Criteria to Turn Off SREF/NAM/RAP

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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 of boundary-layer thermodynamics out to 84 hours every 6 hours

C. Provide initial/lateral boundary conditions that result in skillful CAM forecasts over the CONUS

A) Analyses and Short-Term Forecasts

Current: RAP provides above-surface information for operationally used SPC mesonalysis for diagnosing mesoscale environment for hazardous weather events

Replacement Options

Regional FV3: Demonstration of similar skill as RAP for analyses and forecasts

CAM: Potential for CAMs to take over this role, but much testing, evaluation, and training needed before ready for operations

Global: The current absence of hourly data assimilation, hourly analyses and short-term forecasts, and assimilation of surface temperature and moisture preclude this as a viable option in the short term

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

Regional FV3: Demonstration of similar skill as SREF/NAM for forecasts of boundary-layer thermodynamics

CAM: Potential for CAMs to take over this role, but testing and evaluation needed. Concerns: CAM ensemble forecasts would need to extend to 84; 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

C) ICs/LBCs for CAMs

Current: NAM and RAP successfully provide initial conditions for SREF and HREF members

<u>Replacement Options</u>

Regional FV3: Demonstration of similar skill from CAM forecasts initialized from NAM and RAP

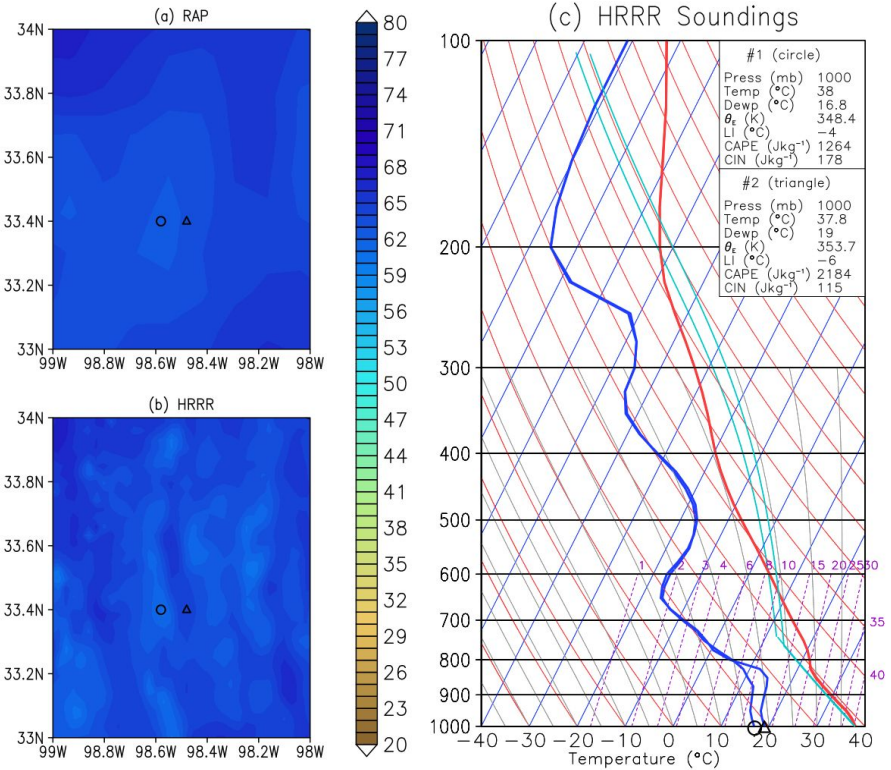
CAM: CAM ensemble DA system adds considerable expense to current cold-start approach without much evidence (yet) of improving forecasts beyond ~6 hours

Global: Cold-start forecasts from GEFS members are an option, but much testing and evaluation would be needed, and thermodynamic issues at initialization would be a concern

Supporting Slides

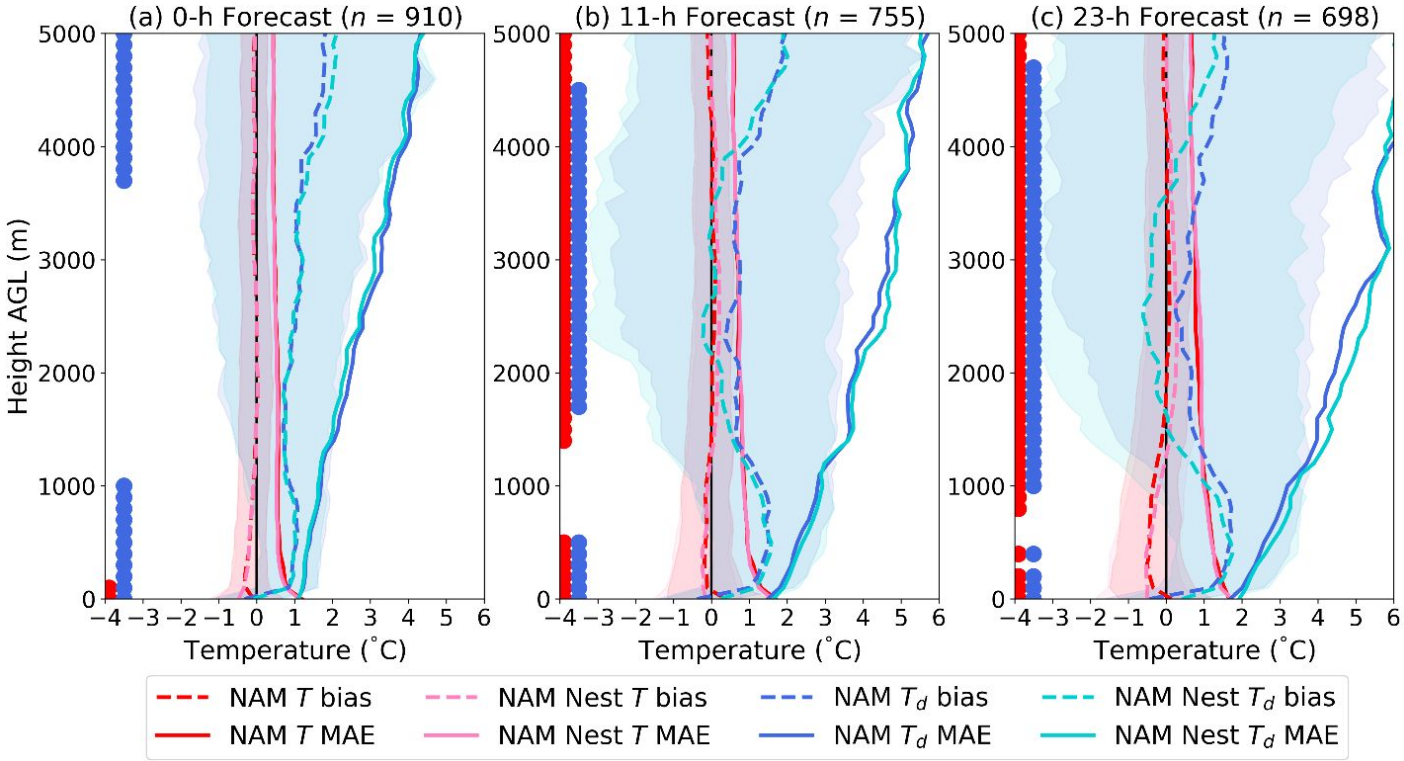
CAM Environment Information

- Clark Evans (UWM) has done some recent work with SPC in comparing analysis and forecast sounding pairs from RAP/HRRR and NAM/NAM Nest
- The small-scale detail & variability (e.g., representation of horizontal convective rolls) in CAMs can be substantial, so smoothing/filtering likely needs to be applied



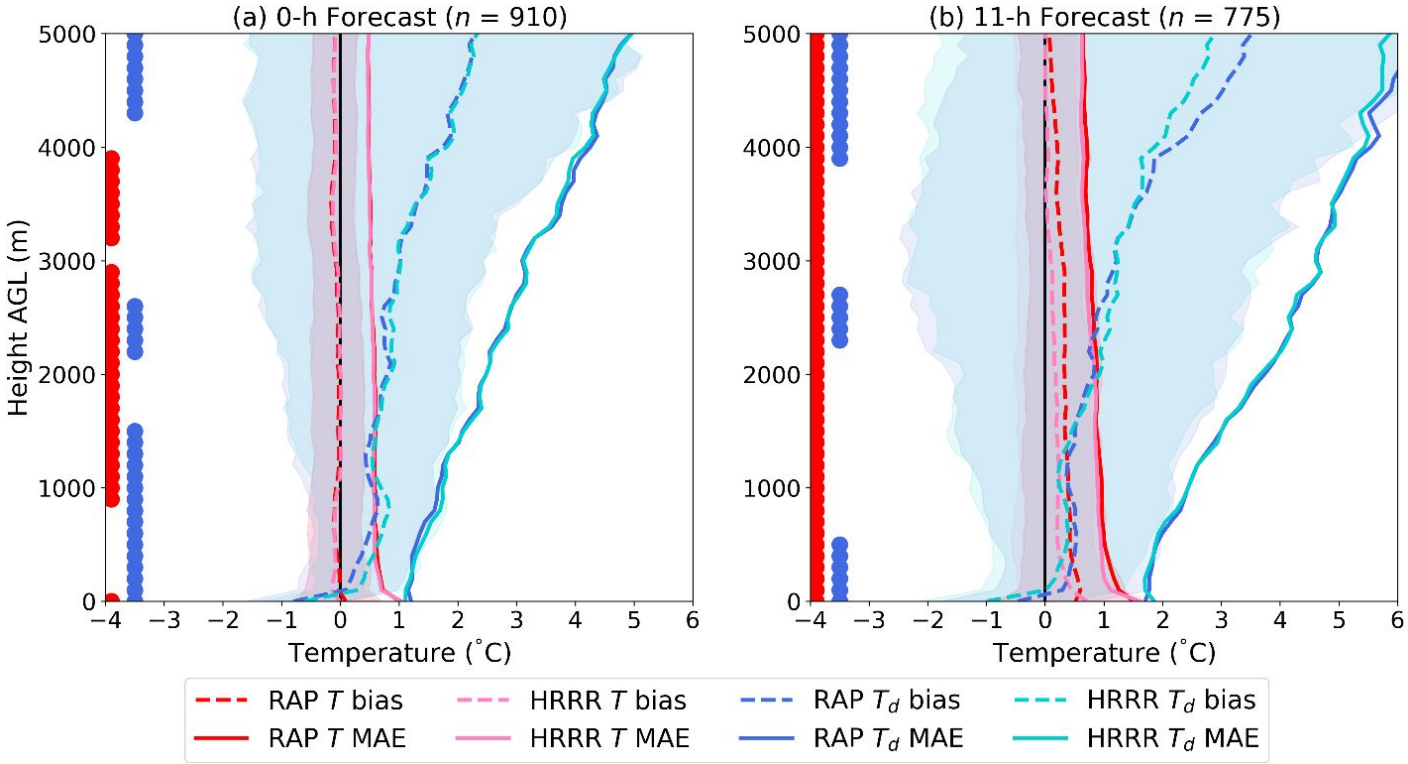
CAM Environment Information

A random sampling of point forecast soundings (from May 2017) reveals that the NAM and NAM Nest have very similar errors and biases.



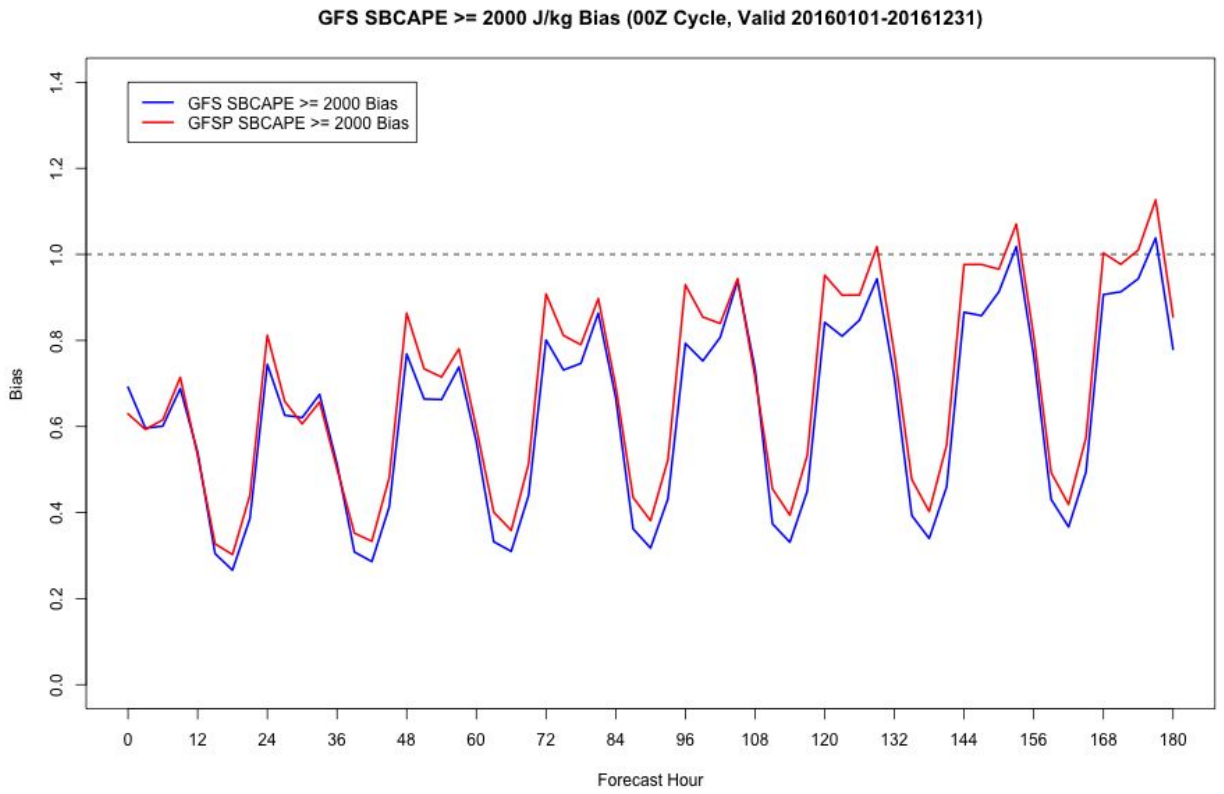
CAM Environment Information

Similarly, the RAP and HRRR have very similar errors and biases to one another (but different from NAM and NAM Nest)



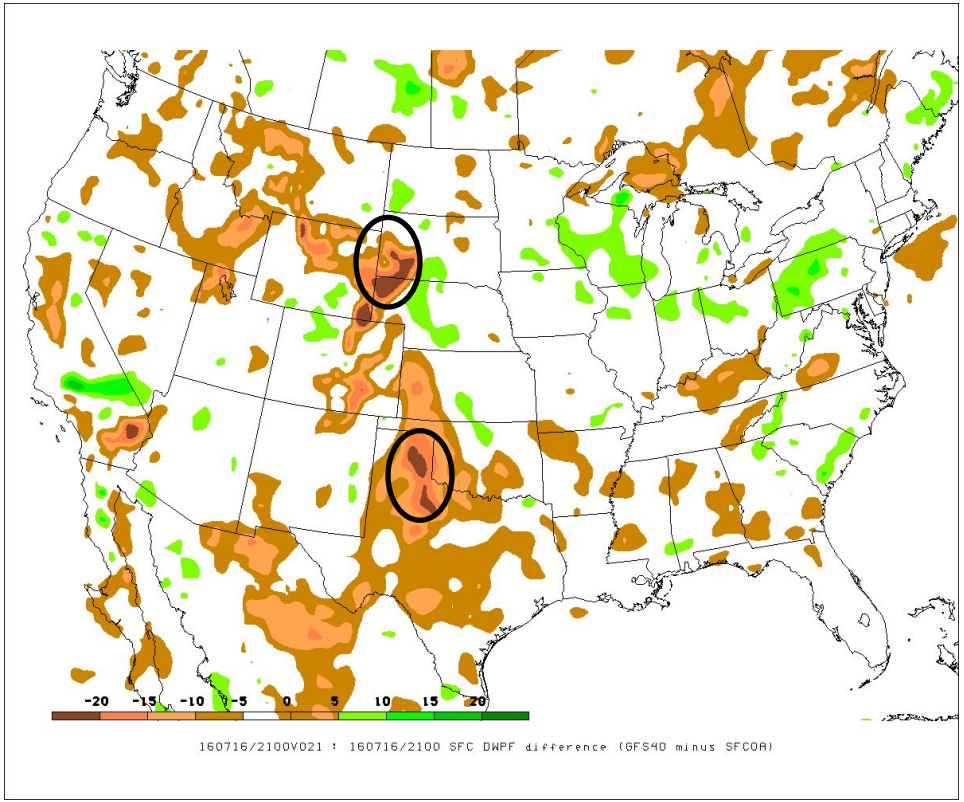
Global Model Environment Information

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



Global Model Environment Information

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

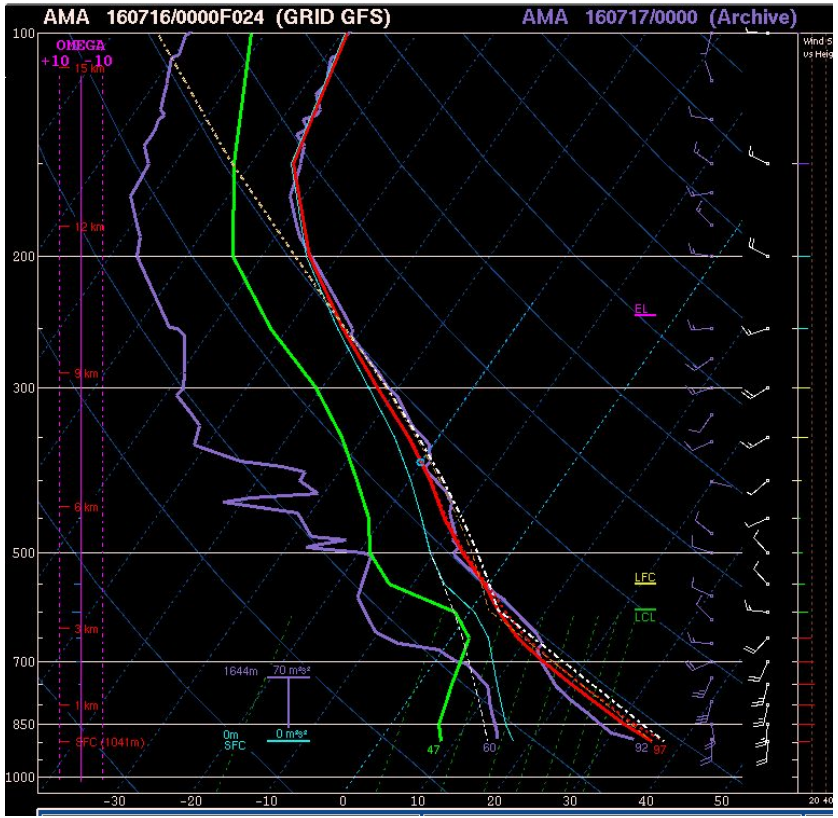


GFS minus sfcOA Difference Field

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

Global Model Environment Information

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



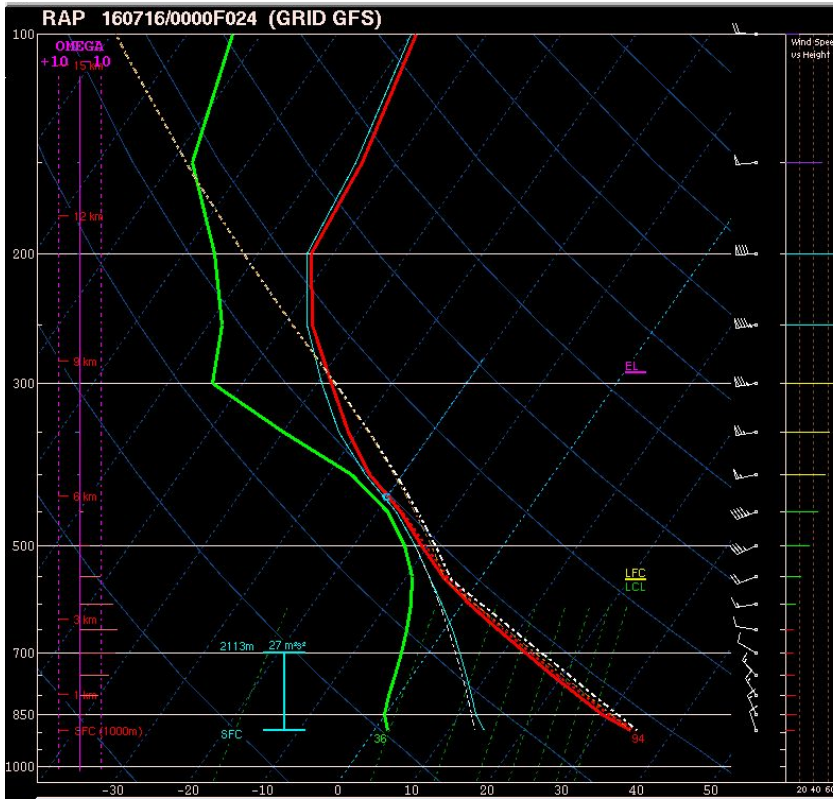
GFS forecast: red/green
Observed: purple

Global Model Environment Information

At Rapid City, similar overmixing in the PBL led to warm, dry bias.

GFS Fcst: 94/36

Observed: 80/60



GFS forecast: red/green