Weather Prediction Center Hydrometeorological Testbed Day 8-10 Experiment

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Presentation Outline

- **Summary of Year 1 (2017)**

  - Monthly and Seasonal Verification

- **Ongoing Work Year 2 (2018)**

- **Application of Ensemble Clustering to Forecast Blend**

- **Visual Forecast Verification**

Experiment Goals Completed 2017

- Explored the utility of daily forecasts of precipitation and temperature out to Days 8 -10

- Evaluated probabilistic forecast products designed for forecasting high impact temperature and precipitation events at medium range

- Collaborated with social scientists to determine the most efficient and user friendly projection of Day 8 -10 probabilistic forecasts

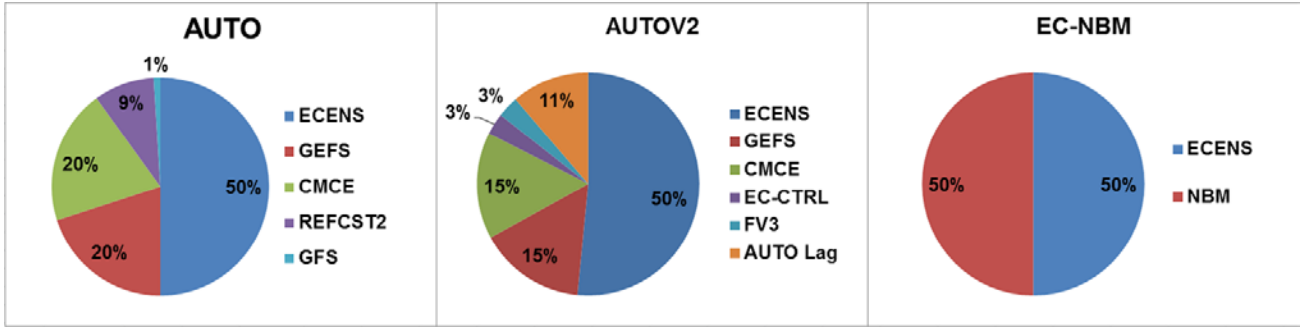
- Explored and demonstrated the application of the North Pacific Jet (NPJ) tool to adjust and improve Day 8 -10 forecasts and identify potential for anomalous weather events

Forecast Process During 2017

Automated Experimental Forecast Blends

AUTO – standard auto-blend

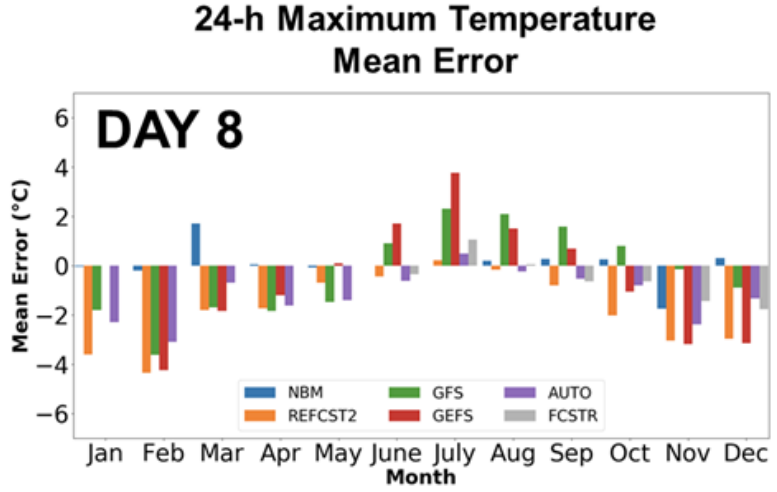
AUTOV2 – version 2 of auto blend (January 2018)

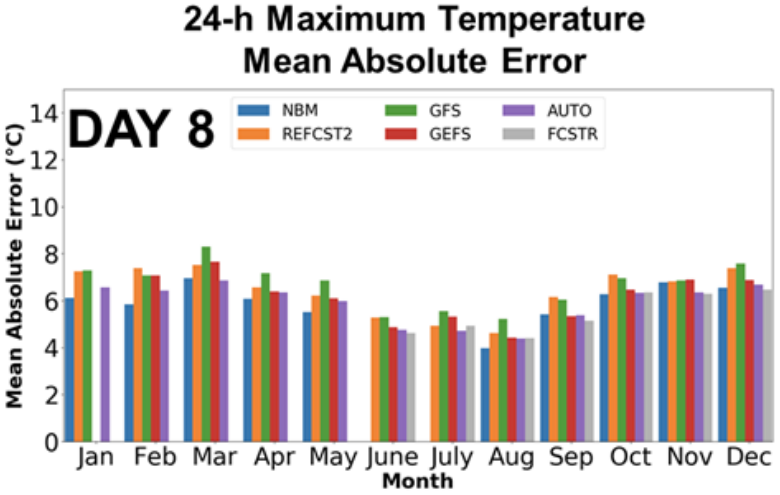


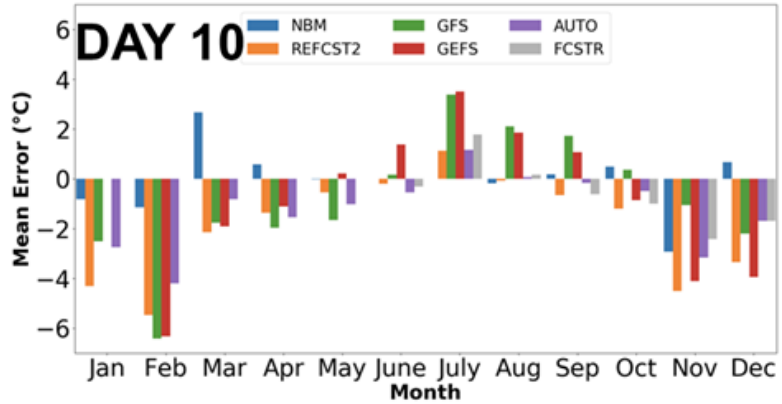
Manual Forecaster Blend

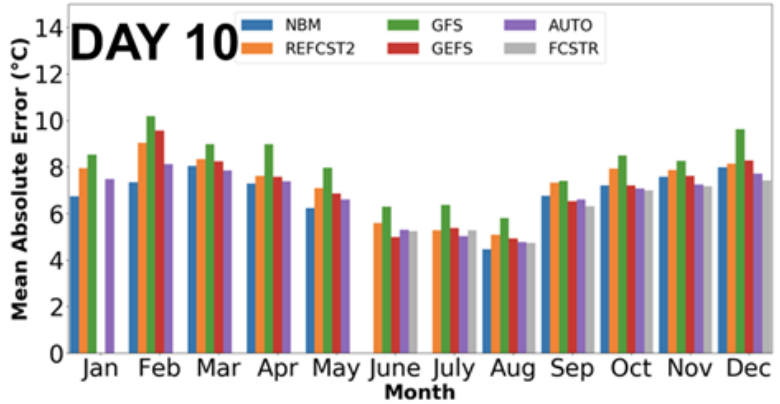
Forecaster Role → goal is to redistribute weights of the above inputs based on experimental canonical tools and model forecasts

Monthly Verification 2017: Monthly Average Error Scores for Maximum Temperature

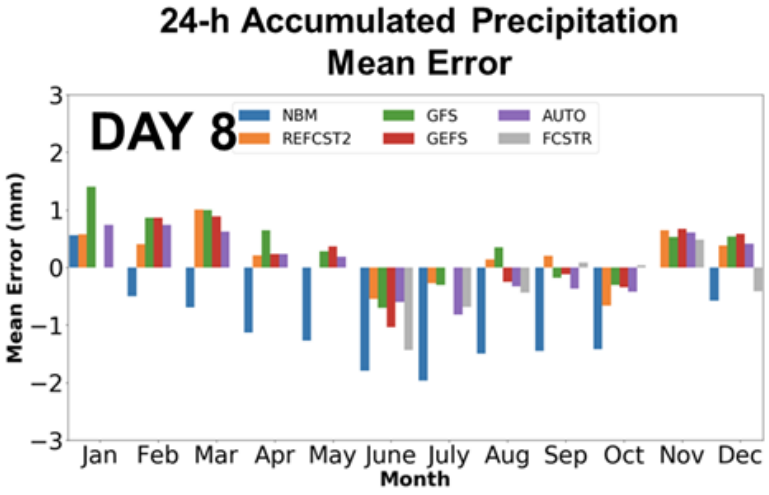


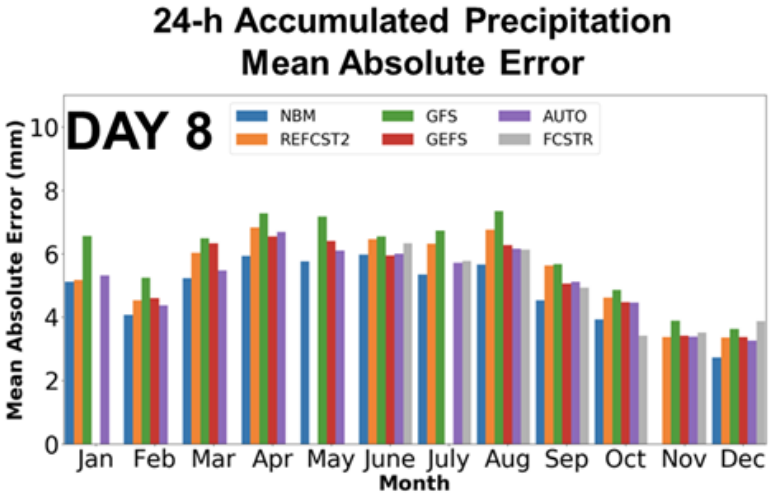


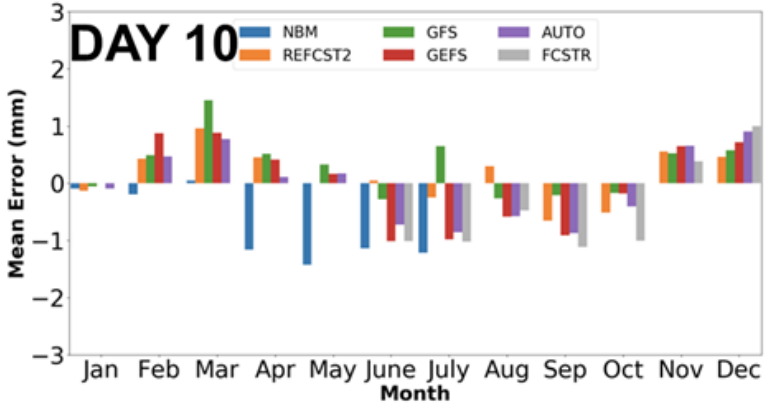


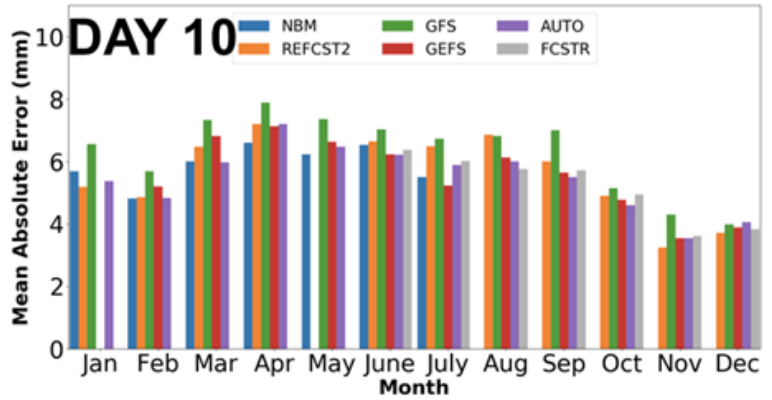


Monthly Verification 2017: Monthly Average Error Scores for 24-h QPF

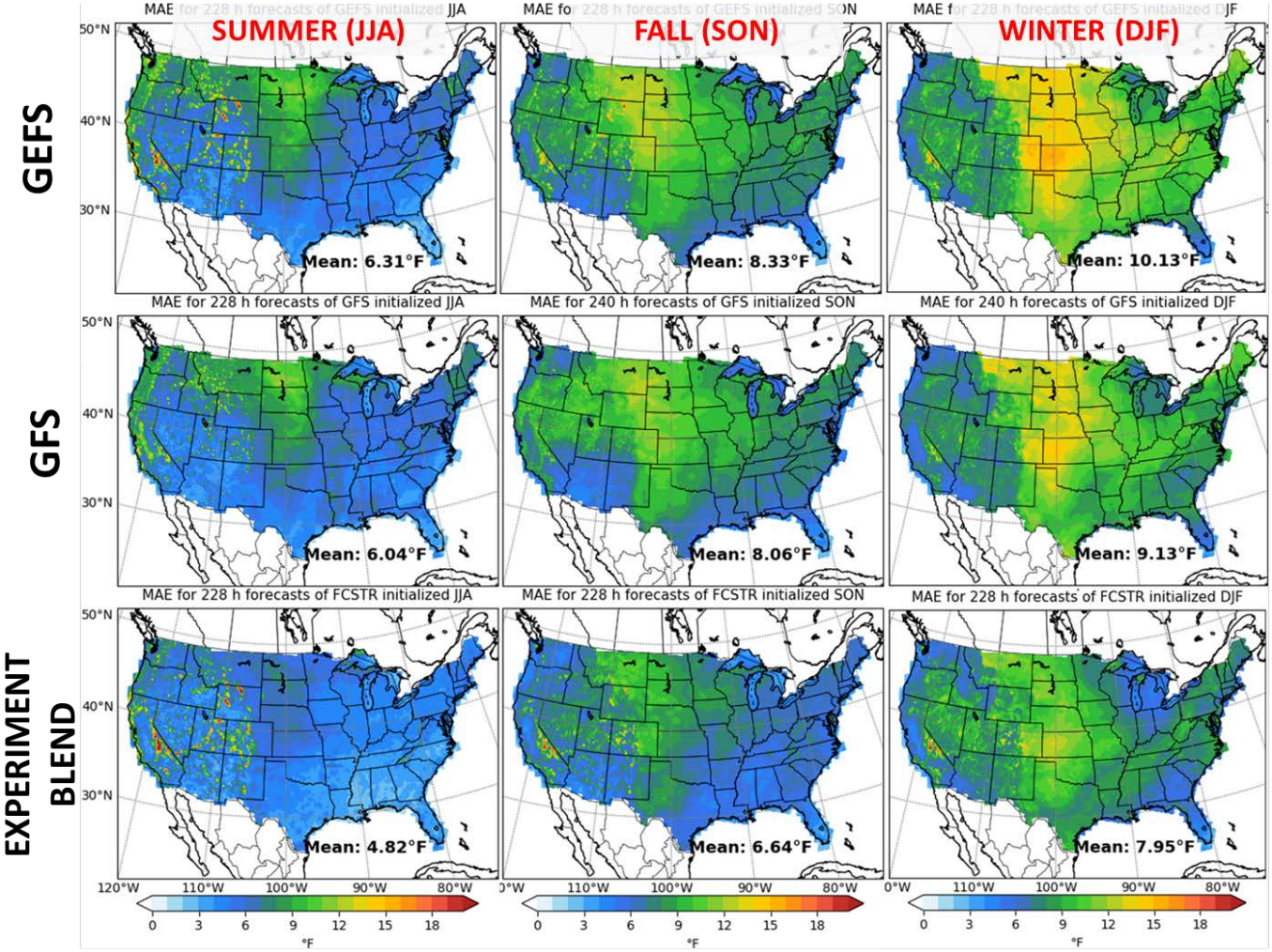




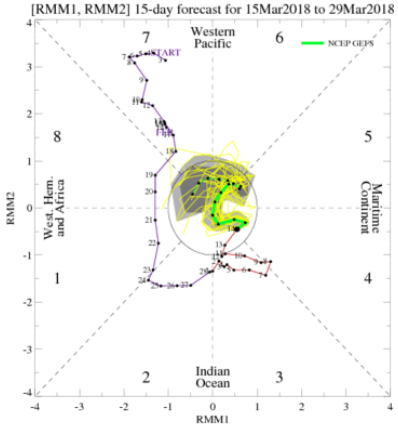




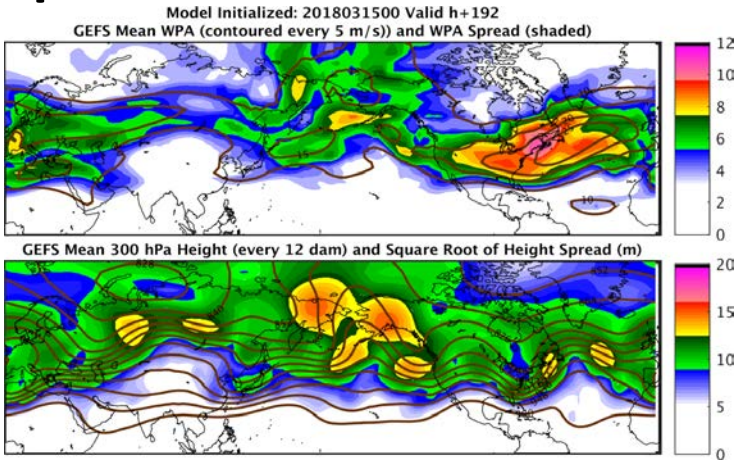
2017-18 Seasonal Verification: 24-h Maximum Temperature Mean Absolute Error for Day 10



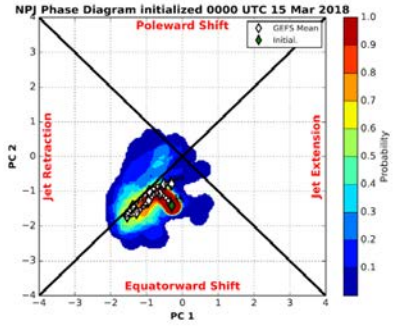
Current Experimental Forecast Tools

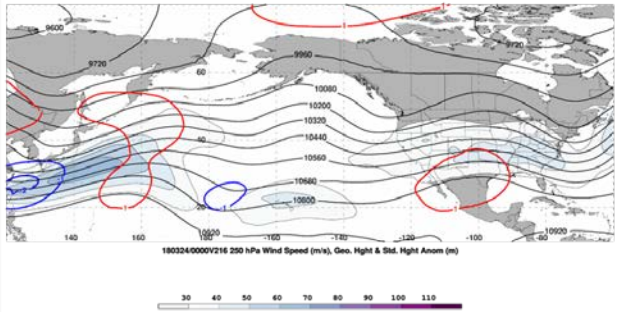


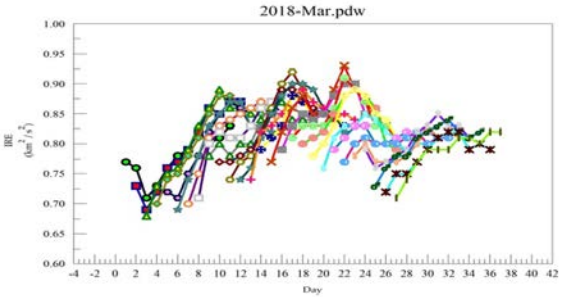
Current phase of MJO and forecast for week 2



Rossby Wave Packet Tool for GEFS (Stony Brook Univerisity)







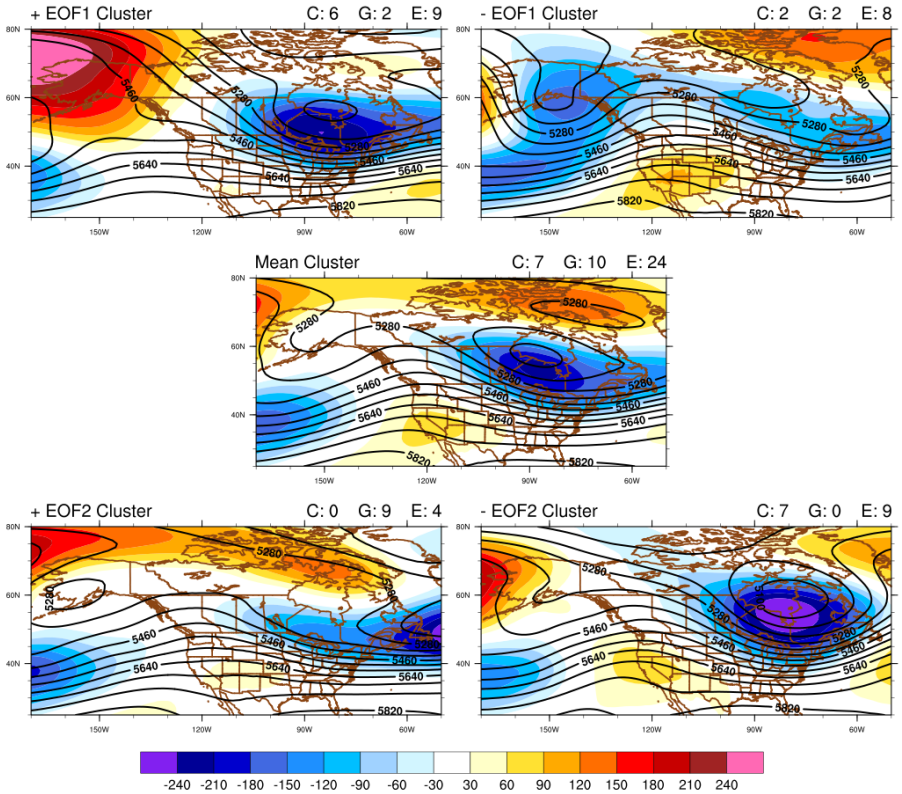
North Pacific Jet (NPJ) Tool (provided by Andrew Winters - University at Albany)

Integrated Regional Enstrophy Blocking Tool (University of Missouri)

Ongoing Work in 2018

- Utilizing ensemble clusters to improve forecaster blend with end goal of improving the NBM
- Event Verification (MET MODE, Anomaly Verification)
- Exploring the benefits of making a weighted forecast blend for each day of Day 8-10 vs. assigning one weight for all 3 days

New Tools for 2018



Cluster Forecasts of 8-10 Day Mean 500 hPa Heights and Anomalies
Initialized 0000 UTC March 27, 2018

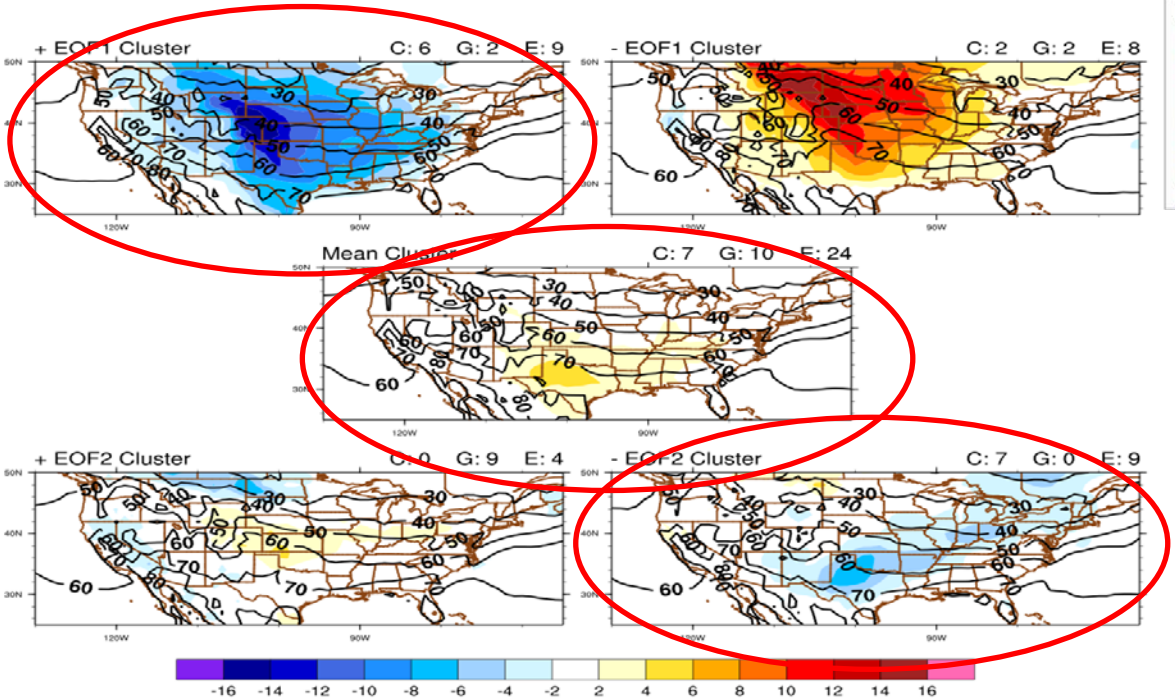
Cluster Tool

EOF1 and EOF2 computed for 500 hPa geopotential height field

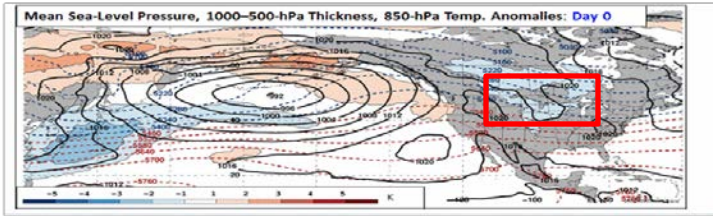
A mean cluster, plus positive an negative sign of each principal component

Forecasters have option to blend individual clusters to make forecast as opposed to ensemble means and deterministic model solutions.

Application of Clusters to Forecast Process



Cluster Forecasts of Day 9 Maximum Temperature (contours) and Difference Between Cluster Mean and 90-Member Ensemble Mean Model Cycle 0000 UTC March 27, Forecast for April 5

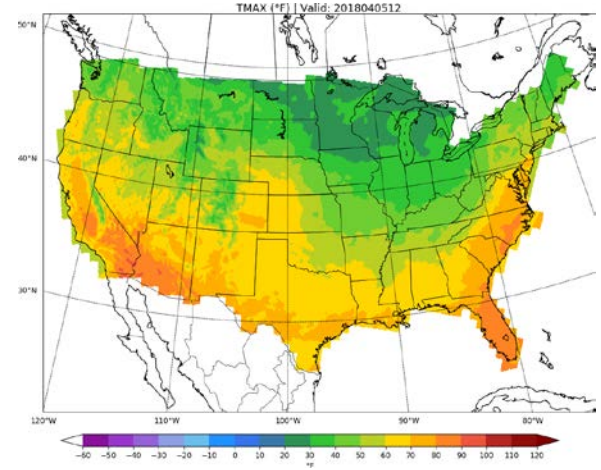


Canonical composite of MSLP, 1000-500 hPa Thickness, and 850 hPa Temperature anomalies

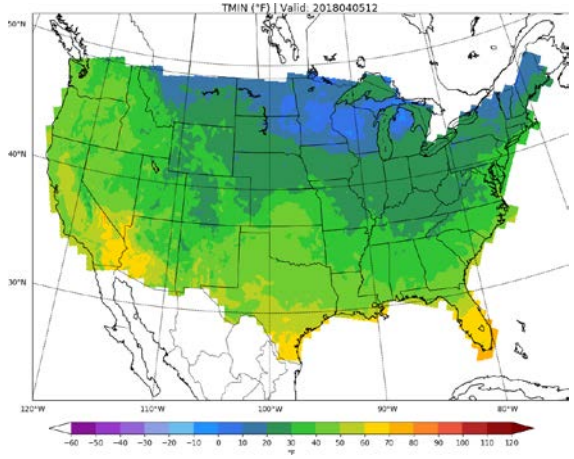
Based on canonical NPJ Tool, the forecast phase space of jet extension, pattern does not support a big warm up for central and eastern U.S.

Therefore the Mean Cluster, EOF1 positive, and EOF2 negative were blended to make the forecast

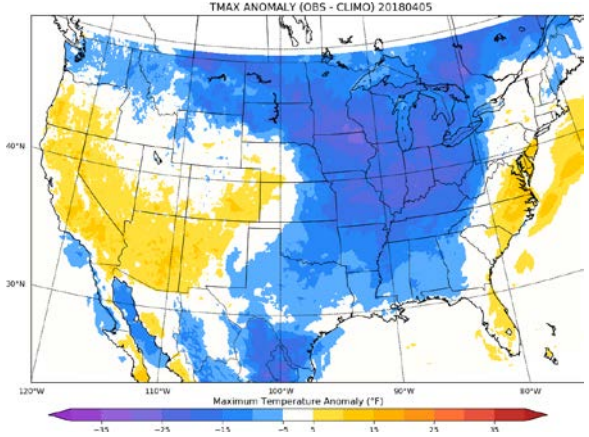
Temperature Observations (URMA) - April 5, 2018



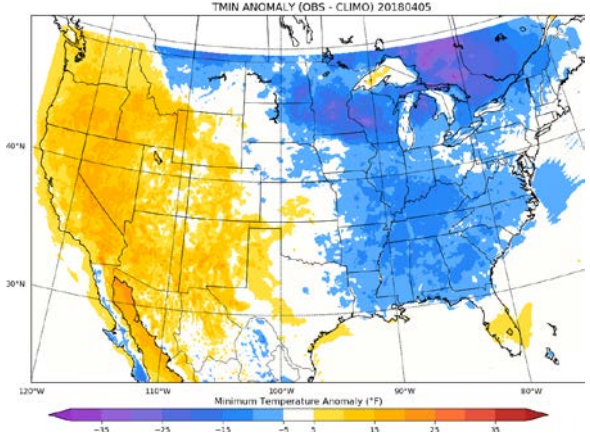
Observed Max Temperatures - April 5, 2018



Observed Min Temperatures - April 5, 2018



Observed Max Temperature Anomalies



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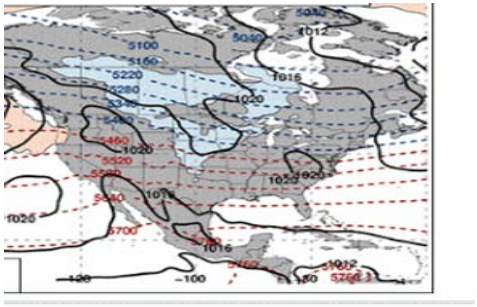
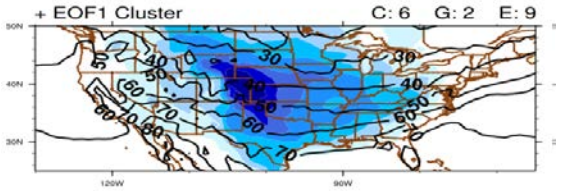
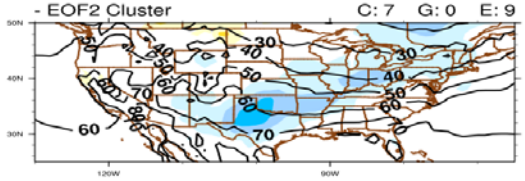


Canonical composite from NPJ Tool
MSLP, 1000-500 hPa Thickness, and 850 hPa Temperature anomalies



EOF +1 Cluster Max Temperature Forecast and Difference from Super Ensemble Mean

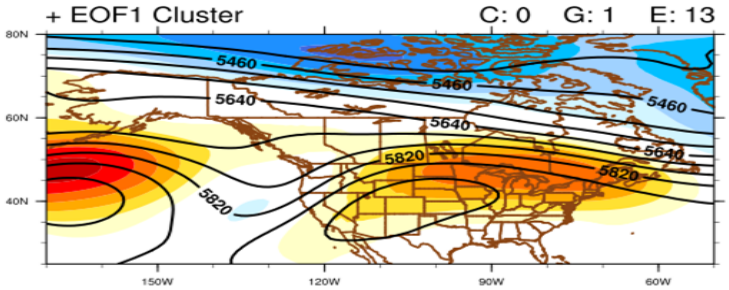


EOF -2 Cluster Max Temperature Forecast and Difference from Super Ensemble Mean

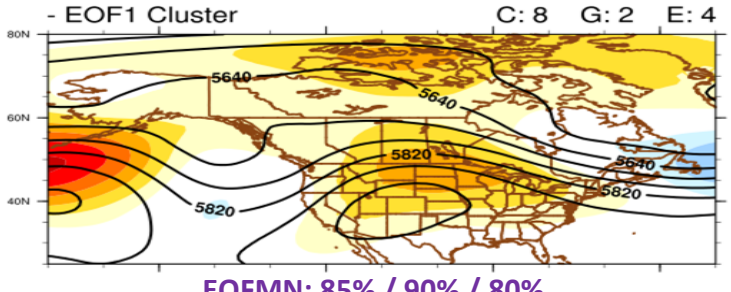
Visual Verification of Clusters

Init: 0000 UTC Jun 28 2018

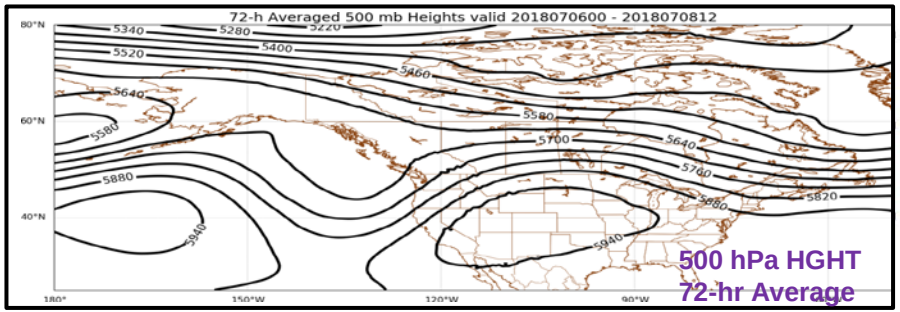
EOF1P: 15% / 10% / 10%



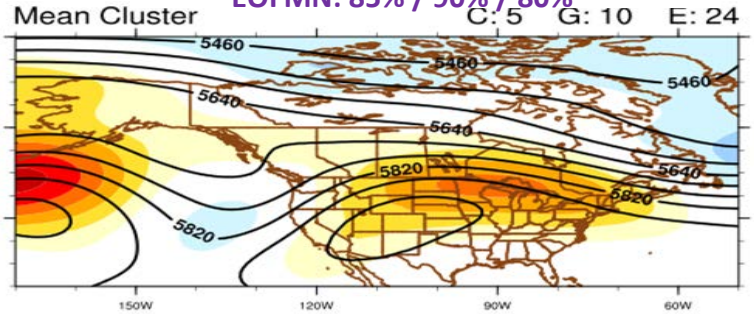
EOF1N: 0% / 0% / 0%

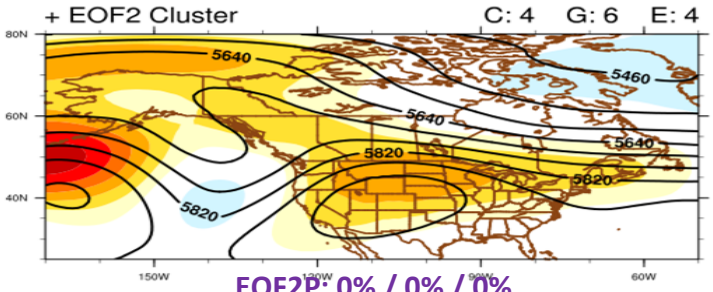


EOFMN: 85% / 90% / 80%

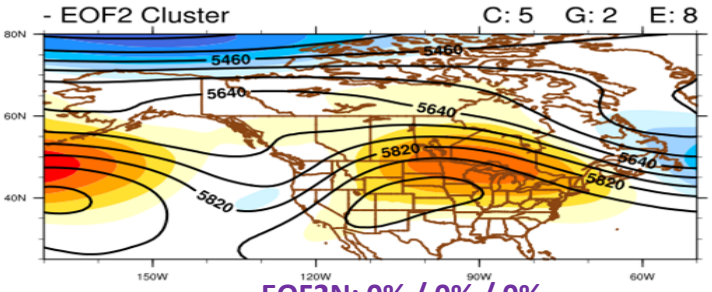


500 hPa HGHT
72-hr Average



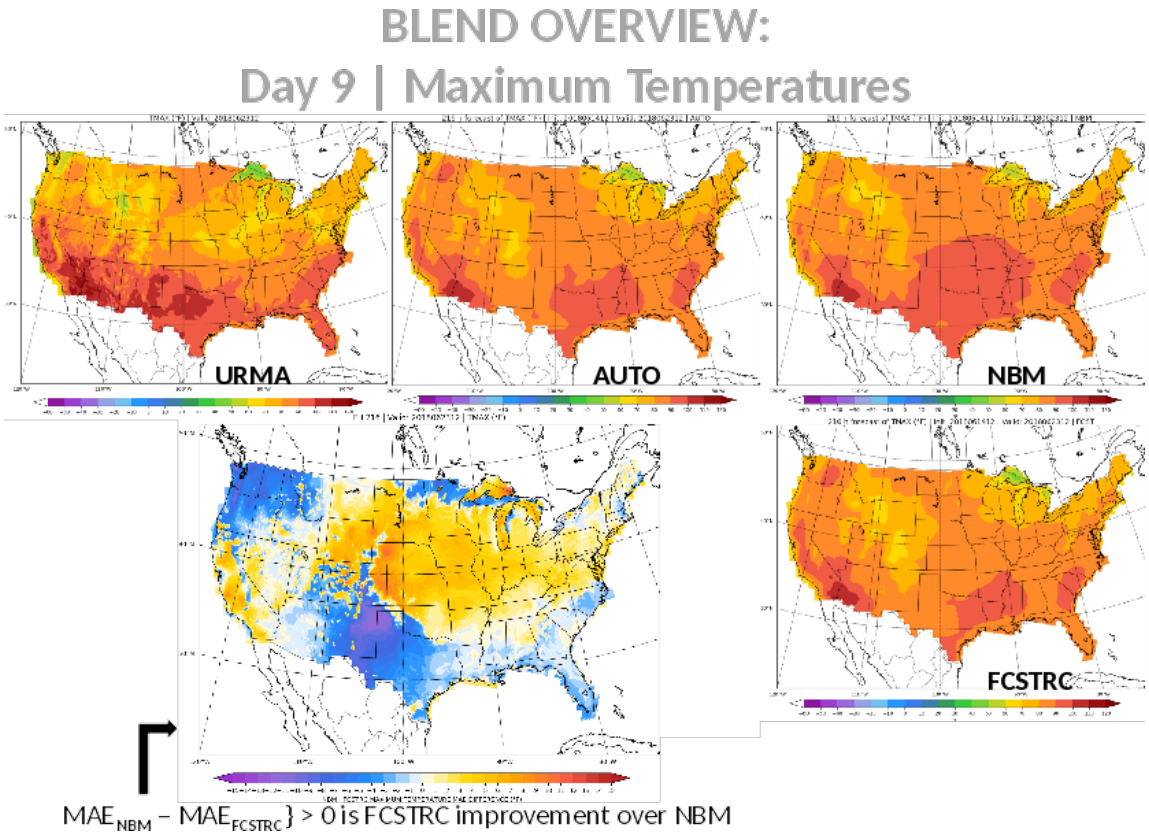


EOF2P: 0% / 0% / 0%



EOF2N: 0% / 0% / 0%

Visual Verification



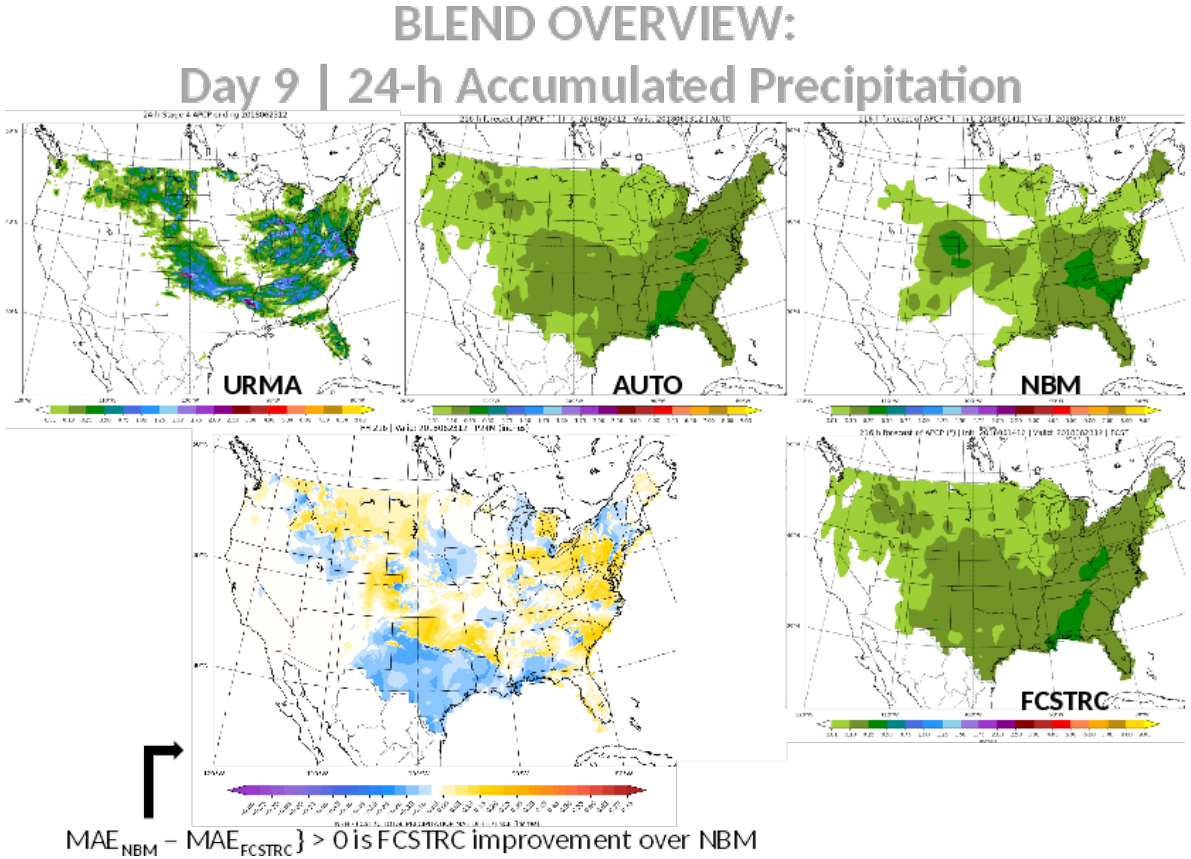
Day 9 Max Temp Verification over CONUS.

Top Row - URMA, Auto Blend, and NBM

Bottom Row - Forecaster Blend and NBM - FCSTR

Gold - FCSTR better forecast
Blue - NBM better forecast

Visual Verification



Day 9 QPF Verification over CONUS.

Top Row - URMA, Auto Blend, and NBM

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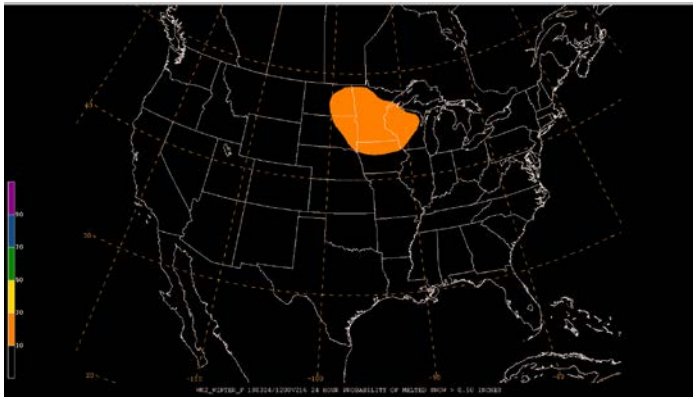
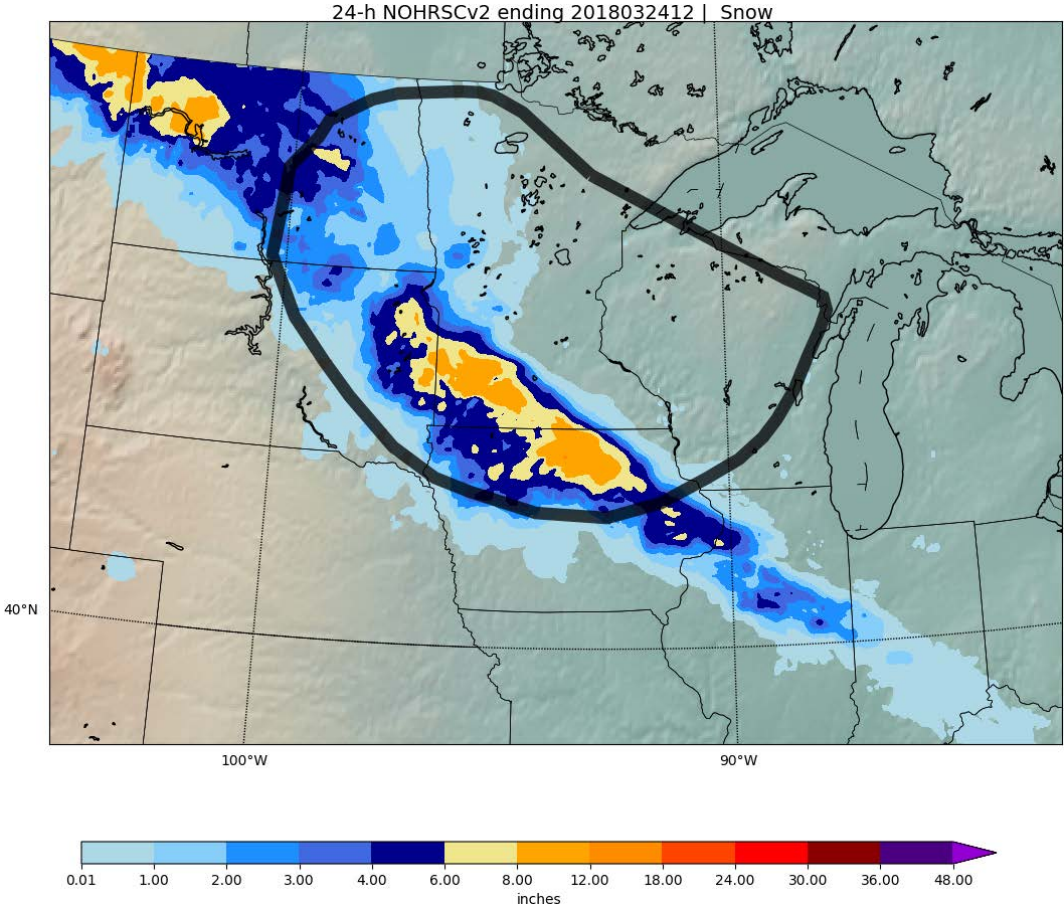
Days 8–10 Anomalous Weather Forecasts



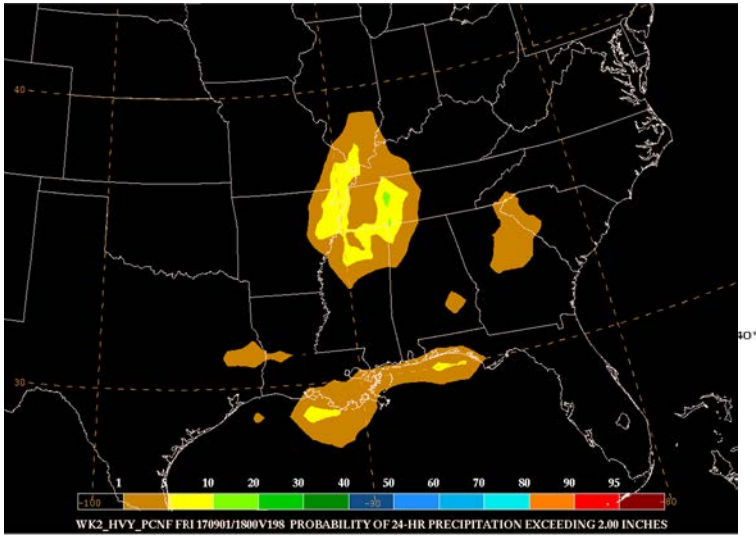
Day 9 Probability of Snow Water Equivalent > 0.5” Based on Forecaster Blend QPF

Days 8-10:
Chance Significant Snow Event > 6.0” in 24h

Day 9 favored and verified

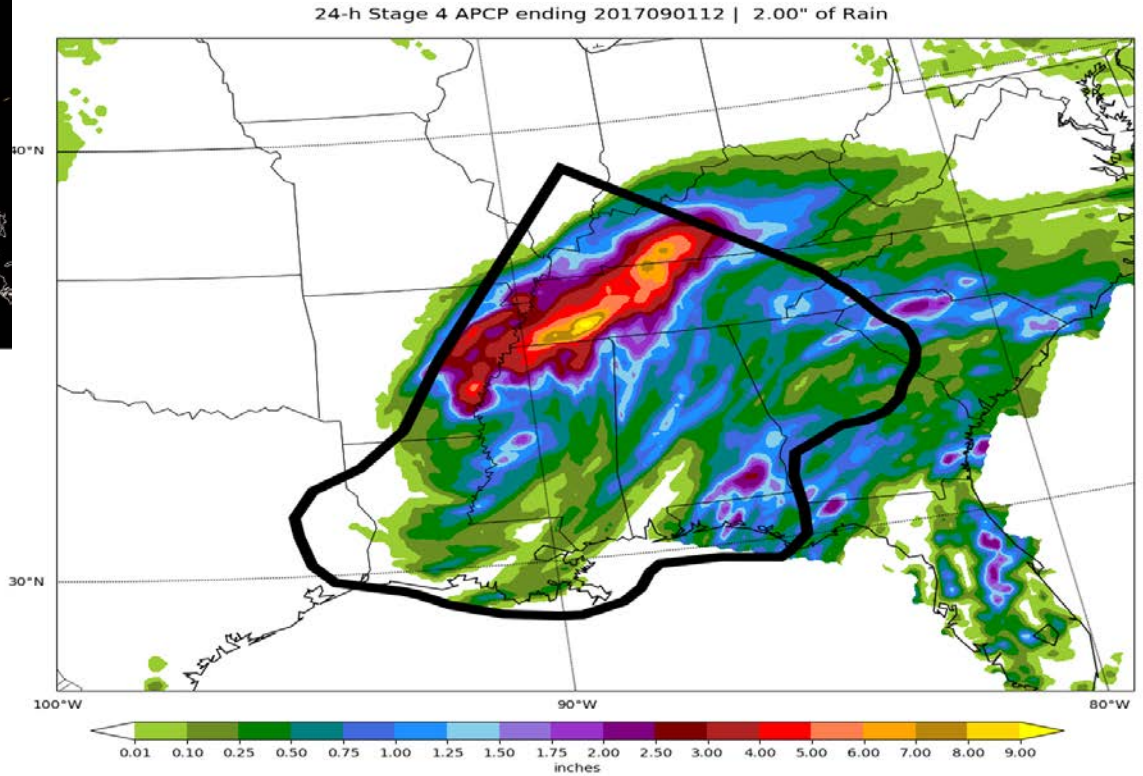


Days 8–10 Anomalous Weather Forecasts



Day 8 Probability of > 2” of Rain in 24-hrs
Based on Forecaster Blend QPF

Day 8:
Chance for 2 inches of rain in 24-hr
VT 12Z September 1, 2017
(remains of Harvey)



Future Work

- Further test formats for depicting extreme weather events (Weather in Context – record, analogues, etc.)
- Further Probabilistic Product Development - winter weather outlook
- Begin training for forecasters to enable application of new tools into the forecast process