (EFGG+EFGD+EFGT)*1.E9


WHERE: Esh = DDX(VGRD)+DDY(UGRD)
             Est = DDX(UGRD)-DDY(VGRD)
         Thetap = ((PRES(LVL)-PRES(LVL+1))*(THETA(LVL-1)-
         THETA(LVL))/(PRES(LVL-1)-PRES(LVL))+(PRES(LVL-1)-PRES(LVL))*
        (THETA(LVL)-THETA(LVL+1))/(PRES(LVL)-PRES(LVL+1)))/
        (PRES(LVL-1)-PRES(LVL+1))
```