Eastern United States Winter Storm

03-05 January, 2018

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Meteorological Overview:

The first major winter storm of 2018 concluded as one of the strongest Nor'easters in modern-day records, impacting nearly the entire Eastern Seaboard. This system began when a wave developed along an old surface frontal boundary positioned between southern Florida and the Bahamas. Embedded shortwave energy within the 500 hPa trough ejected eastward near Florida and Georgia on 03 January as the base of the trough moved through the eastern Tennessee Valley, Southern Appalachians and Southeast (Figure 1). A closed low quickly formed off the Virginia coast and lifted northward to New Brunswick and Quebec. The system underwent rapid intensification between 1800 UTC 03 January 2018 – 1800 UTC 04 January 2018 when the central low pressure plummeted 53 hPa from 1004 hPa to 950 hPa. Deepening persisted through 0300 UTC 5 January 2018 when the minimum of 949 hPa was recorded offshore Downeast Maine.

During the initial hours when the cyclone was intensifying, the dendritic growth layer along the coasts of Georgia and South Carolina was 1000 to 1400 meters deep along with 800-750 hPa Equivalent Potential Vorticity (EPV) values of -2 to -3. Strong upward vertical velocities within this zone led to the development of moderate to heavy snow offshore, with the western edge of the precipitation shield over the coastline. Areas of -1 to -2 EPV were present from North Carolina to Maine as the cyclone tracked northward, with longer durations over the Northeast - increasing to -3 over northern Vermont for a couple of hours late on 04 January 2018. The heaviest snow fell parallel to the deformation zone; in this case, focusing over central Maine in the higher elevations. Intense snow bands formed over the state dumping 1-2+ inches per hour for several hours, while the central pressure of this system bottomed out.

Impacts:

The Regional Snowfall Index (RSI) for this winter storm equated to the following: 2.284 in the Southeast and 2.548 in the Northeast. The Northeast Snowfall Impact Scale (NESIS) for this event was 2.27, suggesting that a majority of this winter storm was notable (Figure 2). By the time the storm diminished it had impacted an area of 341,732 square miles with a total population of 87,768,639 people.

Prior to the storm's initiation, much of the United States east of the Rocky Mountains had been in a prolonged period of well below normal temperatures, with areal averages up to 10 degrees colder for the East Coast. The cold temperatures triggered the closure of some of Orlando, Florida's major water parks: Sea World, Universal Orlando's Volcano Bay and Disney's Typhoon Lagoon.

Dozens of emergency shelters were opened for Florida citizens, while two universities, Florida A&M and Florida State University, were closed. Tallahassee recorded its first measurable snowfall since 1989. Other rare occurrences of measurable snowfall occurred across Georgia and South Carolina. A new daily record of 5.3 inches of snow was set in Charleston, South Carolina, which placed 03 January 2018 as the 3rd all-time highest daily snowfall. Over 13,000 tons of salt were used to treat roads across South Carolina; however, highway patrol still had to respond to numerous accidents. Charleston International Airport was closed due to snow and ice cover. Thousands of flights were cancelled across the eastern third of the United States.

The Governor of Georgia declared a state of emergency for 28 coastal counties for strong winds and coastal flooding. As the storm rapidly intensified, so did the wind. Around 40,000 residents lost power in Virginia and North Carolina; approximately 8,000 Florida residents also lost power in the wake of the storm. Coastal areas from the Mid-Atlantic to the Northeast had near-hurricane force wind speeds, coastal flooding and erosion, record high tides, and storm surge. Nantucket, Massachusetts recorded some of the highest wind speeds – 76 mph, as the storm barreled up the coast. Impressive wave heights developed as the low rapidly deepened. A new record high tide (4.88 feet Mean Higher High Water), combined with the wind, flooded the heavily snow-covered city streets of Boston. The Associated Press stated that the Massachusetts Governor relied on the deployment of National Guard high-water rescue vehicles to aid and assist stranded vehicles. The emergency management director in Suffolk County said that 75 homes had flooding on the first level, which compromised utilities.

Although no low pressure records were established for the United States, a new all-time pressure record was set for Saint John, New Brunswick. With a reading of 951.1 hPa, 05 January 2018 replaced the all-time lowest pressure record previously set on 17 March 1981. Additionally, two buoys located south of Nova Scotia recorded wave heights of 51 and 56 feet with this system. Much of Nova Scotia and the Canadian Maritimes were impacted by widespread, damaging hurricane force winds, storm surge and coastal erosion. A large percentage of the islands' population lost power and a few locations sustained significant structural damage and loss.

The interpolated observed snowfall analysis shown in Figure 3 highlights that the heavier snow spanned from the Chesapeake Bay region to Maine, primarily locations east of I-95 and I-87. More than 13 million people were under Blizzard warnings from Virginia to Maine. Snow amounts increased significantly across southern New Jersey, Long Island and eastern Massachusetts; however, the highest amounts fell over north-central Maine where amounts ranged from 18 to 36+ inches. Media reported that 11 major school districts from Baltimore to Boston were closed on 04 January, 2018. At least 11 lives were claimed in fatal crashes as a direct result of this winter storm: 4 in North Carolina, 2 in Virginia, and 1 each in South Carolina, Massachusetts, Pennsylvania, New Jersey and New

York. Two fatalities were directly attributed to the event in New York and New Jersey, both the result of hypothermia. Total property damage of $4.2 million was reported for this event, primarily the result of coastal flooding.

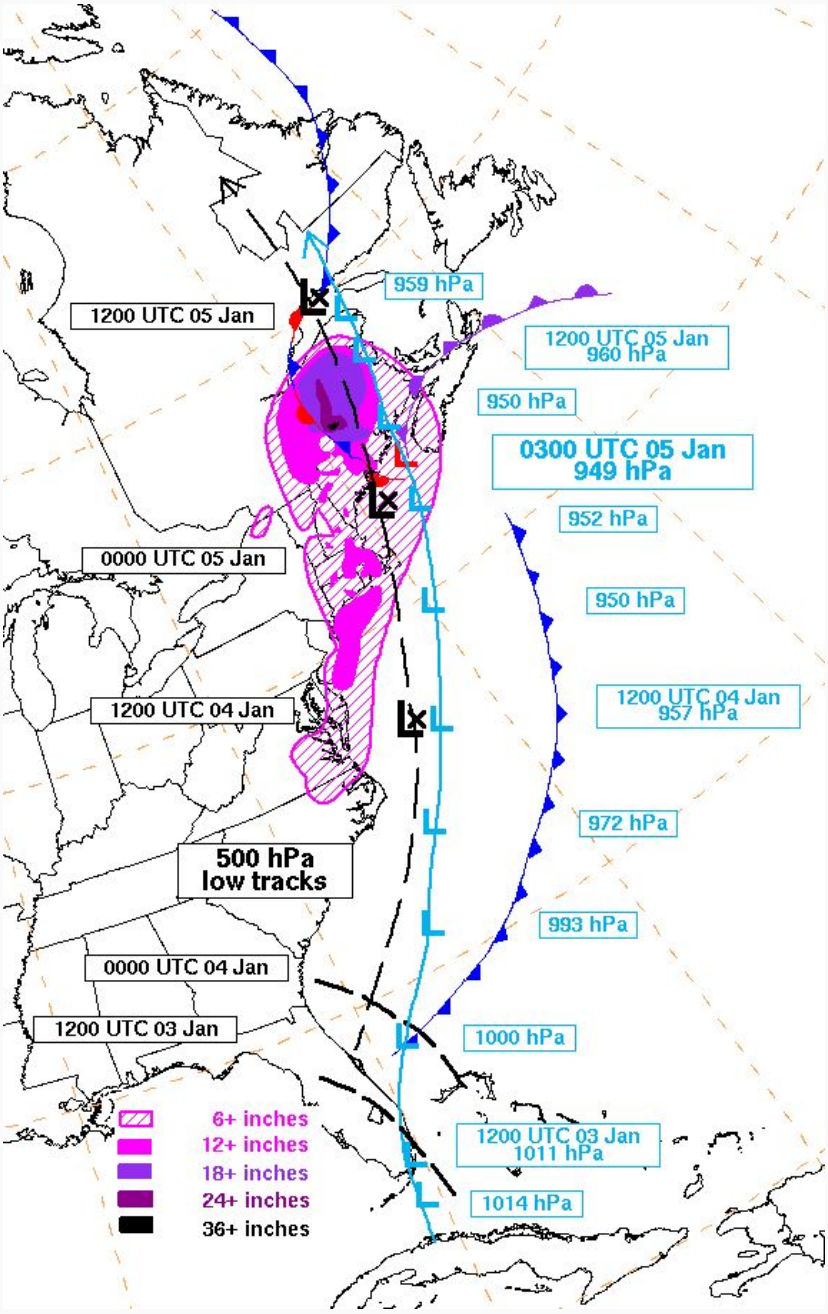

Figure 1: Surface low track (blue), 500 hPa low track (black), approximate areas of snow greater than 6 inches (fuchsia-hatched), 12 inches (fuchsia), 18 inches (purple), 24 inches (dark magenta), 36+ inches (black) and surface fronts at 0300 UTC 05 January 2018.

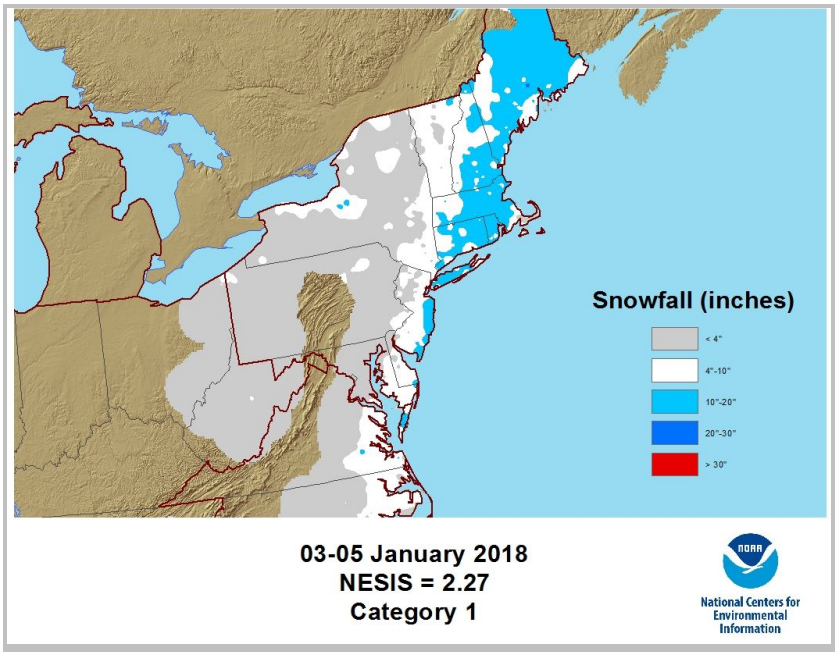

Figure 2: The Northeast Snowfall Impact Scale ranking for 03-05 January, 2018.

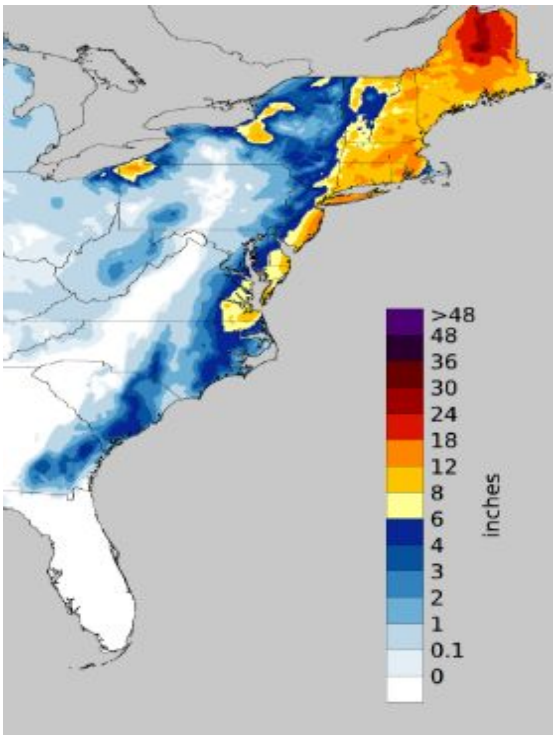

Figure 3: Interpolated Observed Snowfall analysis over a 72-hr period from 0000 UTC 03-06 January, 2018 (NOHRSC)