Characterizing Extreme Precipitation in HREF Individual Ensemble Members

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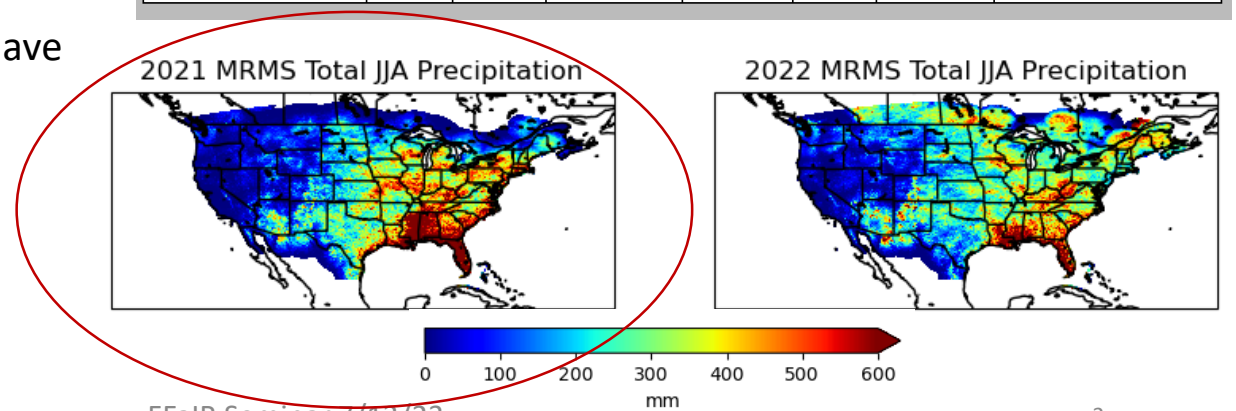
HREF Individual Members

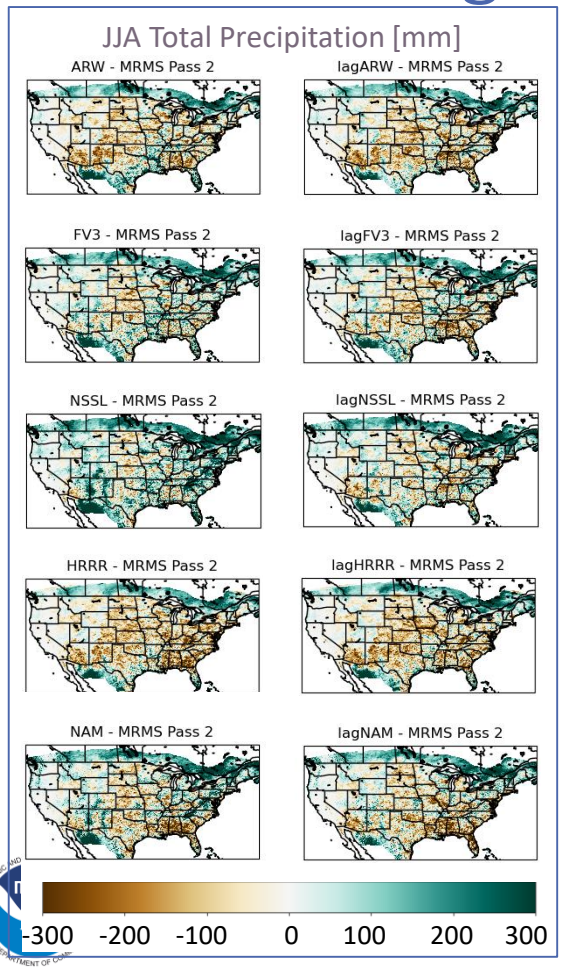
- 10 member “ensemble of opportunity”
  - 5 deterministic CAMS plus time lagged members
  - Diverse dynamical cores, parameterizations, initial and boundary conditions
- 48h forecasts with hourly output 2x/day (00 and 12 UTC)
  - Individual members may have more frequent runs
  - 3km HRRR grid
- HREF v3 since May 2021
  - 2 (very different) warm seasons with consistent model configuration

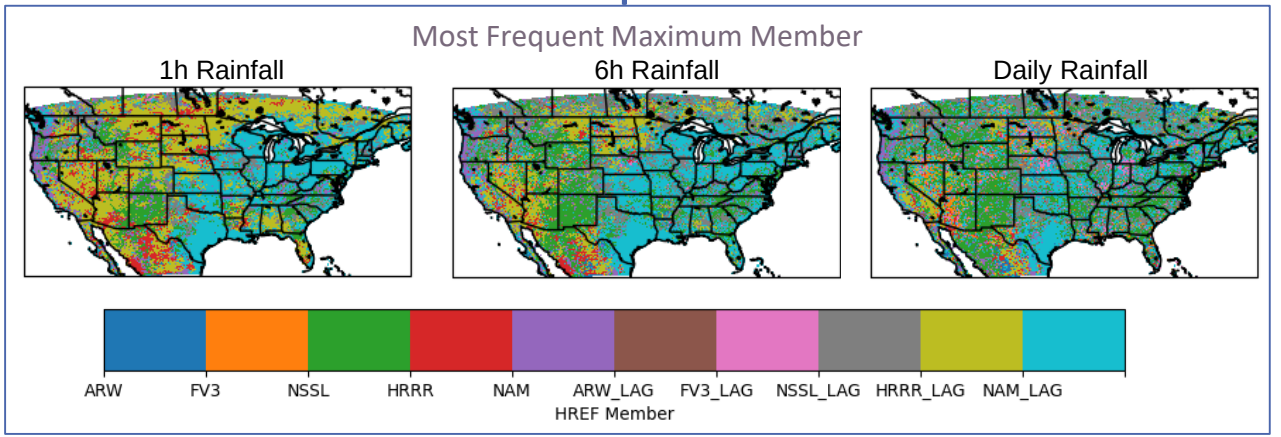
Configuration period: 2021-05-11 through present

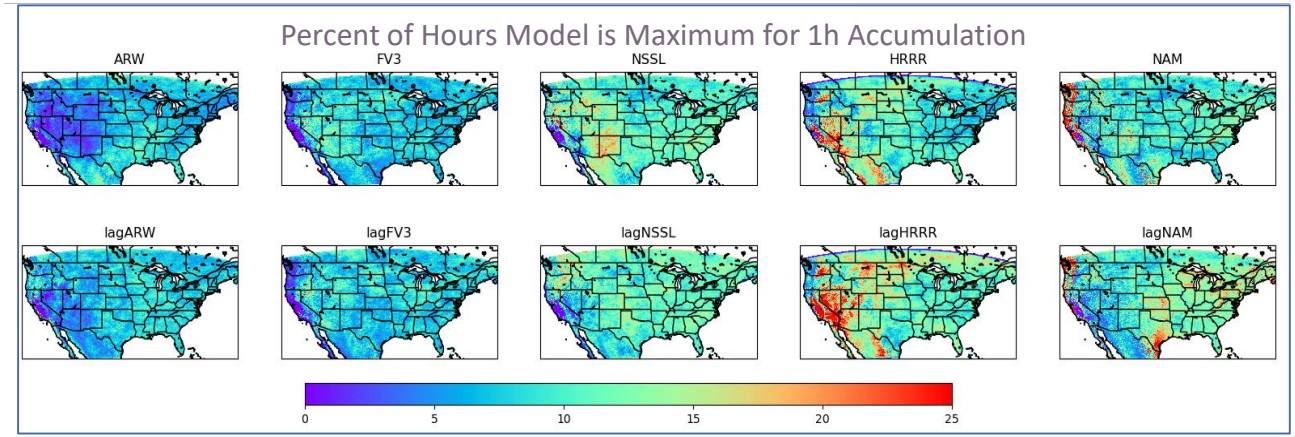
Member	ICs	LBCs	Microphysics	PBL	dx (km)	Vert. levels	Included in HREF hours
HRRR	RAP -1h	RAP -1h	Thompson	MYNN	3.0	50	0 - 36
HRRR -6h	RAP -1h	RAP -1h	Thompson	MYNN	3.0	50	0 - 30
HRW ARW	RAP	GFS -6h	WSM6	YSU	3.2	50	0 - 48
HRW ARW -12h	RAP	GFS -6h	WSM6	YSU	3.2	50	0 - 36
HRW FV3	GFS -6h	GFS -6h	GFDL	GFS EDMF	3.0	60	0 - 60
HRW FV3 -12h	GFS -6h	GFS -6h	GFDL	GFS EDMF	3.0	60	0 - 48
HRW NSSL	NAM	NAM -6h	WSM6	MYJ	3.2	40	0 - 48
HRW NSSL -12h	NAM	NAM -6h	WSM6	MYJ	3.2	40	0 - 36
NAM CONUS Nest	NAM	NAM	Ferrier-Aligo	MYJ	3.0	60	0 - 48
NAM CONUS Nest -12h	NAM	NAM	Ferrier-Aligo	MYJ	3.0	60	0 - 48

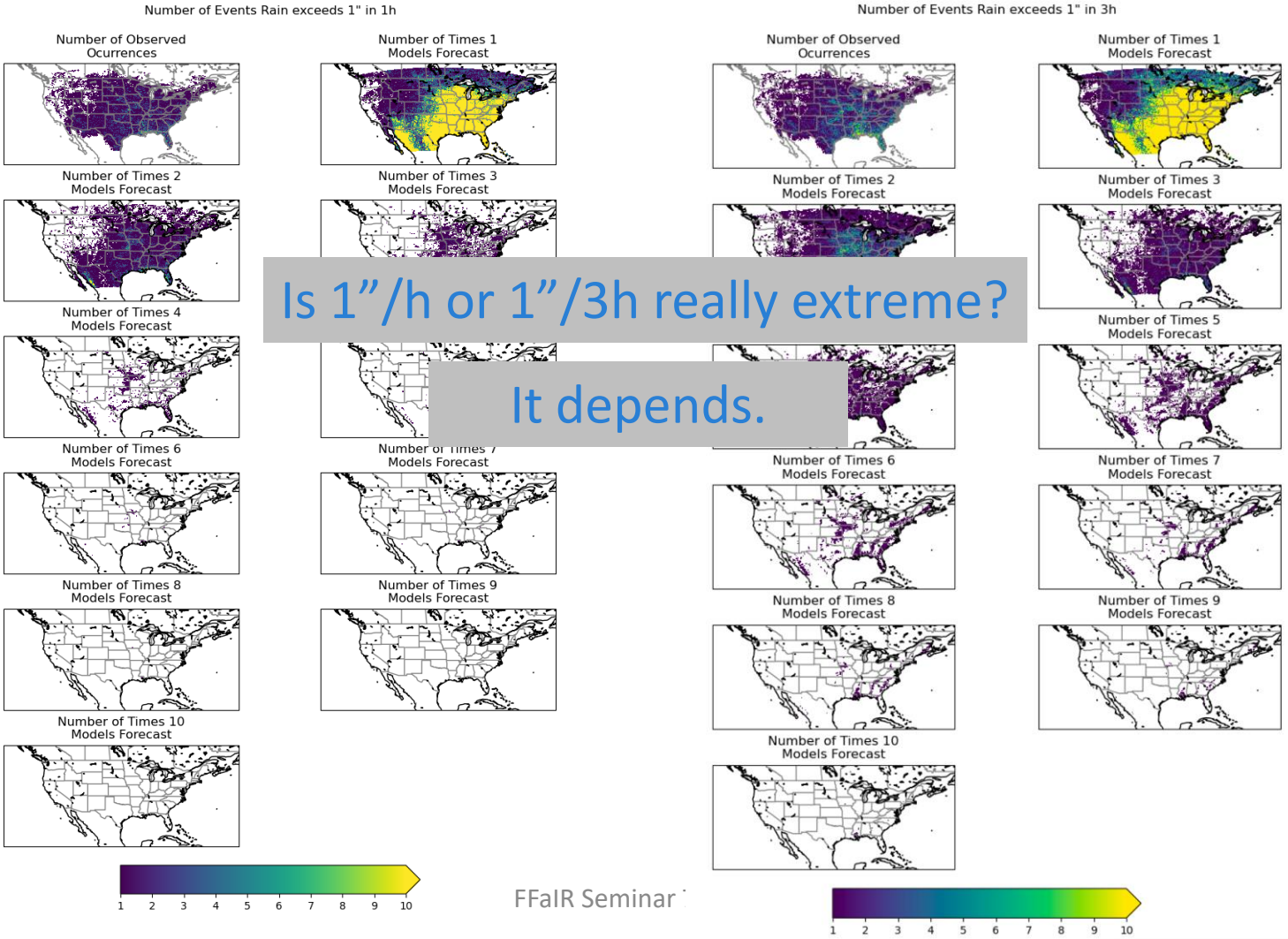


Characterizing HREF Summer Precipitation





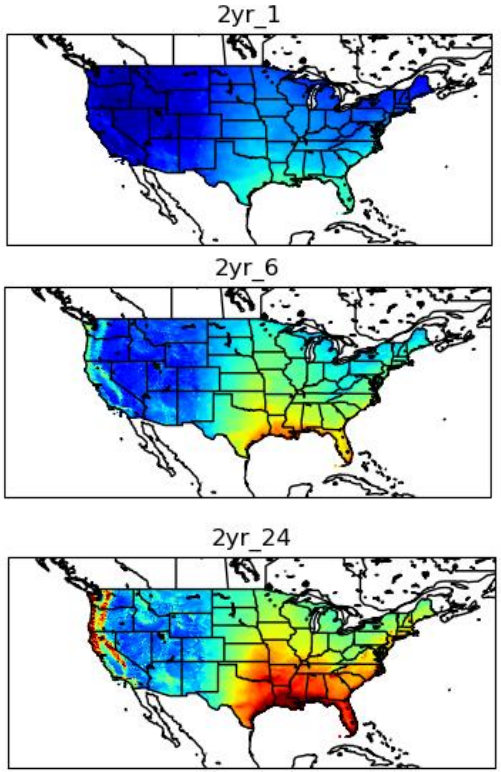




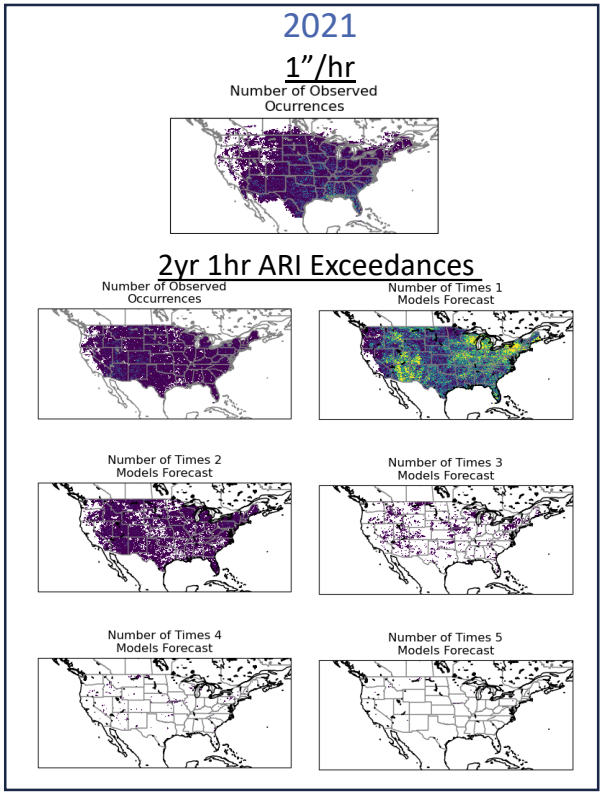
Is 1”/h or 1”/3h really extreme?

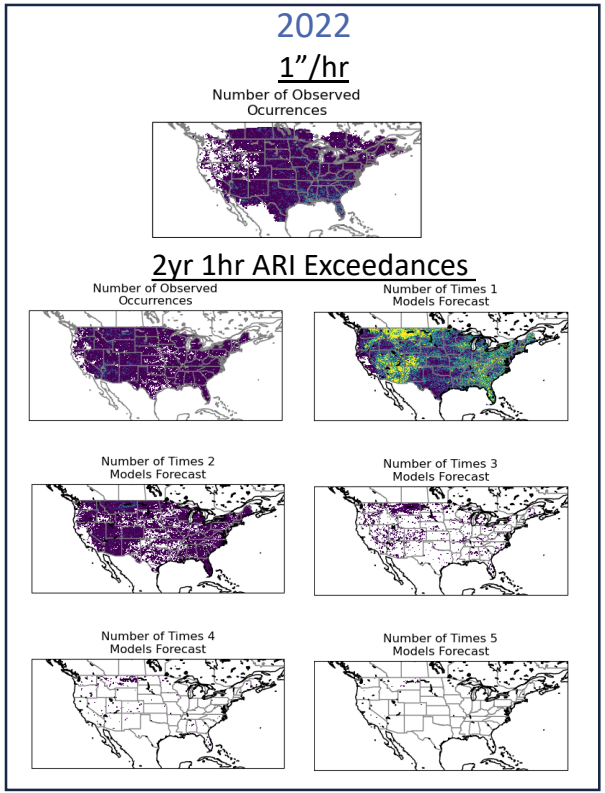
It depends.

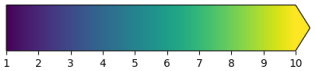
Use ARI instead of 1”/hr



Herman and Schumacher 2016

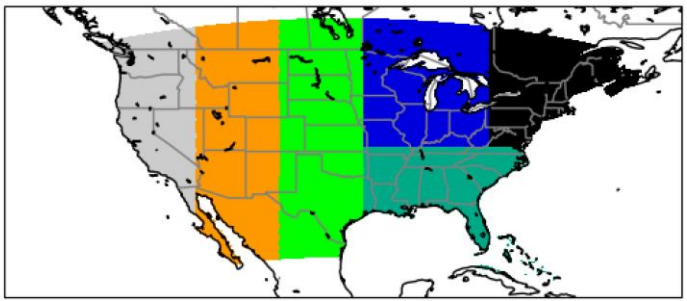




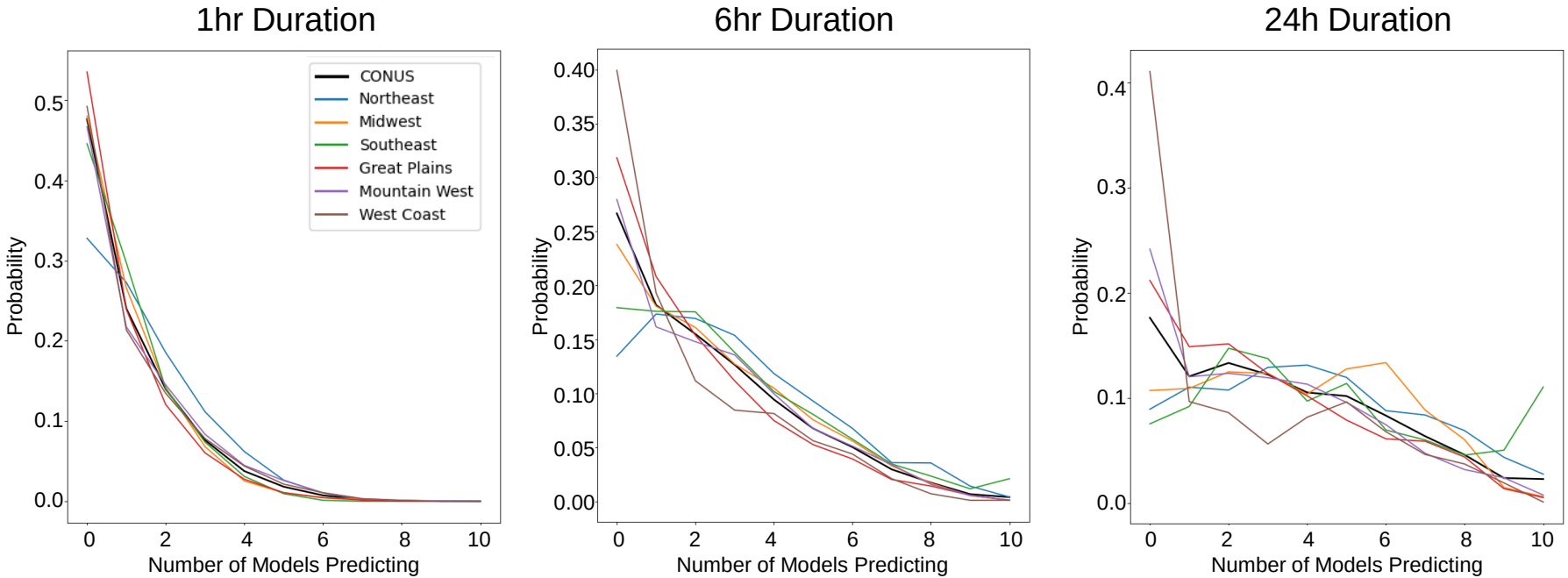


How well do HREF Individual Members capture ARI Exceedances at different durations?

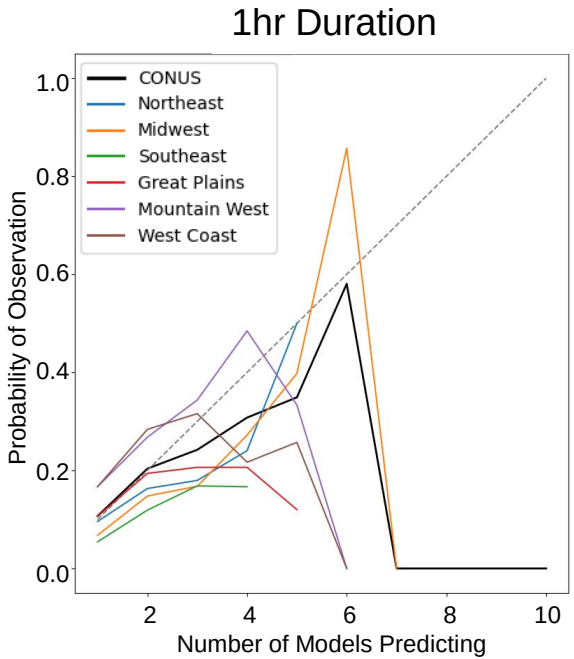
- Focusing on 2 year ARI, for 1, 6, and 24h accumulations
- Include regional analysis for 6 regions of the US
- Compare to MRMS Pass 2
- Consider events occurring within 25km radius

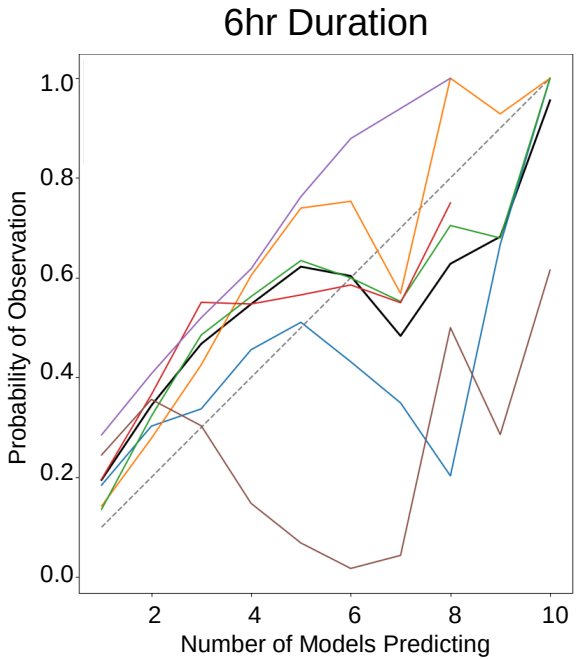


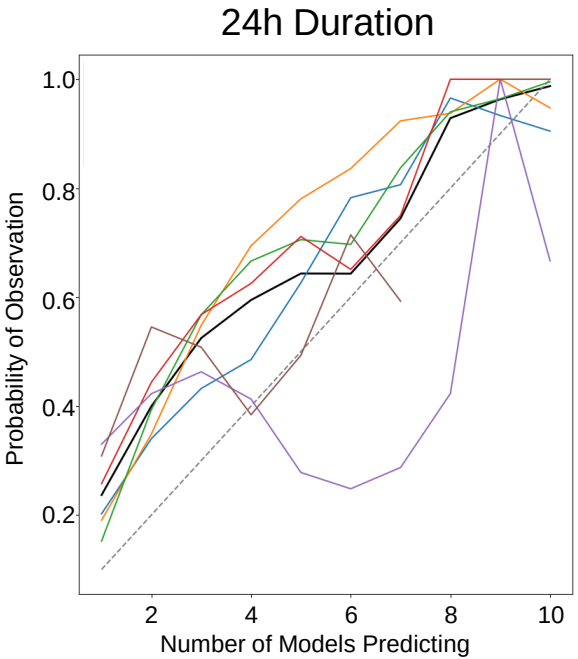
Probability that an observed 2-year ARI exceedance was predicted by HREF



Probability that HREF predicted ARI exceedance will be observed

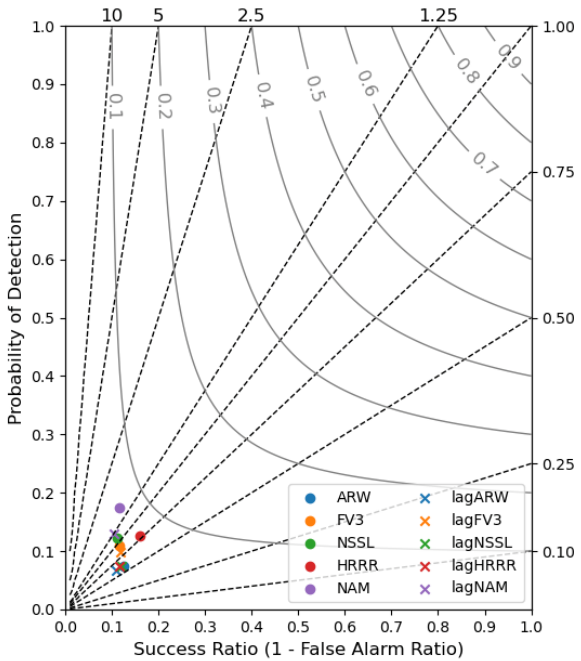




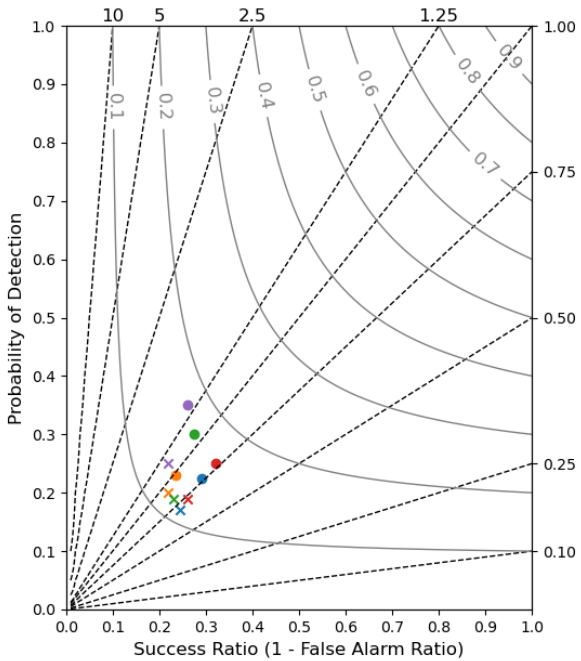


Which models are contributing?

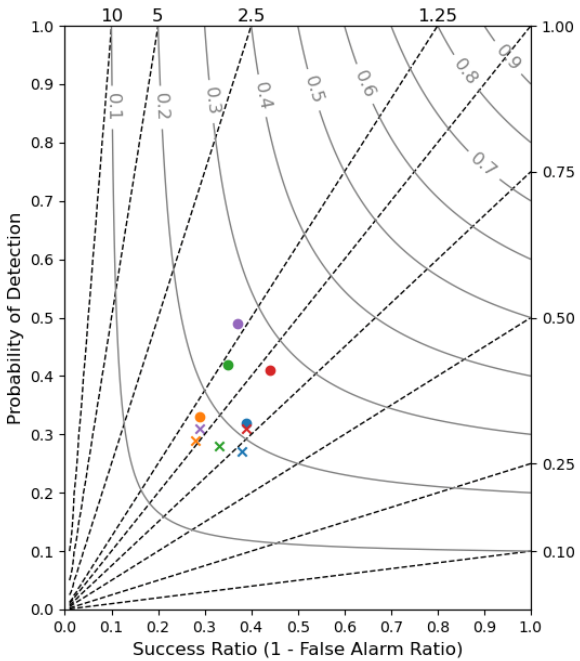
2yr 1h



2yr 6h



2yr 24h



Conclusions and future work

Conclusions

- Model climatology is drier than observed
- Most frequent maximum model depends on accumulation period/lead time.
- POD of an ARI exceedance increases with increasing accumulation period.
- For 2-year ARI Exceedances:
  - Models tend to overpredict 1h exceedances, and underpredict 6 and 24h.
  - NAM has highest POD, but also high FAR.
  - HRRR has lowest FAR, but POD not great.
  - Lag members have lower POD and higher FAR than non-lagged members (except NSSL and FV3 for 1h), and the difference between the two is model dependent.

Ongoing and Future Work

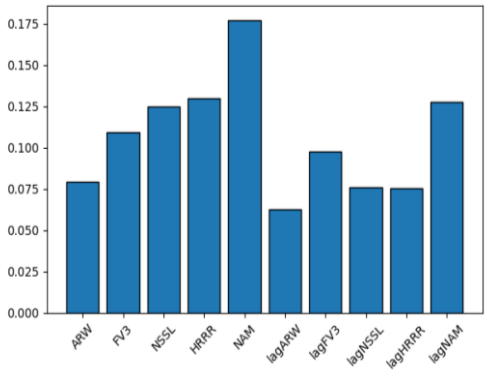
- Evaluation of 10 and 50 year ARIs
- Evaluation by rain rate and duration
- Inclusion of JJA 2023, including combined 2021-2023 analysis

Extra Slide

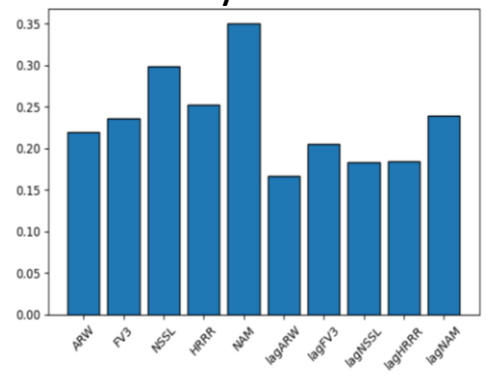
Which models are contributing?

Probability of Forecast given an Observation (POD)

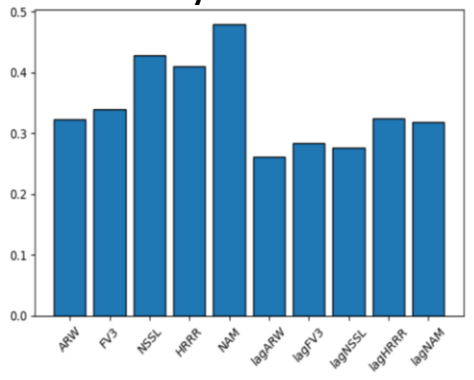
2yr 1h



2yr 6h



2yr 24h



Probability of Observation given Forecast (1-FAR)