SREF Retirement: Not So Fast...

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Why not just turn off the SREF?

- SPC is completely supportive of the move to a unified forecast system (UFS) in NOAA/NWS
- However, we should not abandon an evidence-based decision-making approach to expedite UFS implementation
- Many of the important forecasts, outlooks, watches, and warnings that support the NWS mission of protecting life and property are informed by SREF/NAM/RAP (Days 1-3)
- Lingering issues with PBL thermodynamics in the GFS/ GEFS raise concerns about usefulness in some events

Criteria to Turn off SREF/NAM/RAP

The current operational regional NWP systems with convective parameterization (i.e., SREF/NAM/RAP with grid spacing of 12-16 km) still play an important role in NWS operations for assessing the mesoscale environment for hazardous weather

In order to turn off these systems, there are several key criteria that need to be met by the replacement system:

A. Provide hourly analyses and short-term forecasts that best depict the current state of the atmosphere for situational awareness
B. Produce skillful forecasts (every 6 hours) of boundary-layer thermodynamics out to 84 hours
C. Provide initial/lateral boundary conditions that result in skillful CAM forecasts over the CONUS

B) Boundary-Layer Thermodynamics

Current: Forecast soundings and mesoscale environment from SREF/NAM/RAP are widely examined for hazardous weather events through 84 hours

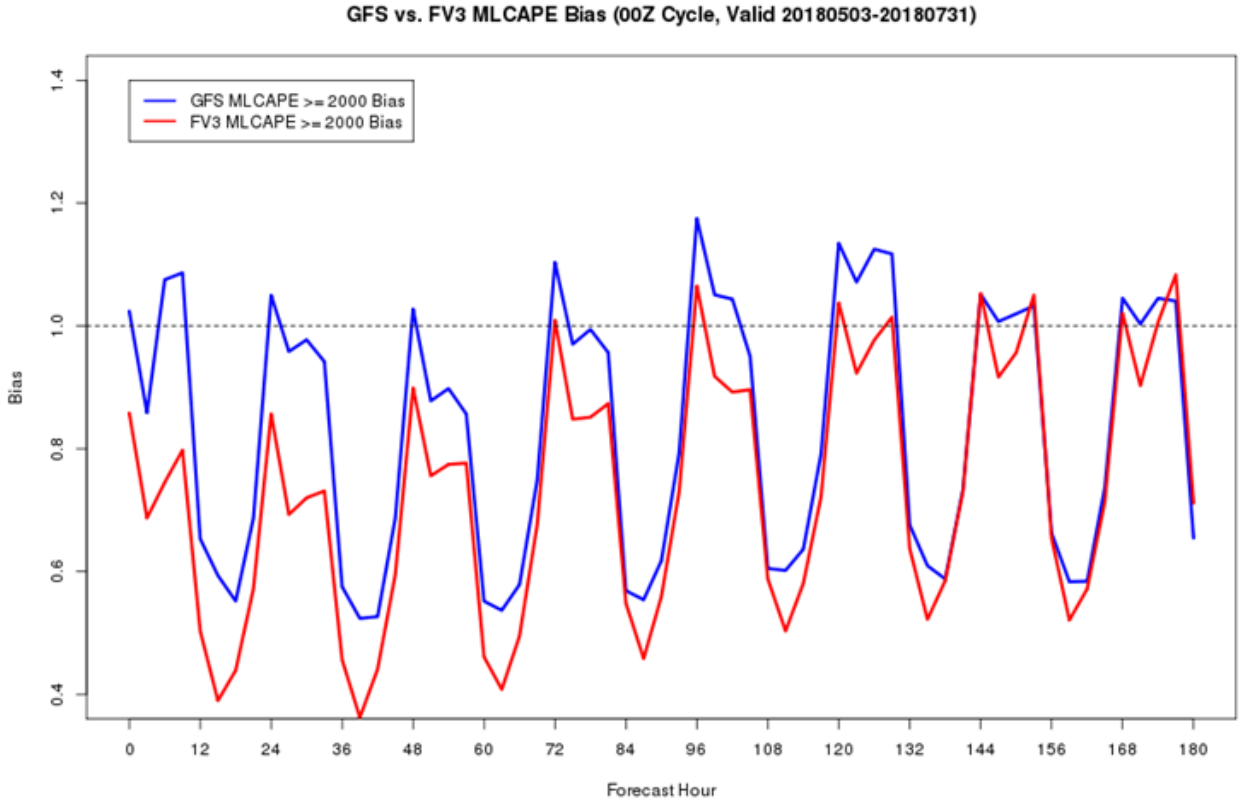
Replacement Options

CAMs: Potential for CAMs to take over this role, but testing and evaluation needed. Concerns: CAM ensemble forecasts would need to extend to 84; fewer members; loading/displaying time in operational forecast systems (N-AWIPS and AWIPS2) is slow

Global: Forecasts of the boundary-layer thermodynamics from the GEFS/GFS have been a long-standing concern of NWS forecasters. The GEFS/GFS boundary-layer forecasts do not currently meet the needs of SPC forecasters on Day 1 and beyond

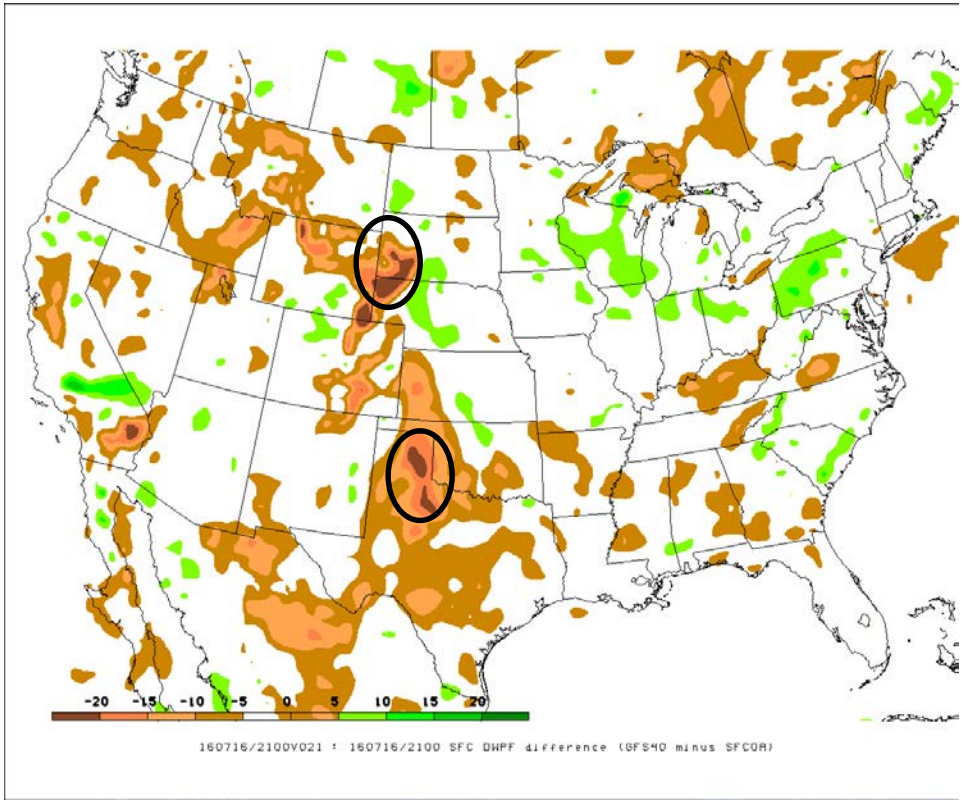
Boundary Layer Thermodynamics: GFS/GEFS

The current GFS and GEFS have a very low frequency bias in instability for unstable environments, especially during the afternoon hours.



Boundary Layer Thermodynamics: GFS/GEFS

The GFS commonly forecasts the boundary layer moisture to be ~20F too dry during the warm season near the moisture gradient.

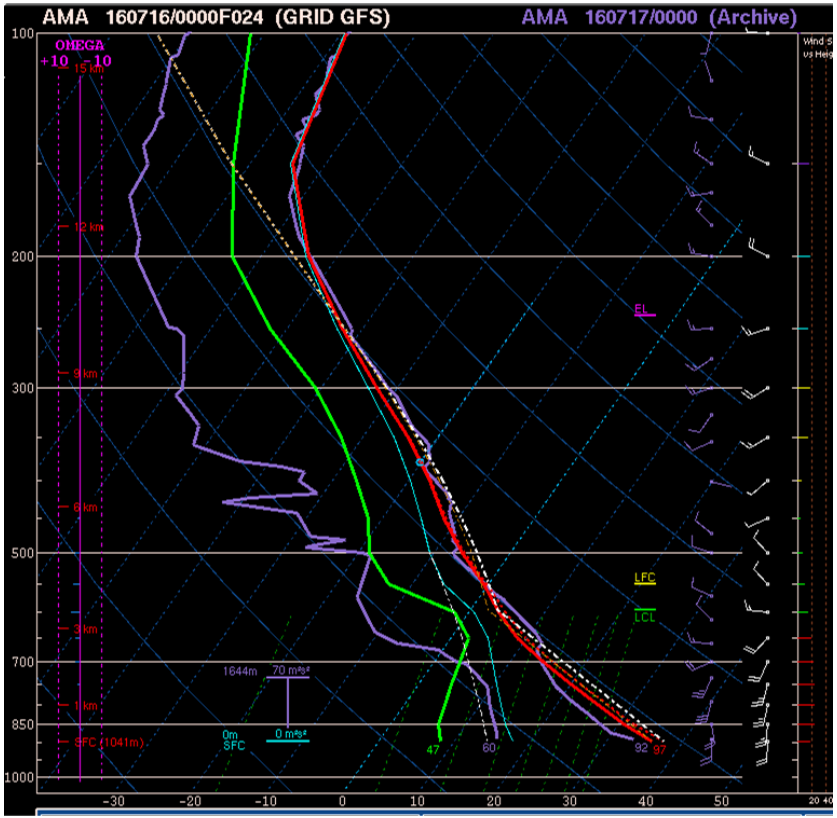


Difference Field: GFS minus RAP-based Analysis

Negative (Dark Brown) difference means GFS too dry (~20 deg F)

Boundary Layer Thermodynamics: GFS/GEFS

At Amarillo, the GFS overmixed the PBL, resulting in conditions that were too warm and much too dry at the surface.



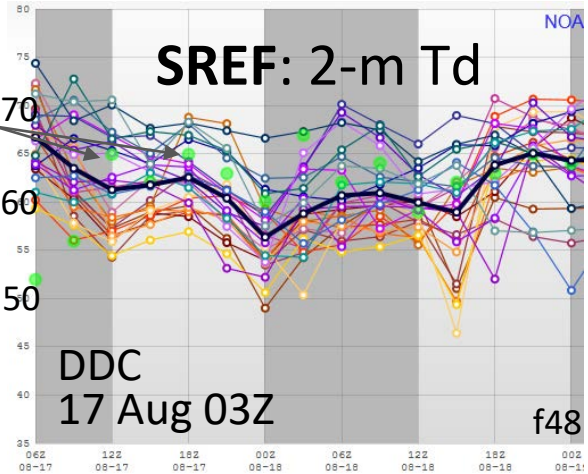
GFS forecast: red/green
Observed: purple

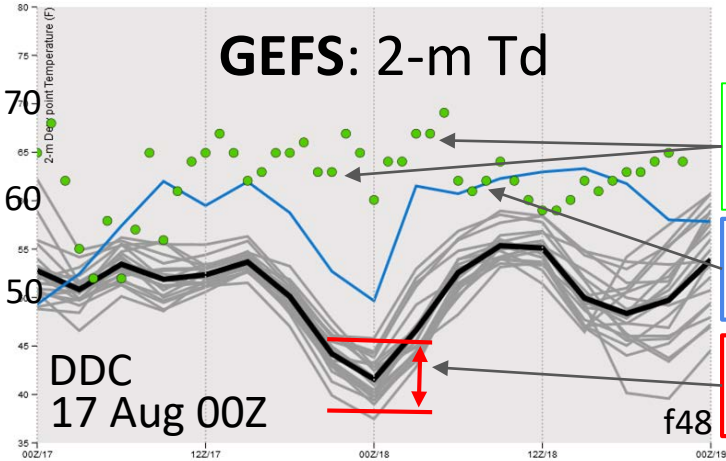
GEFS vs. SREF: Case Study

- Plume diagrams are a quick, easy way to highlight the GEFS issues:
  - **Underdispersiveness**: Little spread in the first few days
  - **Boundary Layer Thermodynamics**: Overmixing of plains PBL in warm season

Obs often fall within ensemble envelope

SREF better captures uncertainty and moisture quality, enabling a better convective forecast



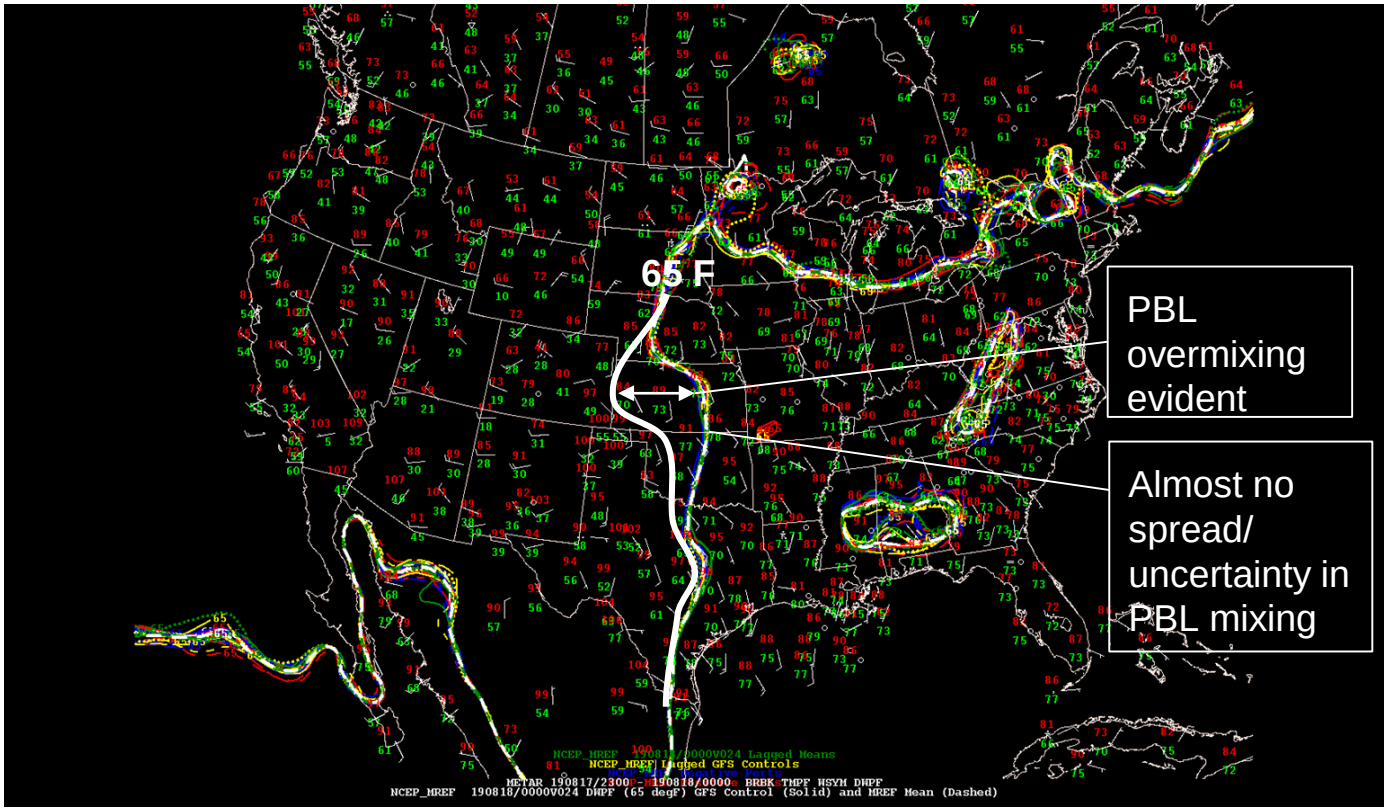


Obs often fall well outside ensemble envelope (too dry)

GFS improvement over GEFS

GEFS spread is too small

GEFS vs. SREF: Case Study



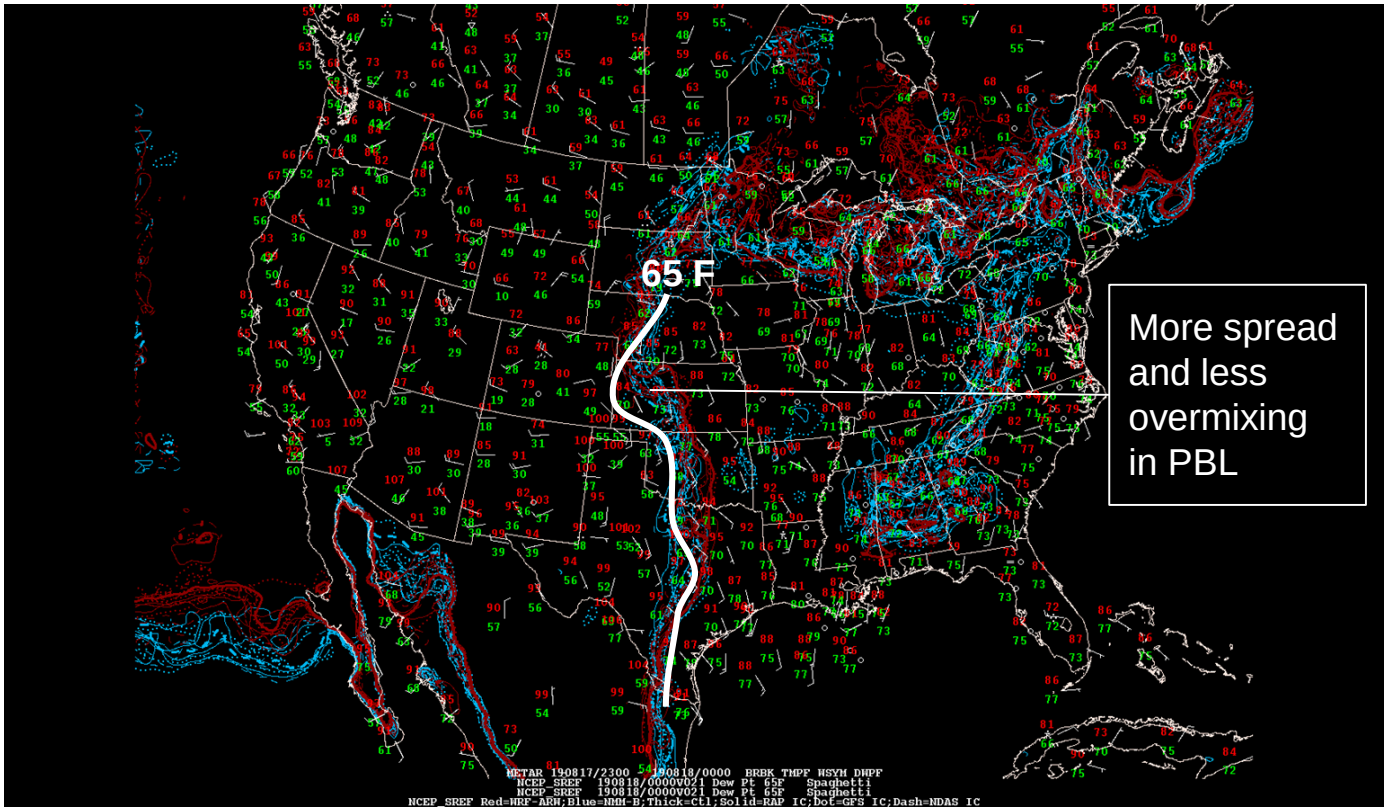
GEFS Forecast

17 August 2019

0000 UTC F024

[SP] 2-m Td: 65F

GEFS vs. SREF: Case Study



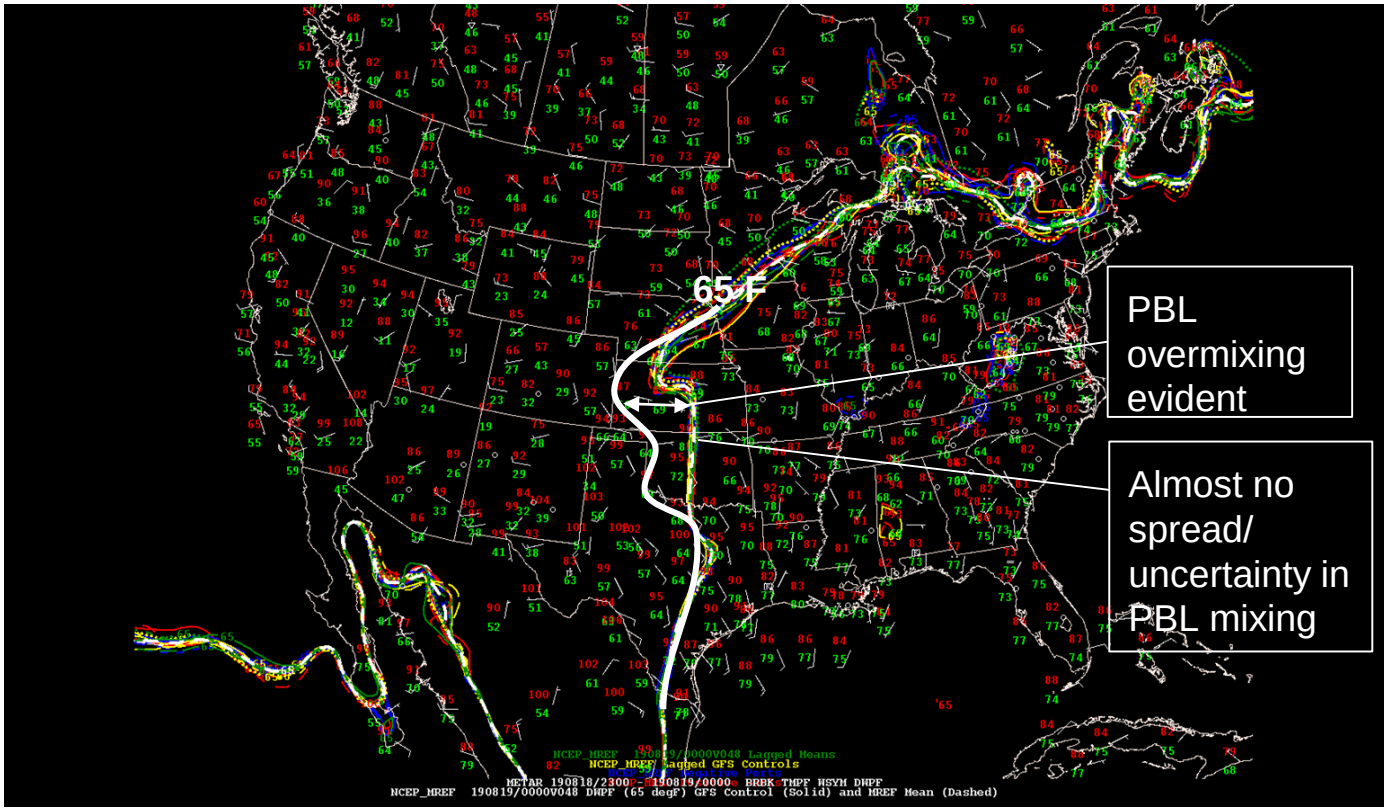
SREF Forecast

17 August 2019

0300 UTC F021

[SP] 2-m Td: 65F

GEFS vs. SREF: Case Study



GEFS Forecast

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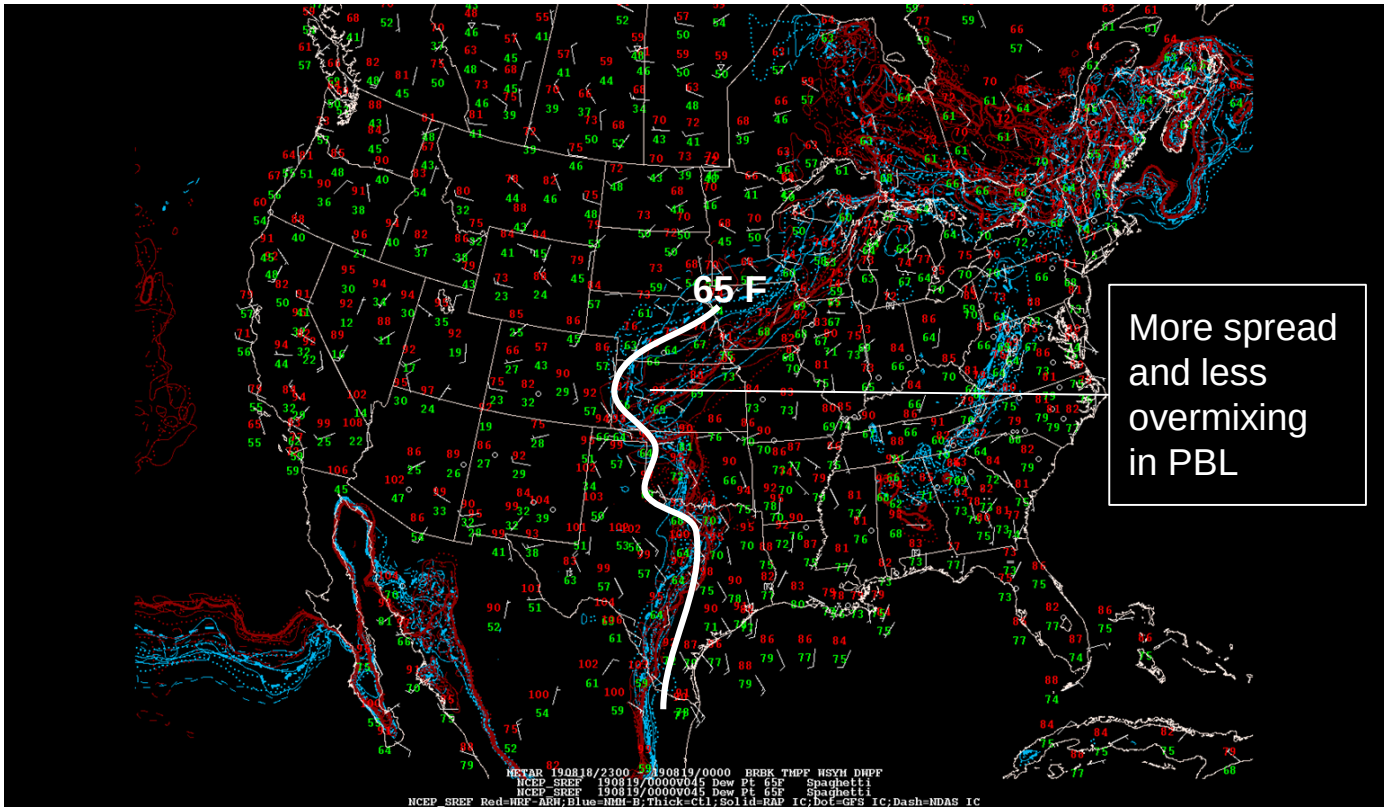
0000 UTC F048

[SP] 2-m Td: 65F

GEFS vs. SREF: Case Study



SREF Forecast

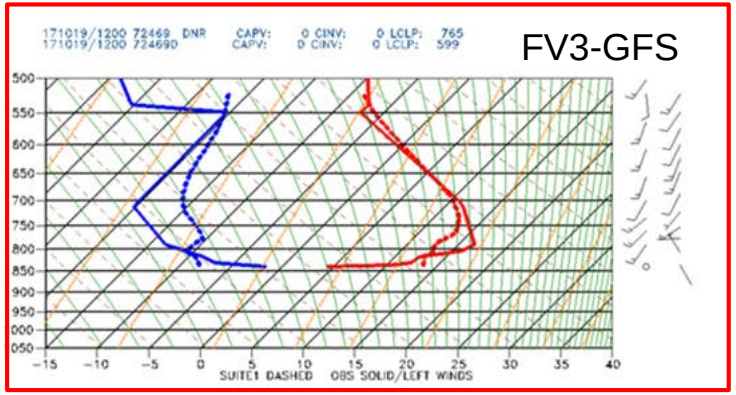
17 August 2019

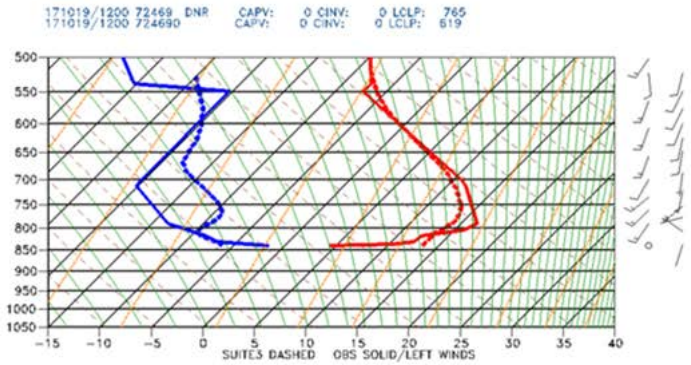
0300 UTC F045

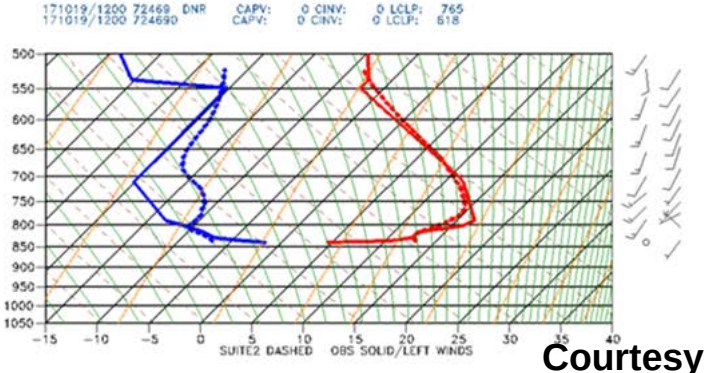
[SP] 2-m Td: 65F

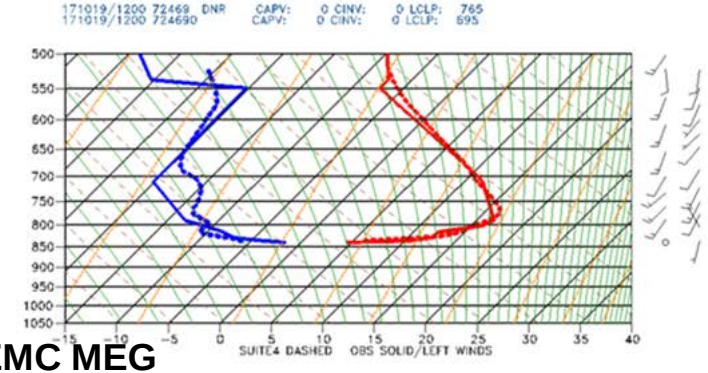
Additional Considerations: Low-level inversions

FV3-GFS struggled the most with inversions of all advanced physics suites tested









Can result in p-type errors for high impact winter weather events

NAM, RAP, SREF often perform better with low-level inversions and difficult p-type forecasts

Courtesy EMC MEG

Additional Considerations: Infrastructure

- Many specialized weather applications/products have been developed from the SREF over the past 15 years: severe weather, aviation weather, winter weather
- Difficult to replicate these applications/products in a short period of time, even if the GEFS performance matched that of the SREF for these applications
- For example, the SPC SREF webpage is widely used for real-time, high impact weather applications and forecasting across the NWS and weather community: