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Decision Brief: Q1 FY2009
Upgrade to NAM/NDAS/DGEX

Mesoscale Modeling Branch

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Brad Ferrier, George Gayno, Zavis Janjic, Dennis Keyser,
Ying Lin, Geoff Manikin, Matthew Pyle, Wan-Shu Wu,
and Jacob Carley (summer visitor now at Purdue)

12 December 2008

where the nation's climate and weather services begin

Changes in NAM/NDAS/DGEX 1: Analysis / Assimilation Changes

- Partial cycling:
 - Use GDAS forecast for atmospheric fields at start (tm12) of NDAS instead of previous NDAS forecast fields
 - Continue to use fully-cycled land-states
- New observations:
 - TAMDAR data
 - Canadian AMDAR data
 - METOP2 data
- Latest GSI analysis code with improved CRTM
- New hi-res AFWA snow depth analysis

Changes in NAM/NDAS/DGEX 2: Model Changes

- Replace the cumbersome WRF-SI (Standard Initialization) with the new faster WRF-WPS (WRF Preprocessing System) and associated REAL codes of WRF version 2.2+
- Radiation: increased absorption for cloud ice and snow
- LSM: two changes related to snow & frozen conditions
- Mixing: vertically mix each hydrometeor species

Changes in NAM/NDAS/DGEX 3: Output Changes

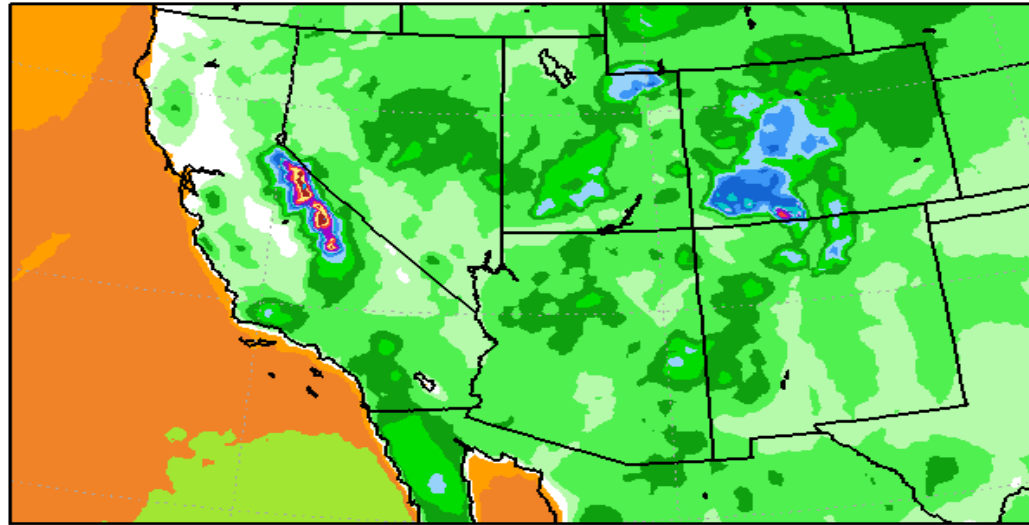
- Add expanded 32-km output grid #151 covering full computational domain containing same fields as grid #221 (req. by AWC/TPC)
- Add Ri-based PBL height, mixed layer depth, and transport u/v wind components to grid #221 (32 km N.America), grid #218 (12 km CONUS), and #242 (11.25 km Alaska)
- Change post to use 2-m temp instead of skin temperature in underground check for lowest freezing level height. (req. by AWC, provided by Hui-Ya Chuang of GWCMB)
- Add snow mixing ratio to 3 grids that had only output cloud ice so that total ice can be computed (for primarily internal use)

Model changes I: Impact of cold-season LSM modifications

Operational NAM

2-m Dewpoint
Temps too low in
Calif. Sierra-Nevada
mountain &
Colorado Rocky
mountains where
Bulk Richardson #
Rib is large (stable)
over snow covered
area.

2-M DEWPT TEMP NA12AQ 21H FCST VALID 09Z 09 JAN 2007

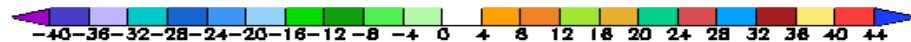
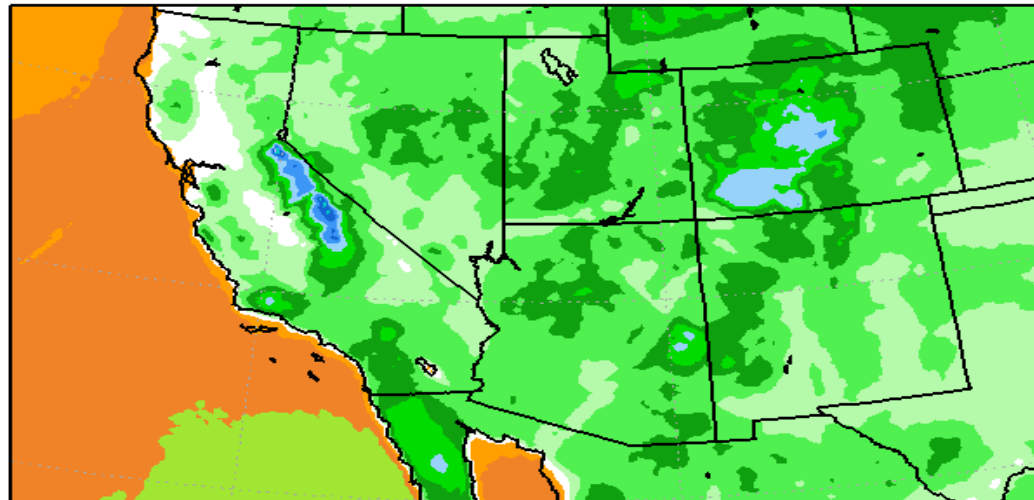


Modified Run:

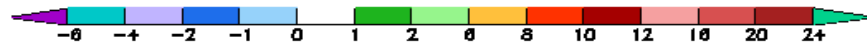
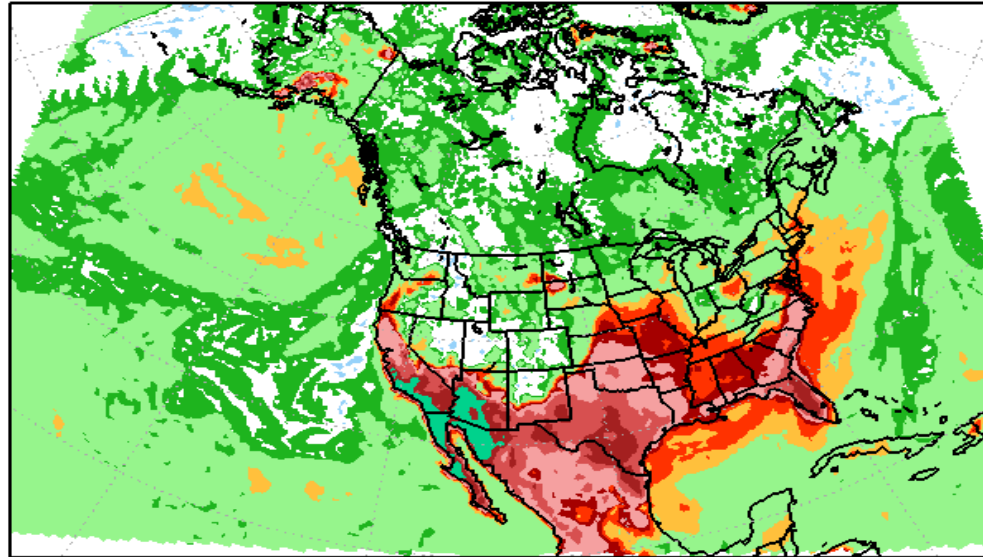
Limit the negative
value of potential
evaporation ETP
(frost fall) on cold
snow covered
ground:

$$ETP = \text{Min}[ETP * (1 - Rib), 0]$$

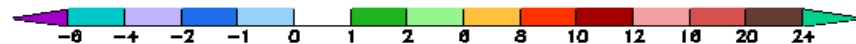
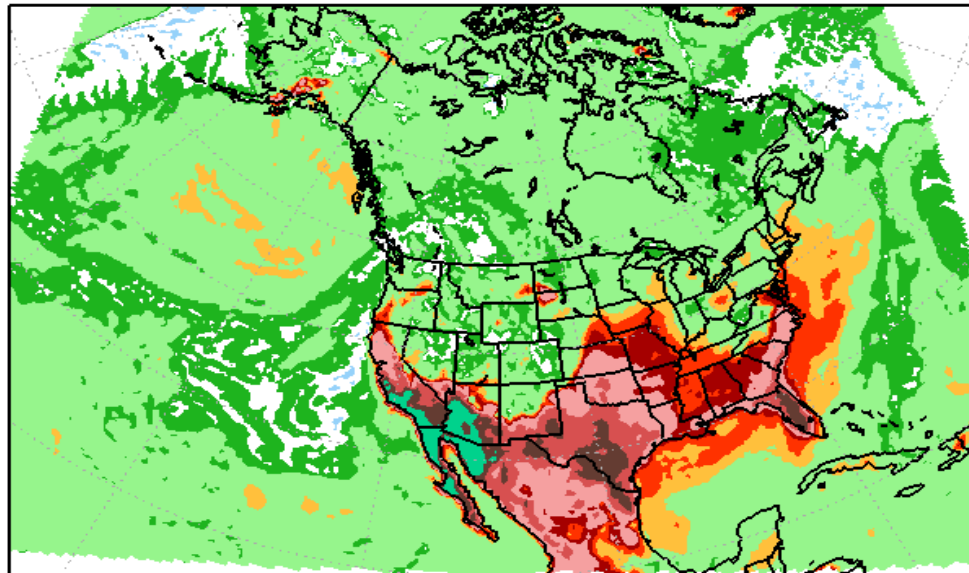
2-M DEWPT TEMP NA12AQ 21H FCST VALID 09Z 09 JAN 2007



2-M T-TD NA12AQ 33H FCST VALID 21Z 09 JAN 2007



2-M T-TD NA12AQ 33H FCST VALID 21Z 09 JAN 2007



Operational NAM

Too foggy (small 2-m T-TD) over daytime, because potential evaporation rises unrealistically as air temperature rises but melting snowpack remains at freezing point.

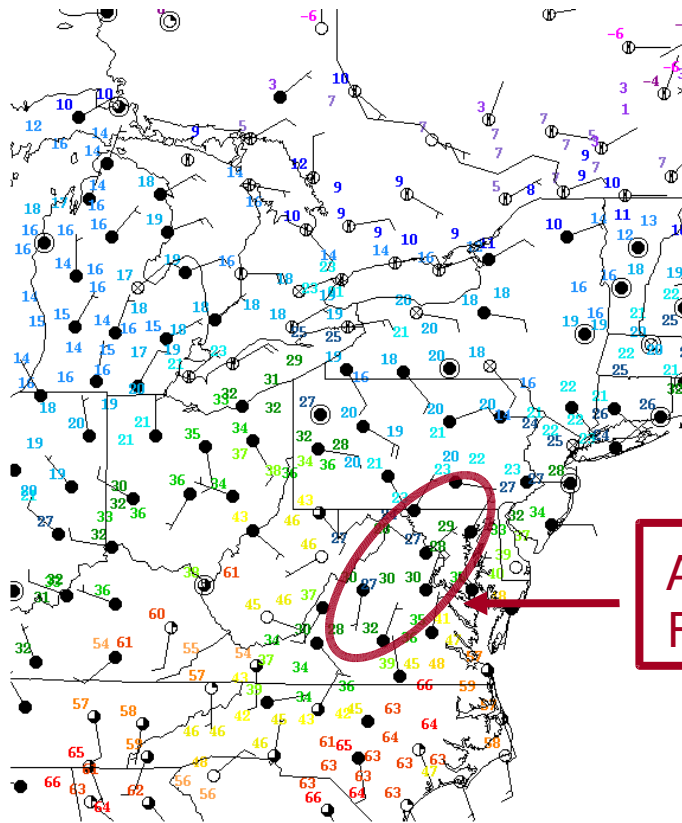
Modified Run:

Rate of change of saturation vapor pressure with temperature over snow
DQSDT2
=DQSDT2*(1.-Snowcover Fraction)

Model changes II: Impact of radiation modification

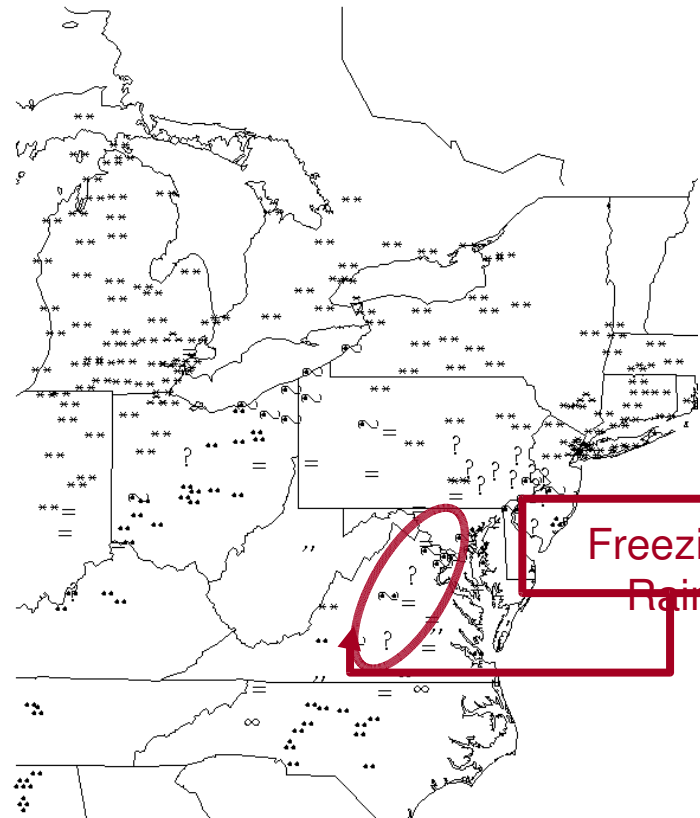
Freezing Rain Case : Impact of Radiation Changes

Observed Conditions at 00z Feb. 13th, 2008



At/Below Freezing

080213/0000 Observed Temperatures (F), Wind

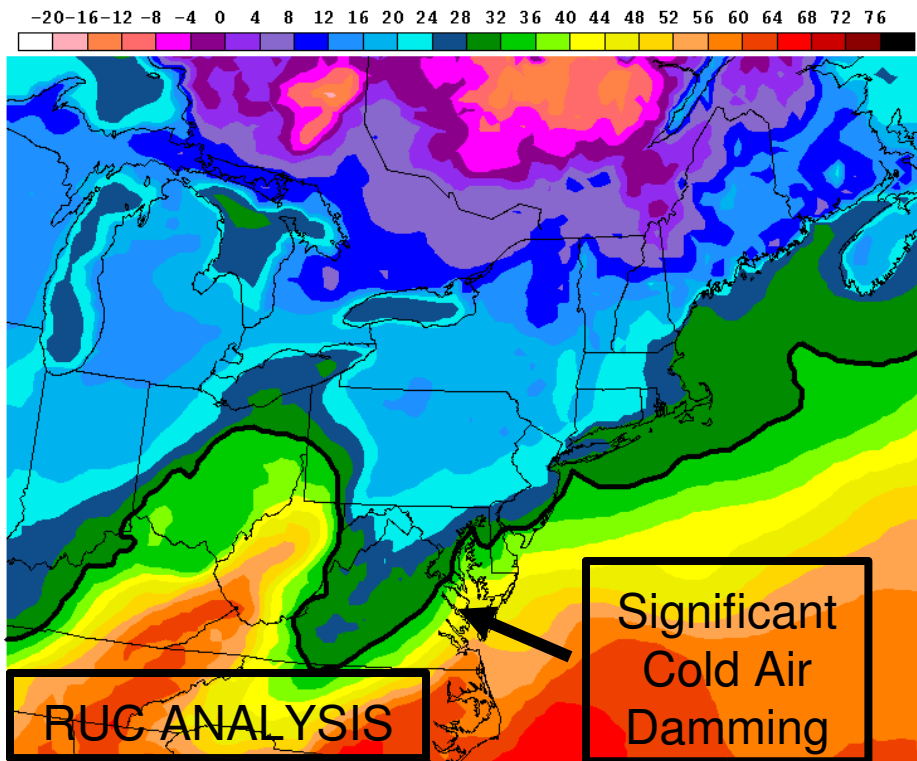


Freezing Rain

080213/0000 Precip. Type

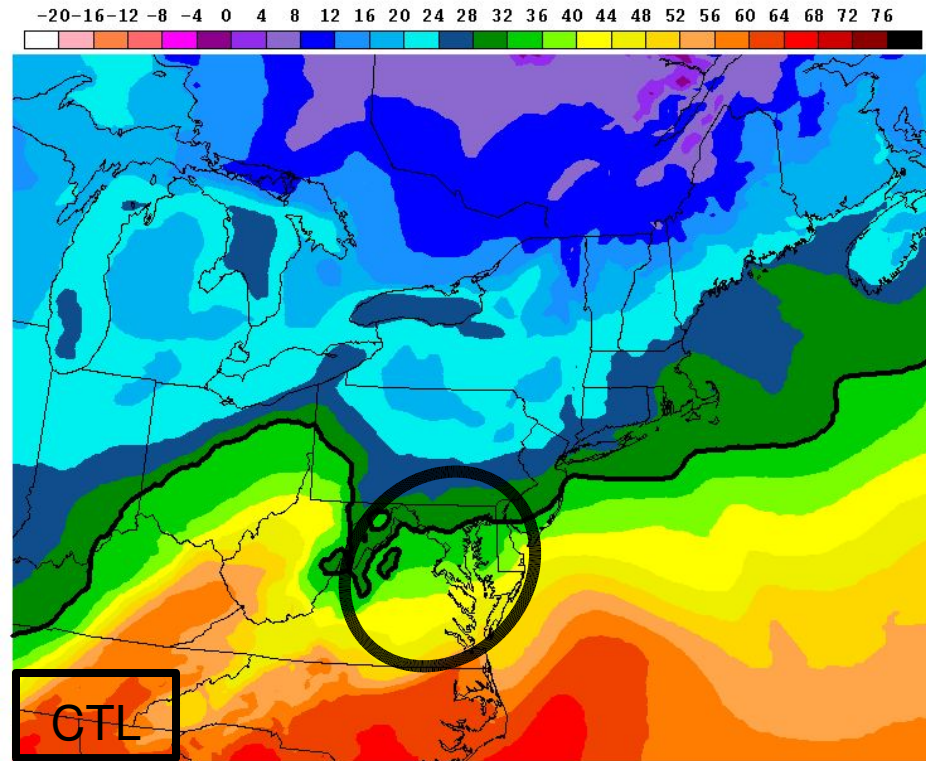
Part I: Freezing Rain Case and Radiation Adjustments

2m Temperature ($^{\circ}\text{F}$): Black line is freezing line



080213/0000V000 RUC 2M Temp (F) 20080213

RUC Analysis of 2mT at 00z Feb. 13th, 2008



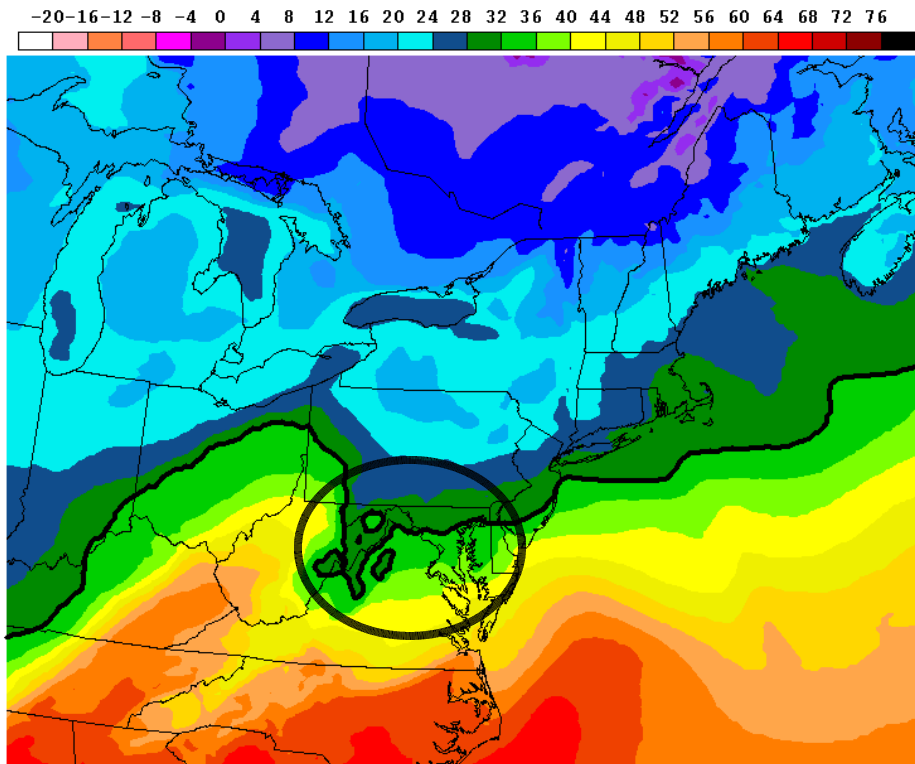
080213/0000V012 CTL 2M Temp (F) 2008021212

Control 12hr forecast of 2mT valid 00z Feb. 13th, 2008

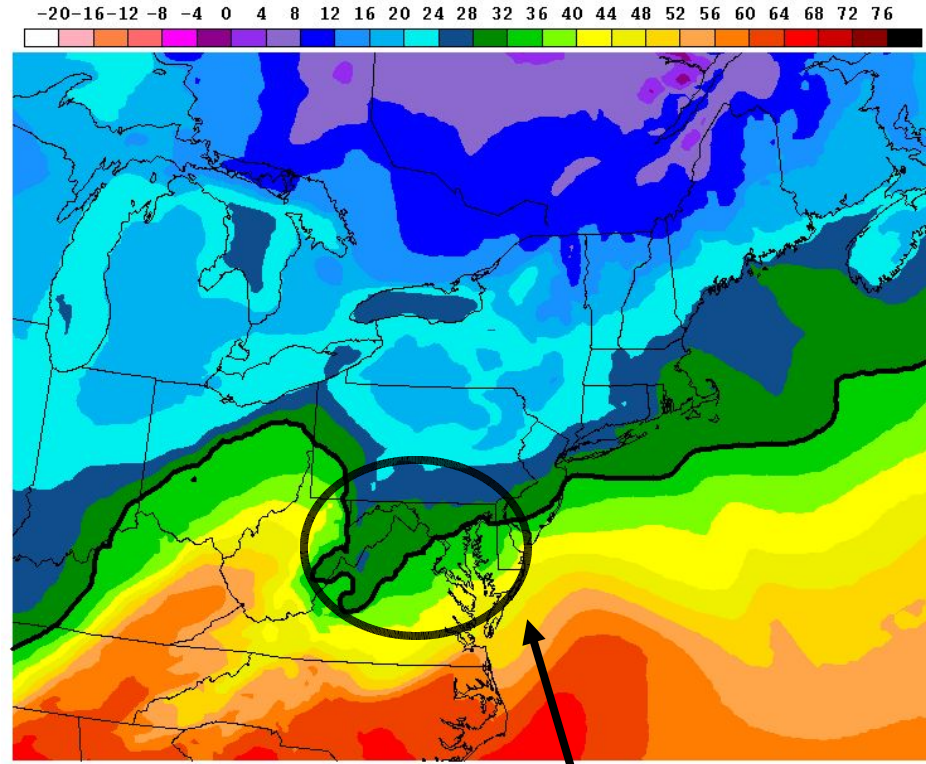
Control used as an analog for the NAM's forecast.

Part I: Freezing Rain Case and Radiation Adjustments

2m Temperature (°F): Black line is freezing line



Control 12hr forecast of 2mT valid 00z Feb. 13th, 2008



Experiment 12hr forecast of 2mT valid 00z Feb. 13th, 2008

More pronounced
damming signature with
radiation changes

AFWA Snow Change George Gayno

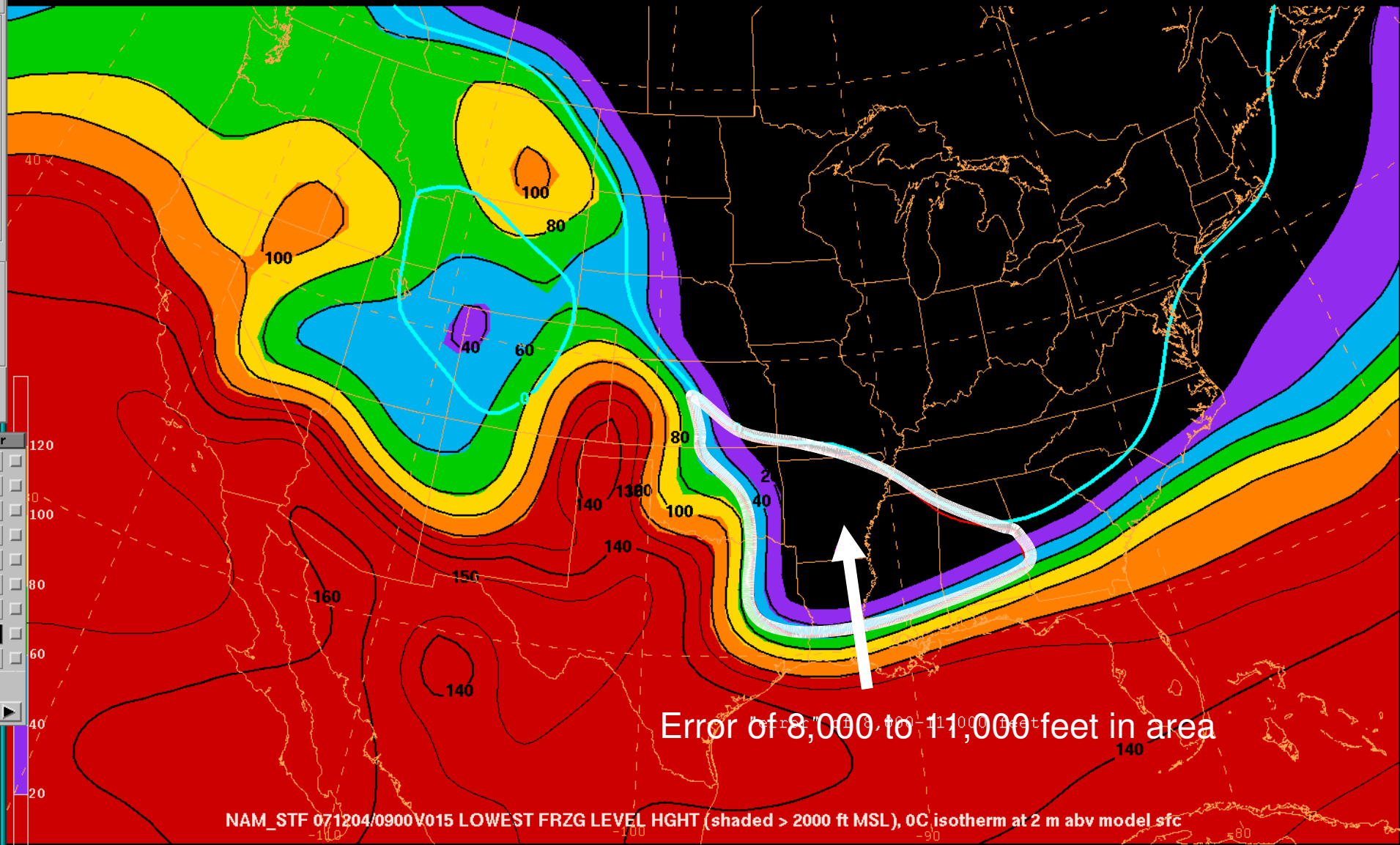
- We need to use 16th mesh data in OPS as
 - (1) The 16th mesh (nominally ~23 km) data is better quality than the current 8th mesh (nominally ~45 km)
 - (2) The 8th mesh data will eventually go away
- Data path is circuitous - NESDIS pulls from AFWA, then NCO pulls from NESDIS
- NESDIS has setup up the dataflow for the 16th mesh AFWA data and NCO is pulling it to CCS in real-time



Loop: 2

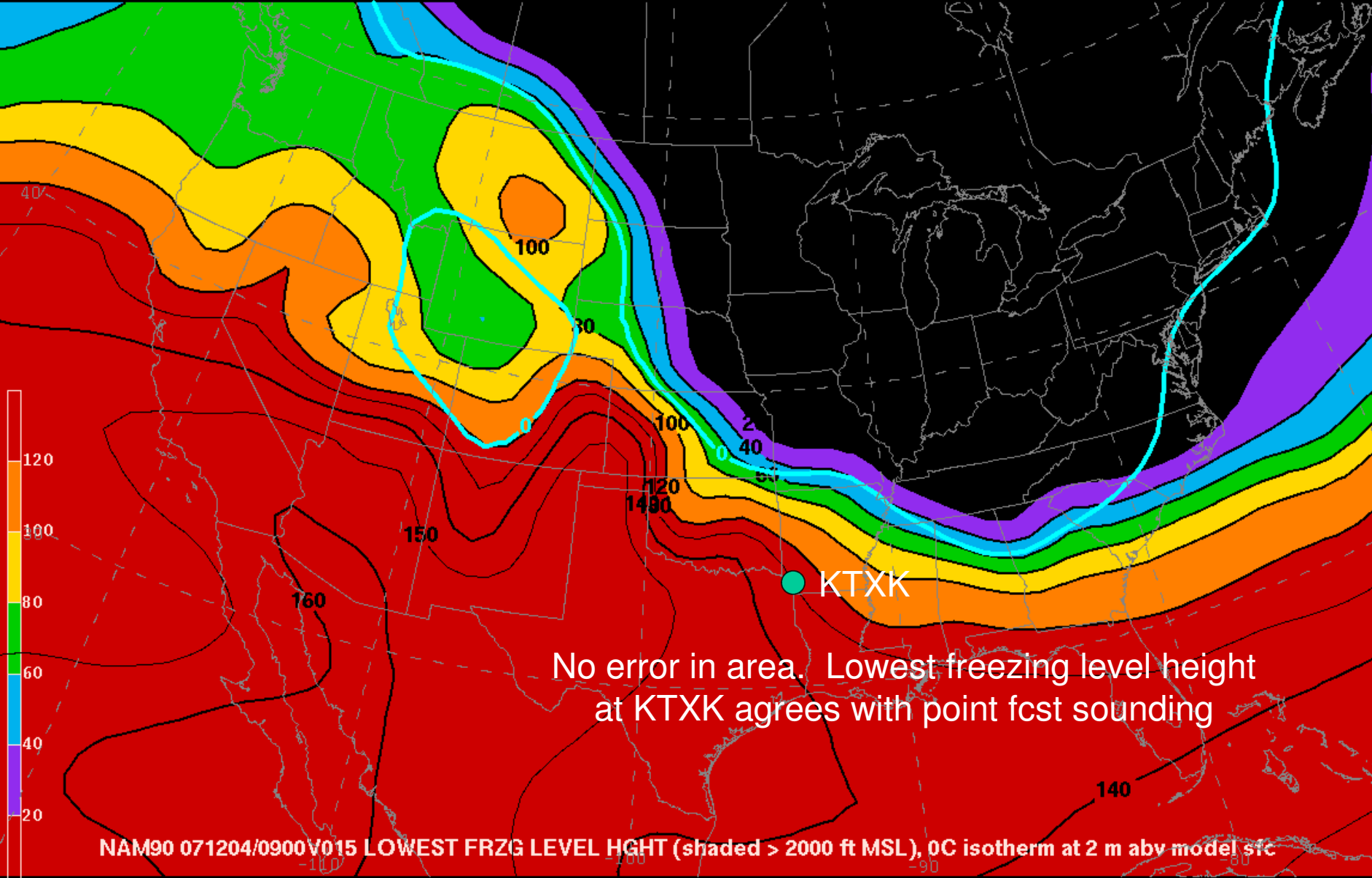


Operational NAM Lowest Freezing Level Height in hundreds of feet (eg 100 = 10,000')



NAM_STF 071204/0900V015 LOWEST FRZG LEVEL HGHT (shaded > 2000 ft MSL), 0C isotherm at 2 m abv model sfc

NAM-PARA Lowest Freezing Level Height in hundreds of feet (eg 100 = 10,000')



No error in area. Lowest freezing level height at KTXK agrees with point fcst sounding

NAM Parallel Page

Extensive Component Testing

Parallel Experiment Name	Slot	Cntrl	Start date	End date
<u>North American WRF-NMM with various physics and/or analysis changes</u>	NAMX	NAMEXP until 00z 8/12/08, NAMY thereafter	2008/07/14/12Z	ongoing
<u>North American WRF-NMM with various physics and/or analysis changes</u>	NAMR	NAMY	2008/07/01/12Z	2008/08/01/00Z
<u>North American WRF-NMM with use of GDAS first guess for on-time GSI analysis</u>	NAMR	NAMY, ops NAM	2008/05/21/00Z	2008/07/01/00Z
<u>North American WRF-NMM with various physics and/or analysis changes</u>	NAMEXP	Ops NAM, NAMY (from 12z 7/14)	2008/03/31/18Z	2008/08/12/00Z

Rogers – Early Test Result Pages

- 1) **NAMY = full bundle**, NAMX = full bundle minus radiation and LSM change
http://www.emc.ncep.noaa.gov/mmb/mmbpll/pll12stats_namy_01aug08-31aug08_3mods/
- 2) http://www.emc.ncep.noaa.gov/mmb/mmbpll/pll12stats_namp_retro_26feb07-13mar08/ (March 2007 retro test of bundle)
- 3) http://www.emc.ncep.noaa.gov/mmb/mmbpll/pll12stats_namexp_namy_18dec07-20mar08/ : Clean test of partial cycling
is NAMEXP (current NAM, full cycling) vs NAMY (current NAM, partial cycling)
- 4) http://www.emc.ncep.noaa.gov/mmb/mmbpll/pll12stats_namy_01apr08-13jun08/ :
NAMY=partial cycling, TAMDAR/AMDAR

Other pages from 2 week test of physics prior to 31 July meeting:

http://www.emc.ncep.noaa.gov/mmb/mmbpll/pll12stats_namx_18jul08-27jul08/ (ops
NAM vs NAMX, test of LSM changes in NAMX)

http://www.emc.ncep.noaa.gov/mmb/mmbpll/pll12stats_namexp_18jul08-27jul08_3mods/ : NAMEXP vs NAMY = test of new radiation (in NAMEXP)

Ferrier Testing of New Shallow Convection Scheme

- Series of shallow convection changes, from which we settled on the "swapsoft22" (at <http://www.emc.ncep.noaa.gov/mmb/bf/bmj/>). This page has a link to the description summarizing each of the cases (i.e., the "case descriptions" you noted below) are at <http://www.emc.ncep.noaa.gov/mmb/bf/bmj/summary.html>.
-
- The radiation change (increased cloud absorption) along with the shallow convection change (<http://www.emc.ncep.noaa.gov/mmb/bf/rad/>), with the control being the shallow convection change.
- The LSM changes were tested (<http://www.emc.ncep.noaa.gov/mmb/bf/lsm/>) with the shallow convection + radiation changes with the control being the previously listed item. Further, it unfortunately included the now-obsolete change relating the uptake of water from roots to root zone soil temperatures over deciduous broadleaf forest.
- All 4 of the previous items were compared against each other over Alaska (<http://www.emc.ncep.noaa.gov/mmb/bf/alaska/>).
- These pages are essentially *stained by the shallow convection change evaluation*, and to a lesser extent *the root zone changes to the LSM evaluation*. Most of these were completed by mid July, except for the shallow convection evaluation that included soundings and forecast CAPE comparisons available to SPC through the "summary link" (2nd link in item #2), which was finished in early August.

That said, using some common sense and screening results to mostly cool season conditions and focusing on the Alaska statistics where shallow convection was not very active, one can conclude the following:

- The radiation change most dramatically improved surface temperature forecasts ([00Z runs for T](#), [12Z runs for T](#), [00Z runs for Tdew](#), [12Z runs for Tdew](#)) over CONUS.
- Over Alaska, the radiation change was colder than the other runs ([00Z T](#), [12Z T](#), [00Z Tdew](#), [12Z Tdew](#)).
- Despite the flaws and caveats, the results from these runs are consistent with what Eric showed today. While the NAMy is cooler over Alaska now, there was hardly any change in the March 2007 retro (e.g., [00Z T over Alaska](#)), as you keenly noted during the meeting. I've attached the short presentation I gave at the July 31 meeting regarding the radiation change in case you need to refer to it, where slide7 shows no cool bias over SAK, NAK for cool season Launcher runs.
- **We engaged SPC to assess impact of the shallow changes on CAPE. They indicated the lower values of CAPE would cause them problems, so we withdrew the change from consideration.**

Ferrier - Assess Impact of Radiation Change on 2-m Temp over Alaska with Launcher runs

- Negative: Cooler surface temperatures during warm season when NAM was already too cool
- Positive: Warmer surface temperatures during cold season when NAM is also too cool

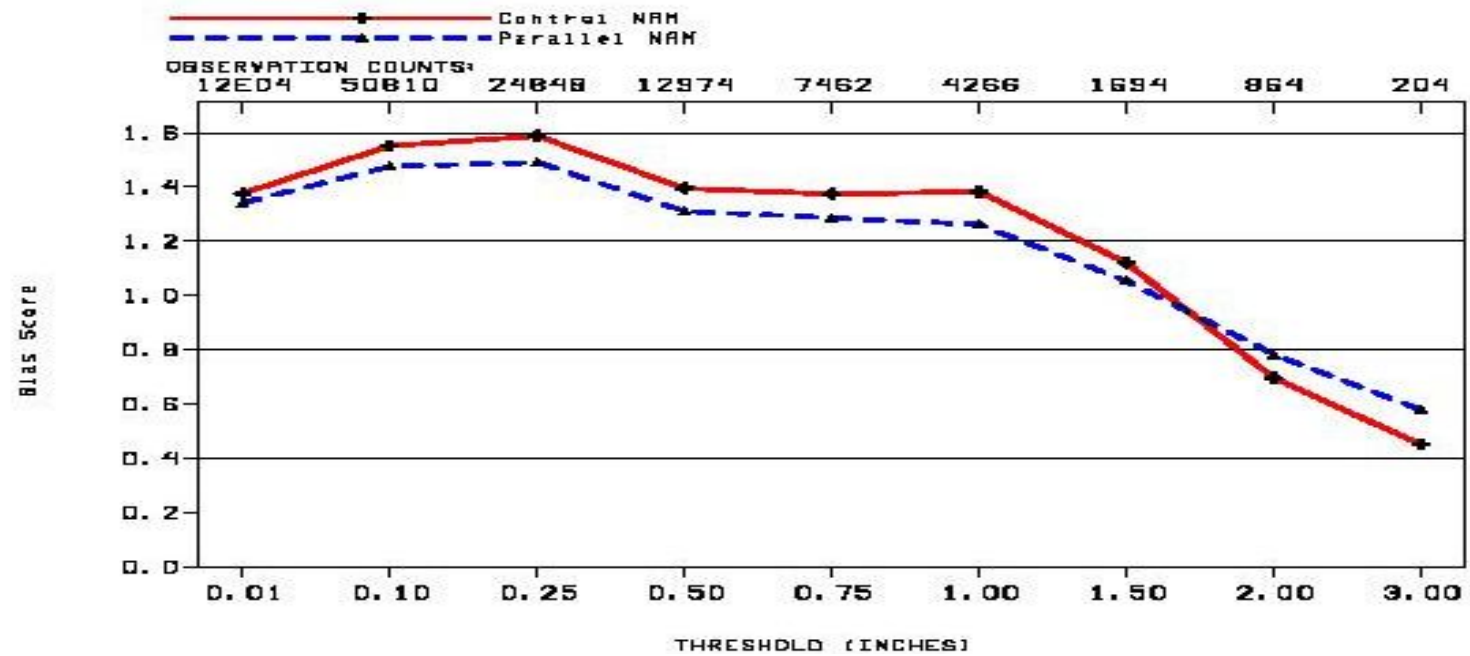
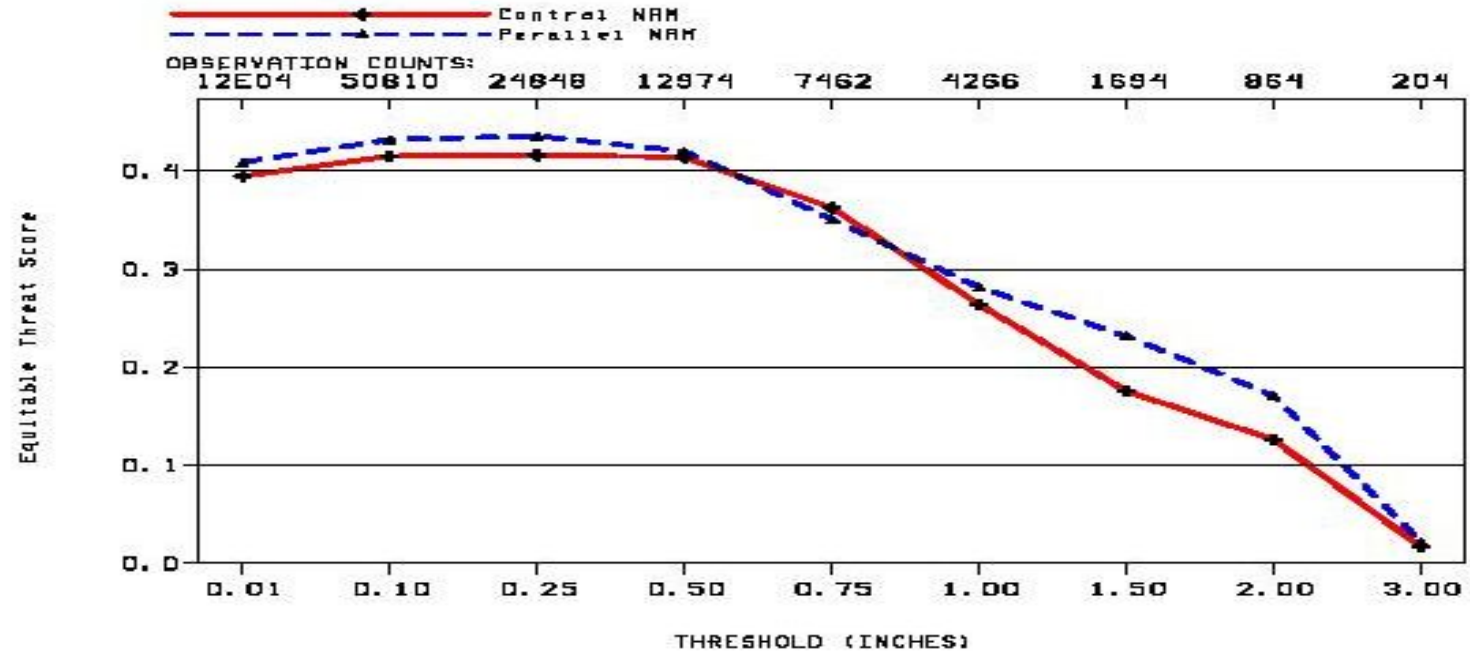
Final Decision Made 2 September

- Final Bundle: shallow out & radiation in
- Cold Season retro parallel run with NAMV setup: http://www.emc.ncep.noaa.gov/mmb/mmbpll/pll12stats_namp_retro_26feb07-13mar08/

Testing Supporting Final Physics Decision

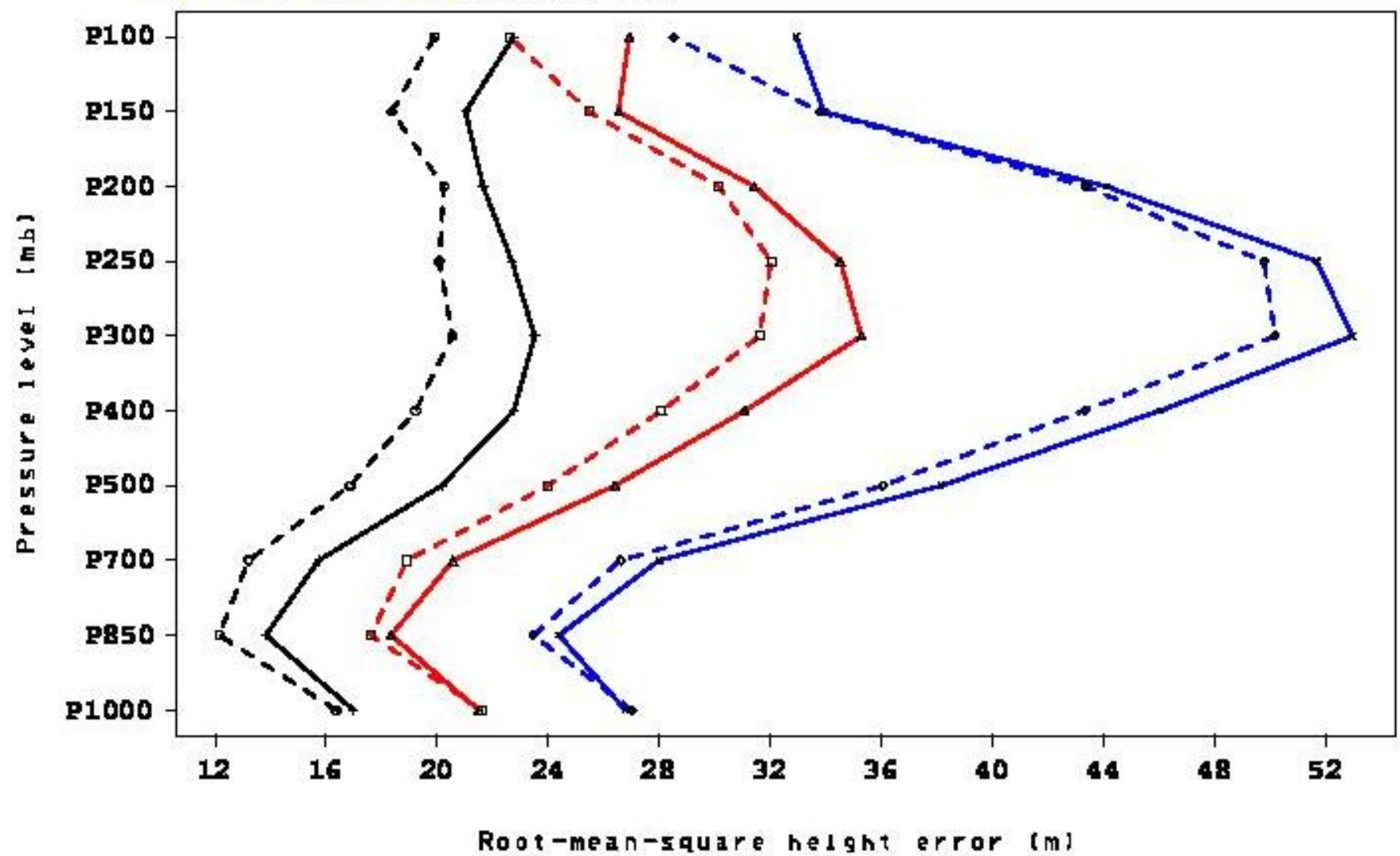
- Real-time parallel NAMX (partial cycling only) & NAMY (everything)
- Cold Season retro parallel with NAMY setup:
http://www.emc.ncep.noaa.gov/mmb/mmbpll/pll12stats_namp_retro_26feb07-13mar08/
- Final Decision Made 2 September based on real-time and cold-season retro results: use NAMY setup
- Final Bundle Frozen: shallow changes out and radiation change in

24-84 h CONUS precip verification for 200702260000 to 200703122300



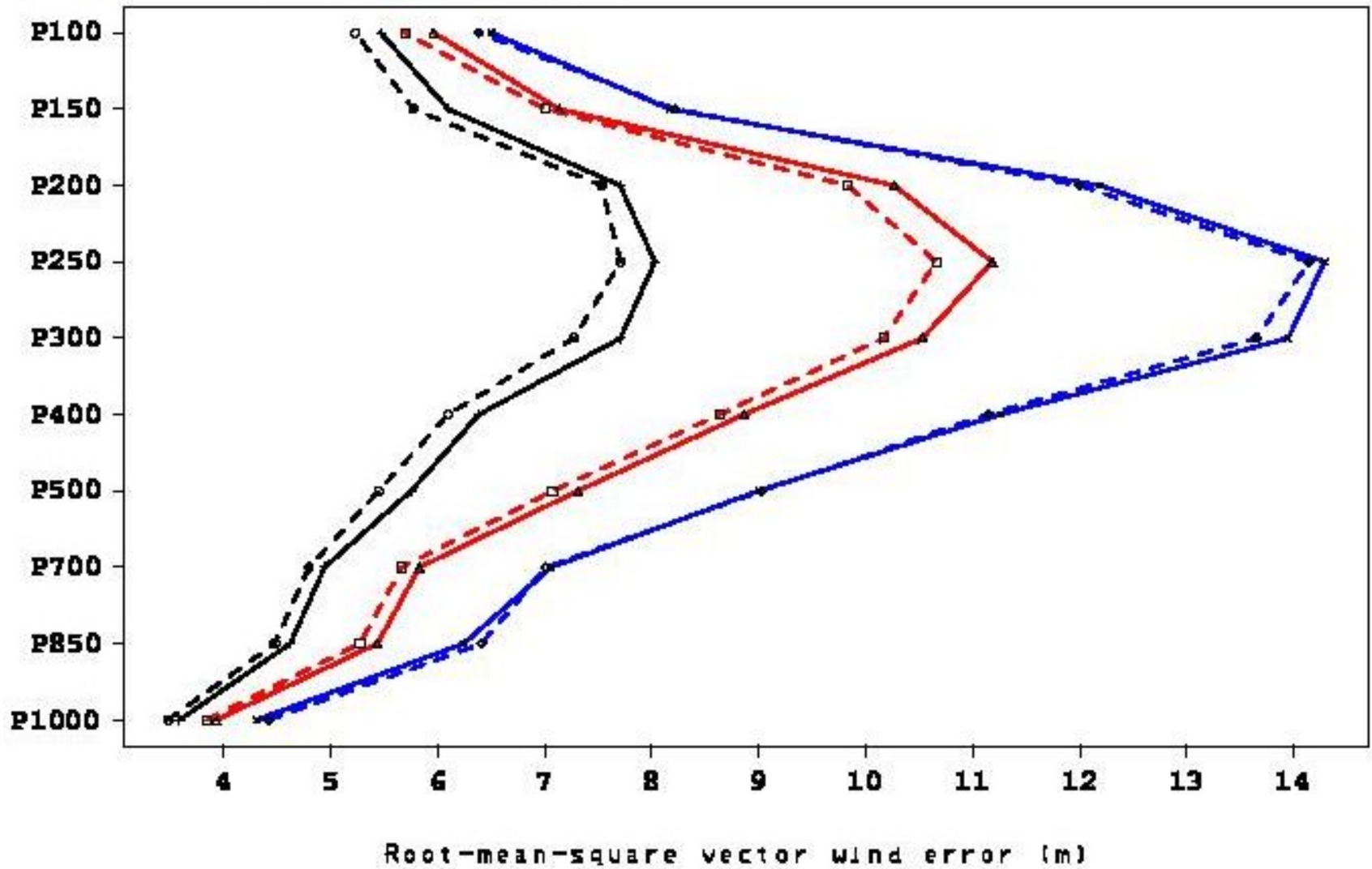
RMS height error vs. raobs over the CONUS for ct1 NAM and P11 NAM forecasts from 2007022600 to 2007031312

- +— 24-H ct1 NAM
- - -+ - 24-H P11 NAM
- △— 48-H ct1 NAM
- - -△ - 48-H P11 NAM
- +— 72-H ct1 NAM
- - -+ - 72-H P11 NAM

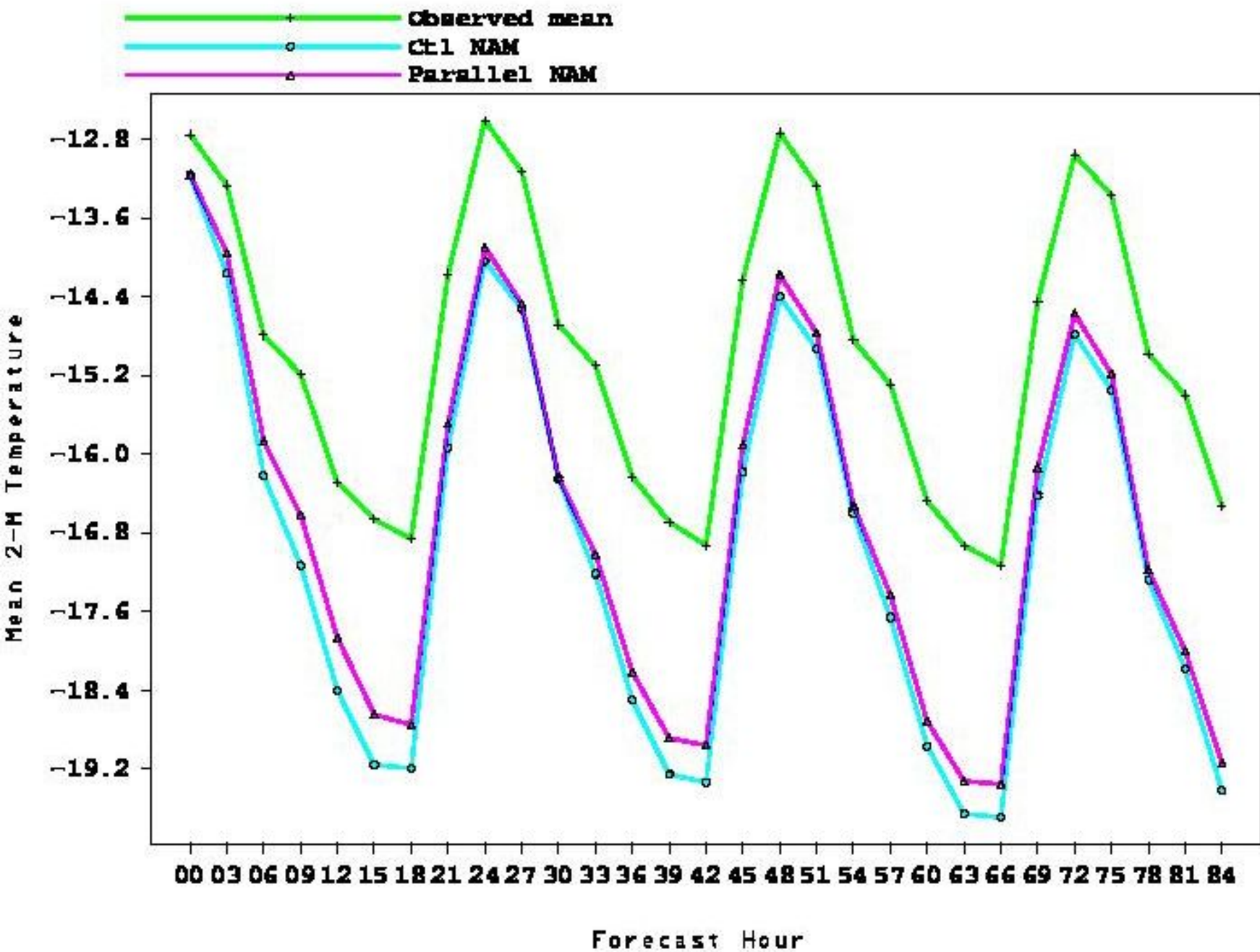


RMS vector wind error vs. raobs over the CONUS for ct1 NAM, p11 NAM forecasts
 from 2007022600 to 2007031312

- +— 24-H Ct1 NAM
- - -+ - 24-H P11 NAM
- △— 48-H Ct1 NAM
- - -□ - 48-H P11 NAM
- *— 72-H Ct1 NAM
- - -+ - 72-H P11 NAM



an 2-M Temp vs. sfc obs (00Z cycle) over Alaska DS for ct1 NAM and parallel NAM forecasts from 200702250000 to 200703131200

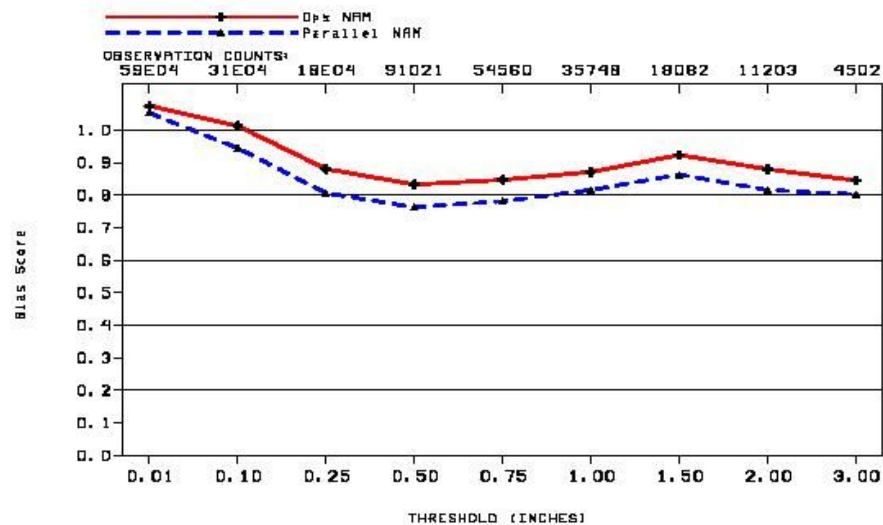
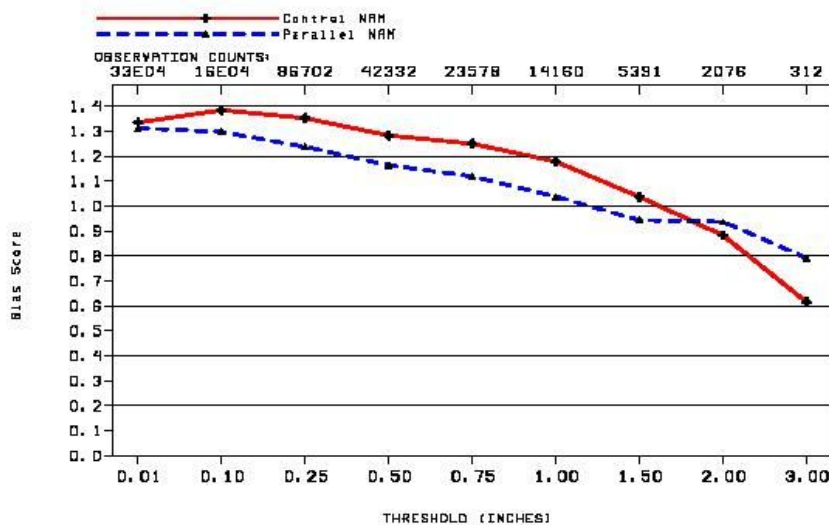
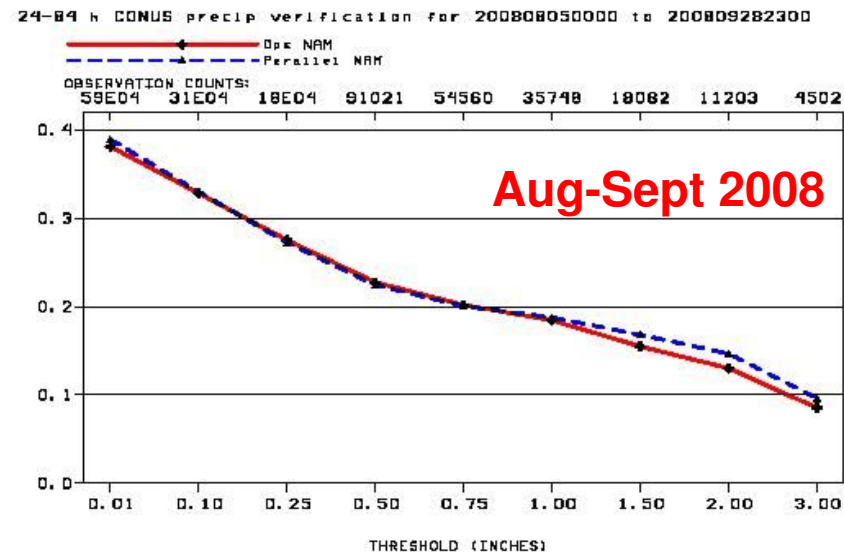
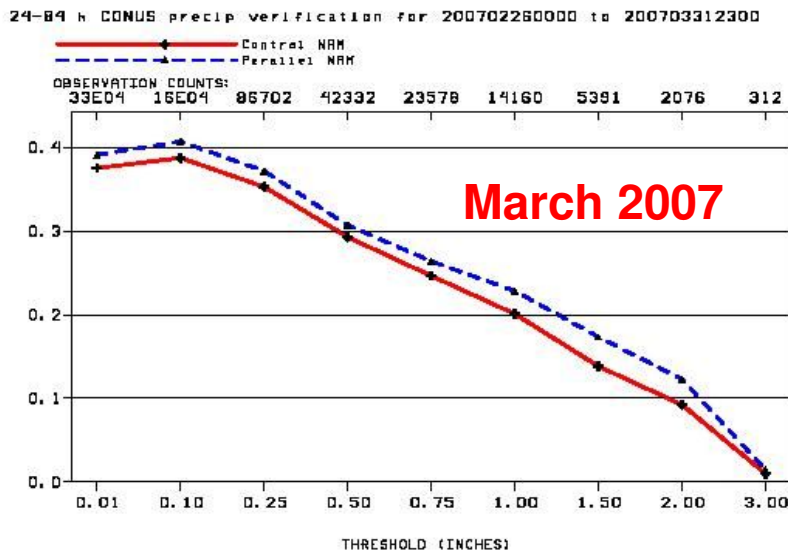


NAM Parallel Briefing
2 October 2008
MMB Meeting

Final NAM Parallel testing

- 1 August 2008 – present : EMC Real-time
- 26 Feb 2007 – 31 Mar 2007 : Retrospective
- 5 Aug 2008 – 28 Sept 2008 : Retrospective
- 28 Oct 2008 – present : NCO Real-time providing gridded product for subjective evaluation

Equitable Threat (top) and Bias (bottom) QPF Scores: Left=March 2007; Right=Aug-Sept 2008. Red=Ops NAM, Blue=PII NAM



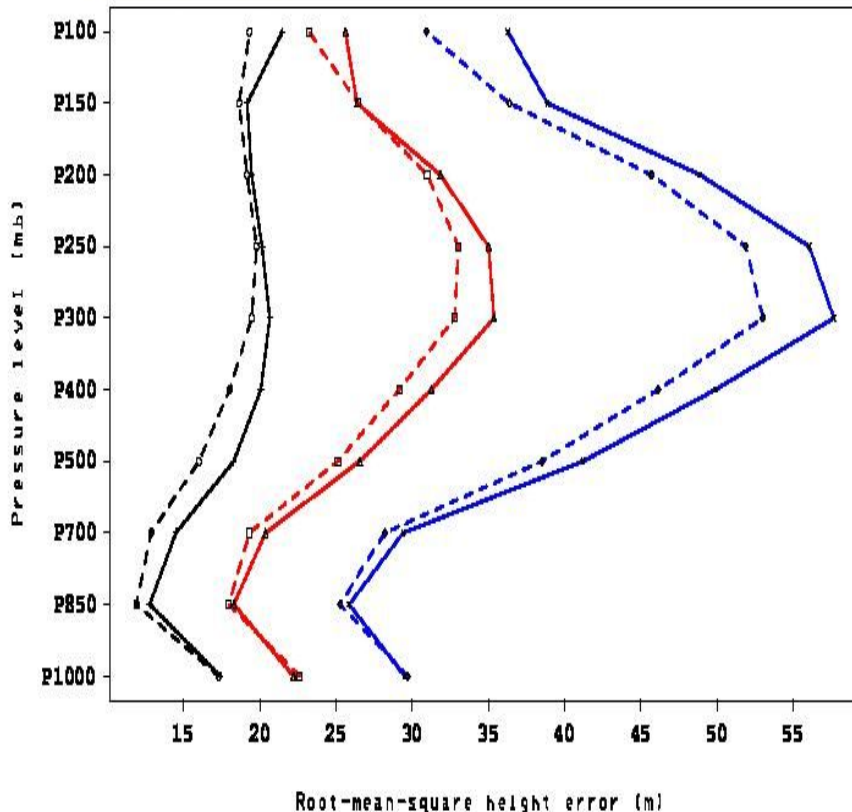
24/48/72-h CONUS RMS Height Error :

Left=March 2007; Right=Aug-Sept 2008.
 Solid=Ops NAM, Dashed=Parallel NAM

RMS height error vs. raobs over the CONUS for ctl NAM and P11 NAM forecasts from 2007022600 to 2007033112

March 2007

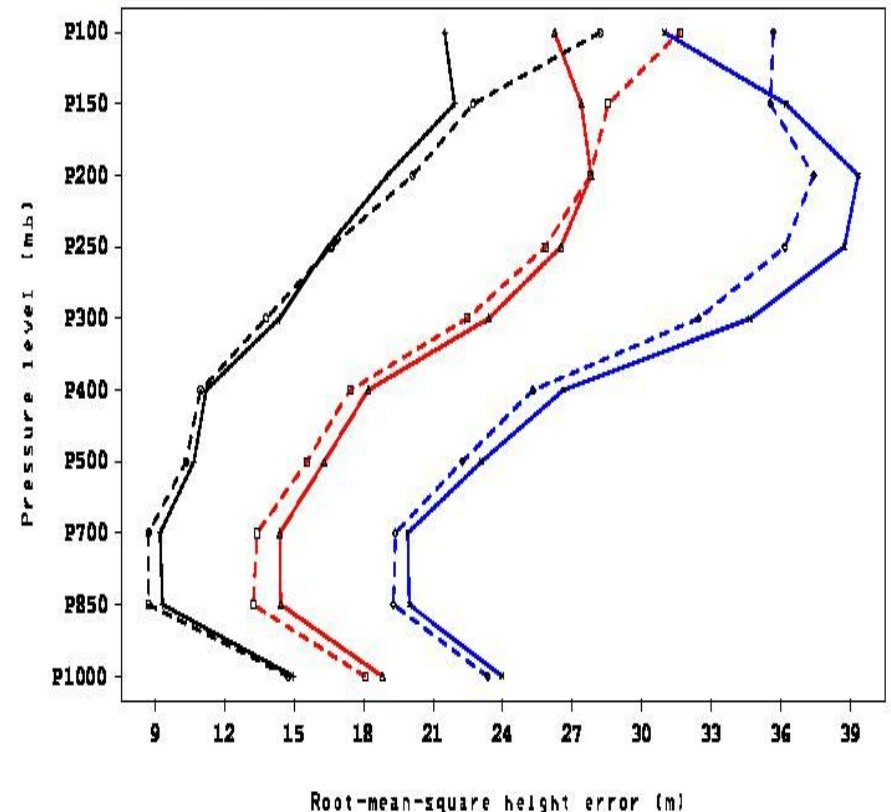
- 24-H Ctl NAM
- - - 24-H P11 NAM
- 48-H Ctl NAM
- - - 48-H P11 NAM
- 72-H Ctl NAM
- - - 72-H P11 NAM



RMS height error vs. raobs over the CONUS for ctl NAM and p11 NAM forecasts from 2008080500 to 2008092812

Aug-Sept 2008

- 24-H Ops NAM
- - - 24-H P11 NAM
- 48-H Ops NAM
- - - 48-H P11 NAM
- 72-H Ops NAM
- - - 72-H P11 NAM



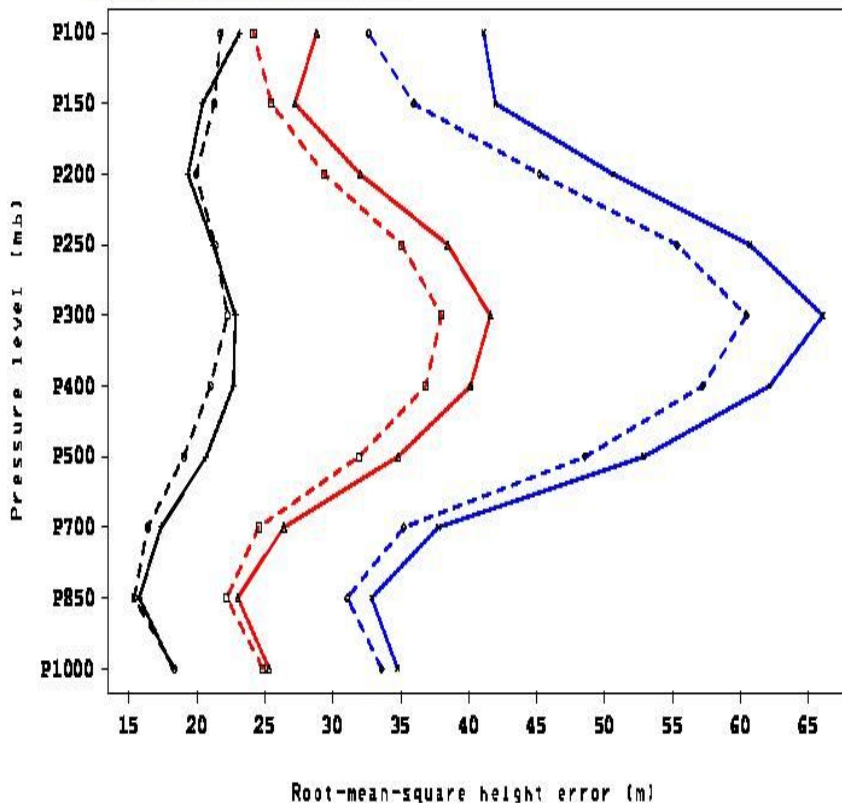
24/48/72-h Alaska RMS Height Error :

Left=March 2007; Right=Aug-Sept 2008.
 Solid=Ops NAM, Dashed=Parallel NAM

RMS height error vs. raobs over Alaska for ctl NAM and P11 NAM forecasts from 2007022600 to 2007033112

March 2007

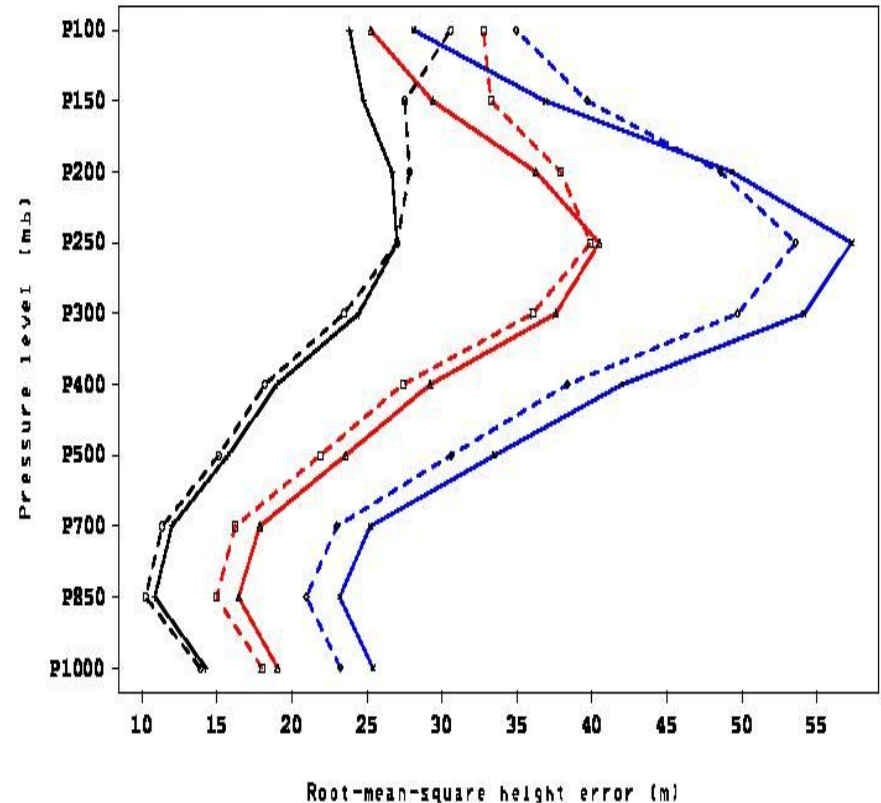
- +— 24-H Ctl NAM
- - -+ 24-H P11 NAM
- +— 48-H Ctl NAM
- - -+ 48-H P11 NAM
- +— 72-H Ctl NAM
- - -+ 72-H P11 NAM



RMS height error vs. raobs over Alaska for ctl NAM and p11 NAM forecasts from 2008080500 to 2008092812

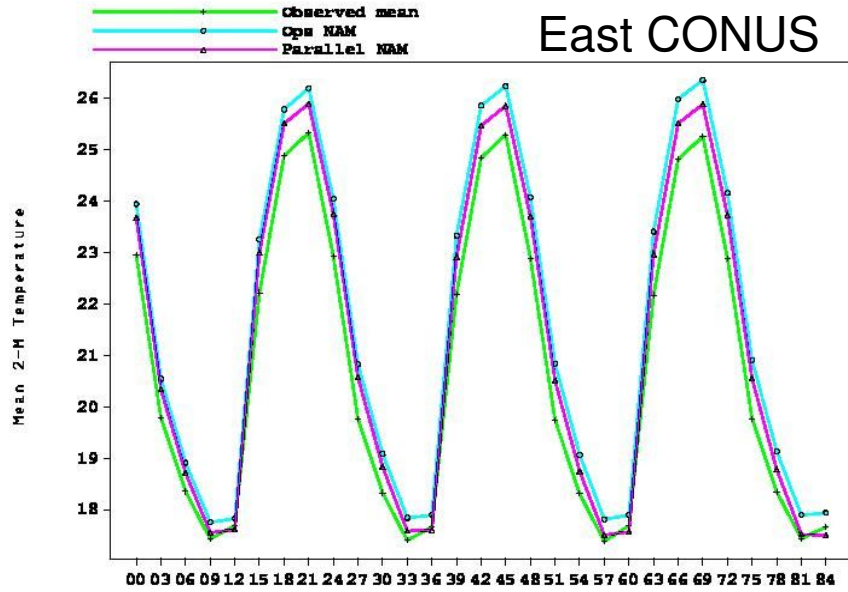
Aug-Sept 2008

- +— 24-H Ops NAM
- - -+ 24-H P11 NAM
- +— 48-H Ops NAM
- - -+ 48-H P11 NAM
- +— 72-H Ops NAM
- - -+ 72-H P11 NAM

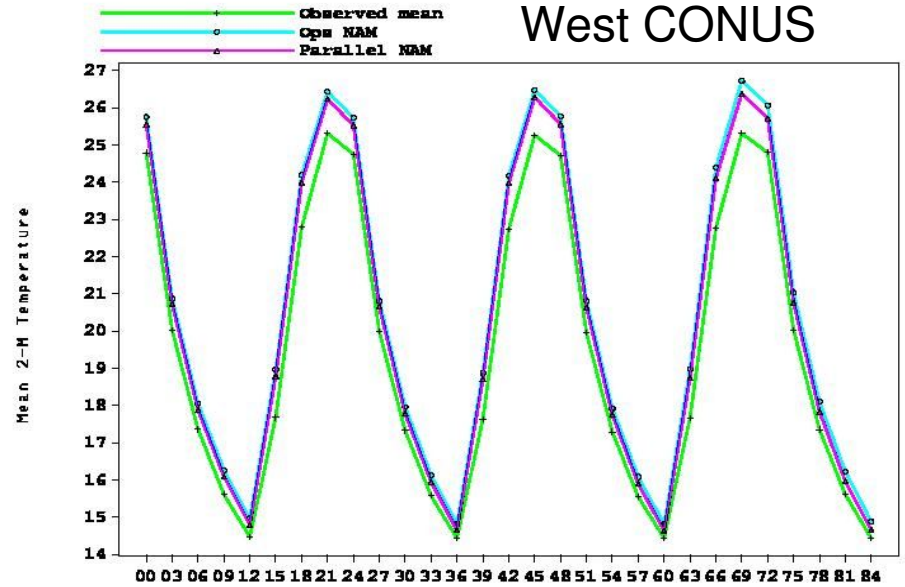


00z cycle 2-m Temp : Aug-Sept 08

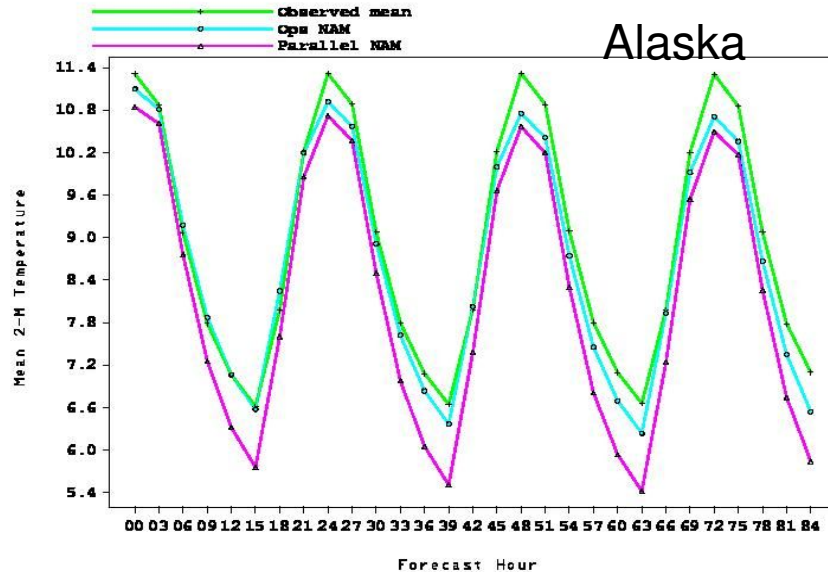
Mean 2-M Temp vs. sfc obs (00Z cycle) over the Eastern US for ops NAM and p11 NAM forecasts from 200808050000 to 200809281200



Mean 2-M Temp vs. sfc obs (00Z cycle) over the Western US for ops NAM and p11 NAM forecasts from 200808050000 to 200809281200

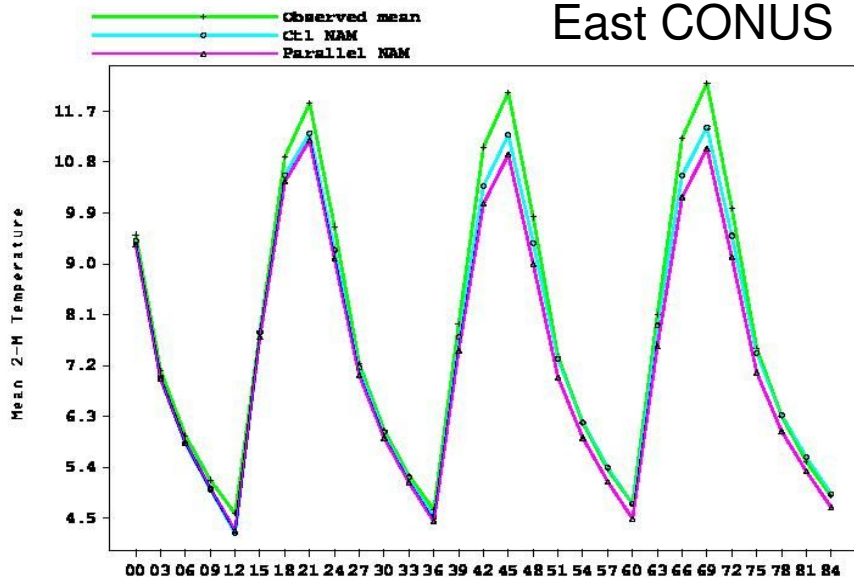


Forec Mean 2-M Temp vs. sfc obs (00Z cycle) over Alaska US for ops NAM and parallel NAM forecasts from 200808050000 to 200809281200

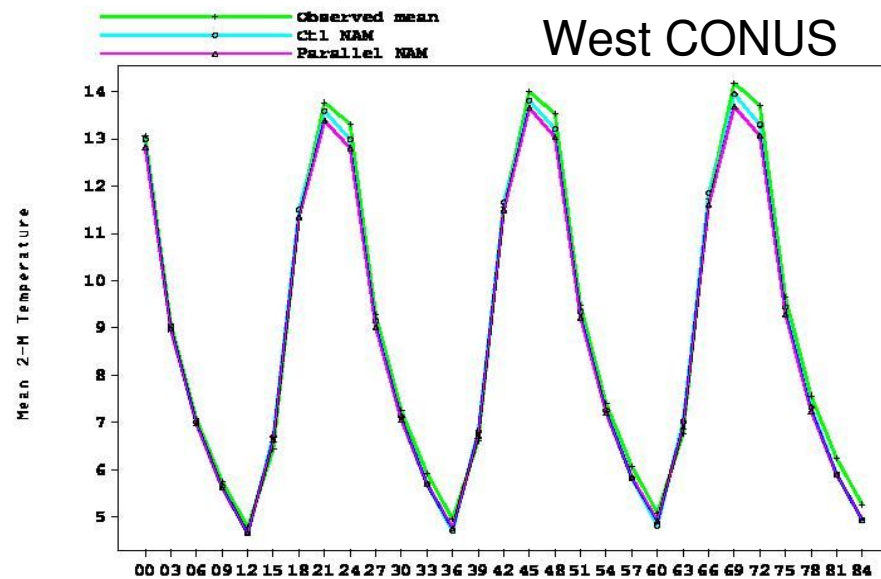


00z cycle 2-m Temp : March 2007

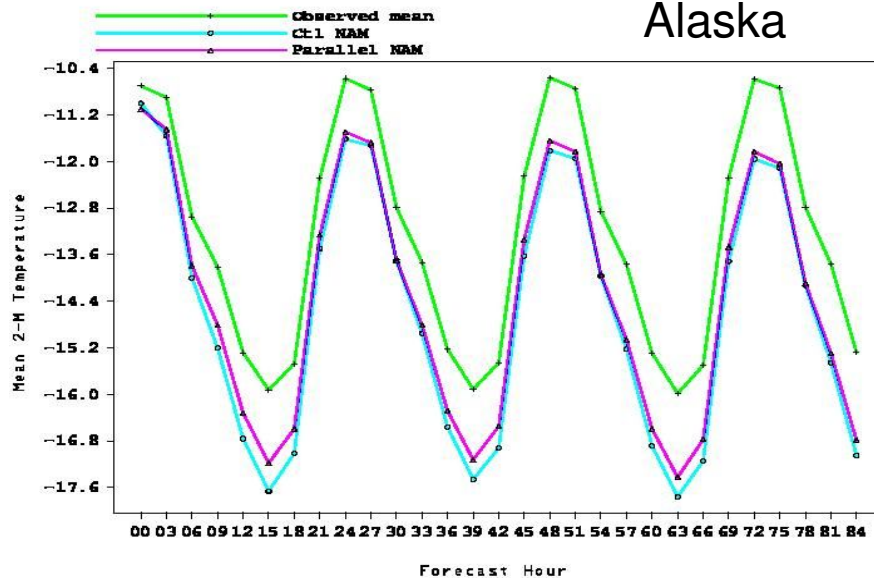
Mean 2-M Temp vs. sfc obs (00z cycle) over the Eastern US for ctl NAM and pl1 NAM forecasts from 200702250000 to 200703311200



Mean 2-M Temp vs. sfc obs (00z cycle) over the Western US for ctl NAM and pl1 NAM forecasts from 200702250000 to 200703311200



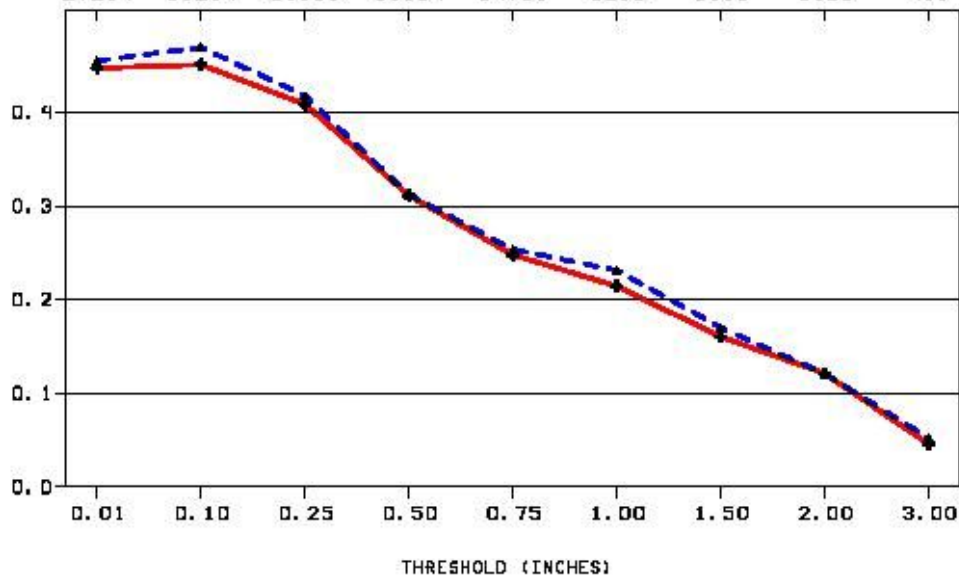
Mean 2-M Temp vs. sfc obs (00z cycle) over Alaska US for ctl NAM and parallel NAM forecasts from 200702250000 to 200703311200



Equitable Threat Score

—●— Dps NAM
 - - -▲- - Parallel NAM

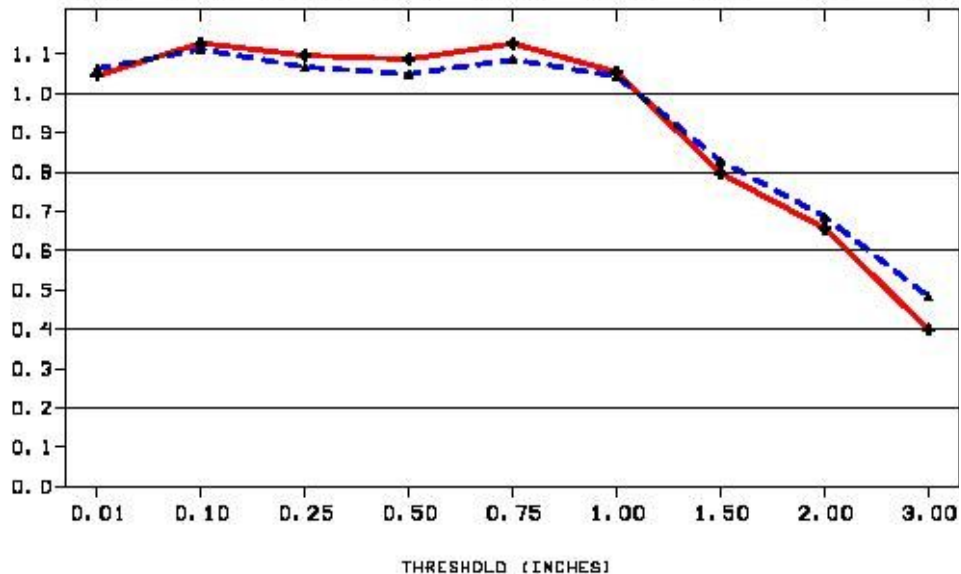
OBSERVATION COUNTS:
 27E04 13E04 68983 30984 14798 8283 3860 1823 489



Bias Score

—●— Dps NAM
 - - -▲- - Parallel NAM

OBSERVATION COUNTS:
 27E04 13E04 68983 30984 14798 8283 3860 1823 489



Real-Time QPF Stats for Nov. CONUS

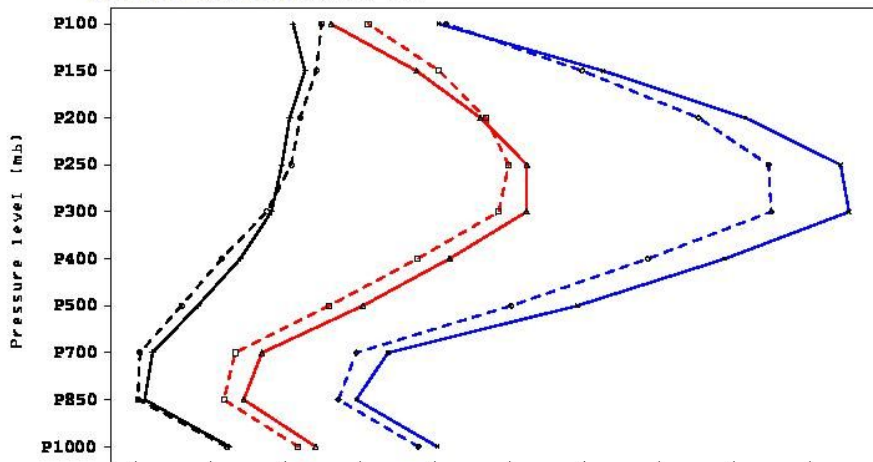
Real-Time Stats for Nov. CONUS

RMS height from 2008110100 to 2008120412

2008110100 to 2008120412

- 24-H Ops NAM
- - 24-H P11 NAM
- 48-H Ops NAM
- - 48-H P11 NAM
- 72-H Ops NAM
- - 72-H P11 NAM

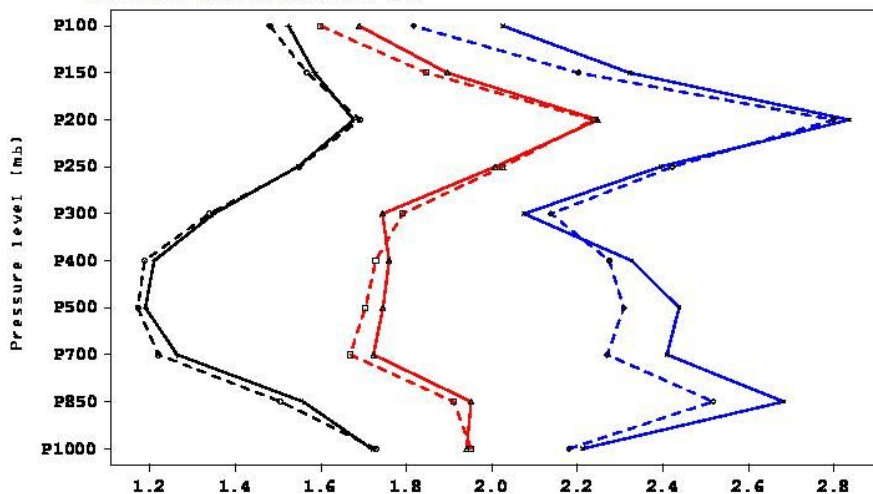
HEIGHT



RMS temperature error vs. raobs over the CONUS for ops NAM and p11 NAM forecasts from 2008110100 to 2008120412

- 24-H Ops NAM
- - 24-H P11 NAM
- 48-H Ops NAM
- - 48-H P11 NAM
- 72-H Ops NAM
- - 72-H P11 NAM

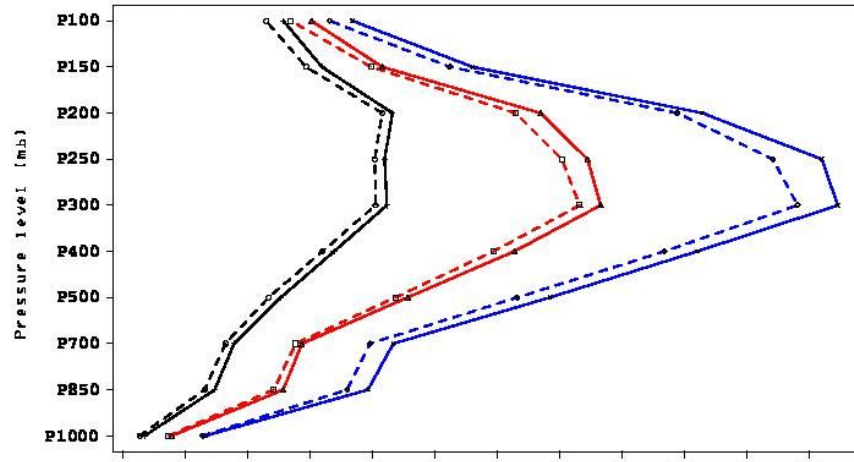
Temperature



from 2008110100 to 2008120412

- 24-H Ops NAM
- - 24-H P11 NAM
- 48-H Ops NAM
- - 48-H P11 NAM
- 72-H Ops NAM
- - 72-H P11 NAM

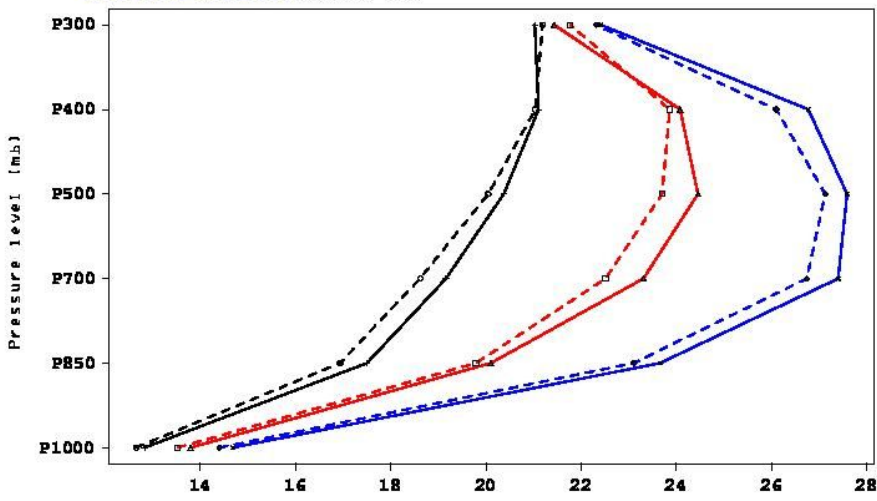
WIND



RMS relative humidity error vs. raobs over the CONUS for ops NAM and p11 NAM forecasts from 2008110100 to 2008120412

- 24-H Ops NAM
- - 24-H P11 NAM
- 48-H Ops NAM
- - 48-H P11 NAM
- 72-H Ops NAM
- - 72-H P11 NAM

Rel. Humidity



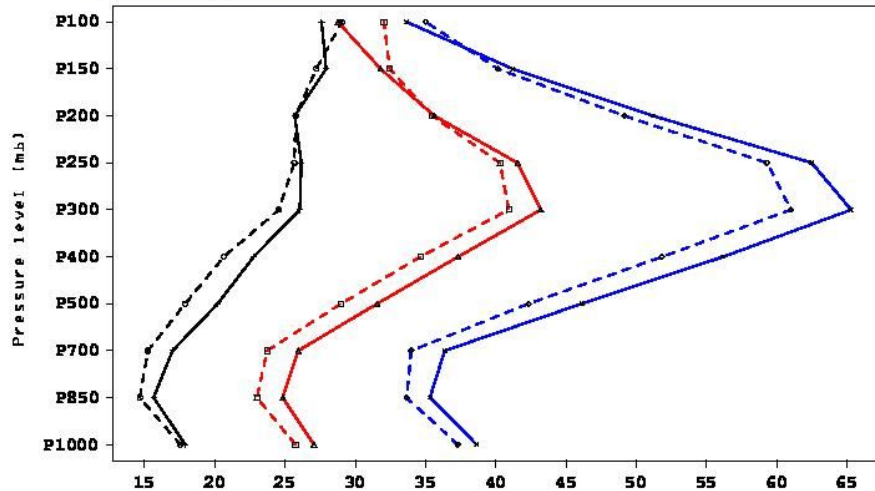
Real-Time Stats for Nov. Alaska

RMS height from 2008110100 to 2008120412

2008110100 to 2008120412

- 24-H Ops NAM
- - 24-H P11 NAM
- 48-H Ops NAM
- - 48-H P11 NAM
- 72-H Ops NAM
- - 72-H P11 NAM

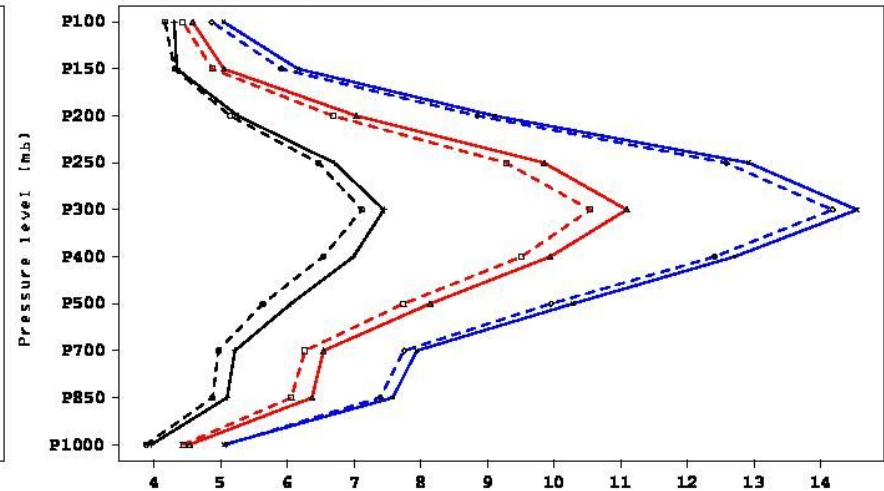
HEIGHT



from 2008110100 to 2008120412

- 24-H Ops NAM
- - 24-H P11 NAM
- 48-H Ops NAM
- - 48-H P11 NAM
- 72-H Ops NAM
- - 72-H P11 NAM

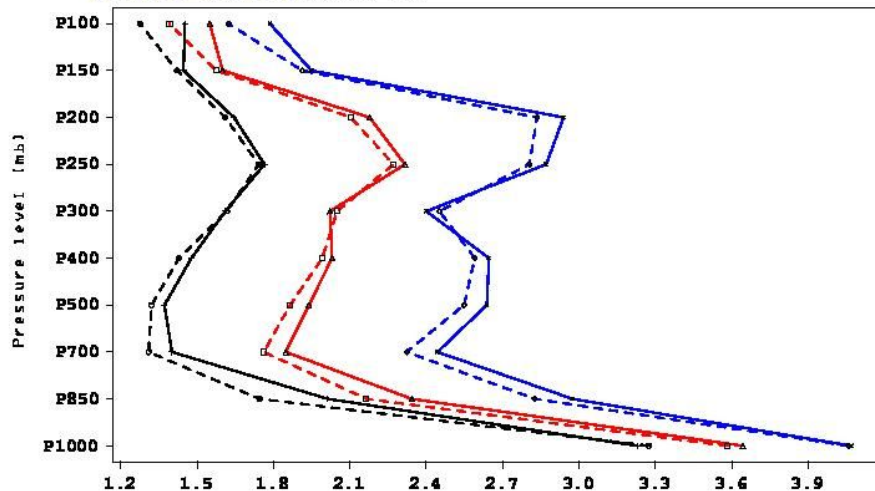
WIND



RMS temperature error vs. raobs over Alaska for ops NAM and p11 NAM forecasts from 2008110100 to 2008120412

- 24-H Ops NAM
- - 24-H P11 NAM
- 48-H Ops NAM
- - 48-H P11 NAM
- 72-H Ops NAM
- - 72-H P11 NAM

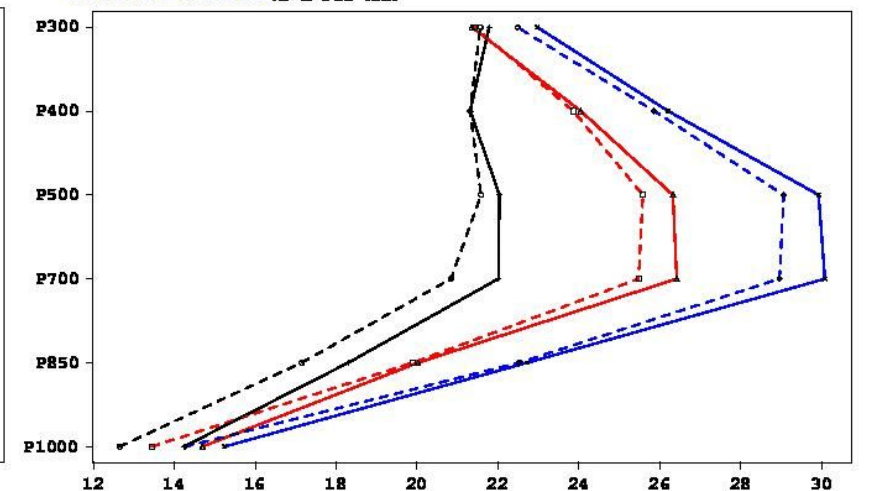
Temperature



RMS relative humidity error vs. raobs over Alaska for ops NAM and p11 NAM forecasts from 2008110100 to 2008120412

- 24-H Ops NAM
- - 24-H P11 NAM
- 48-H Ops NAM
- - 48-H P11 NAM
- 72-H Ops NAM
- - 72-H P11 NAM

Rel. Humidity



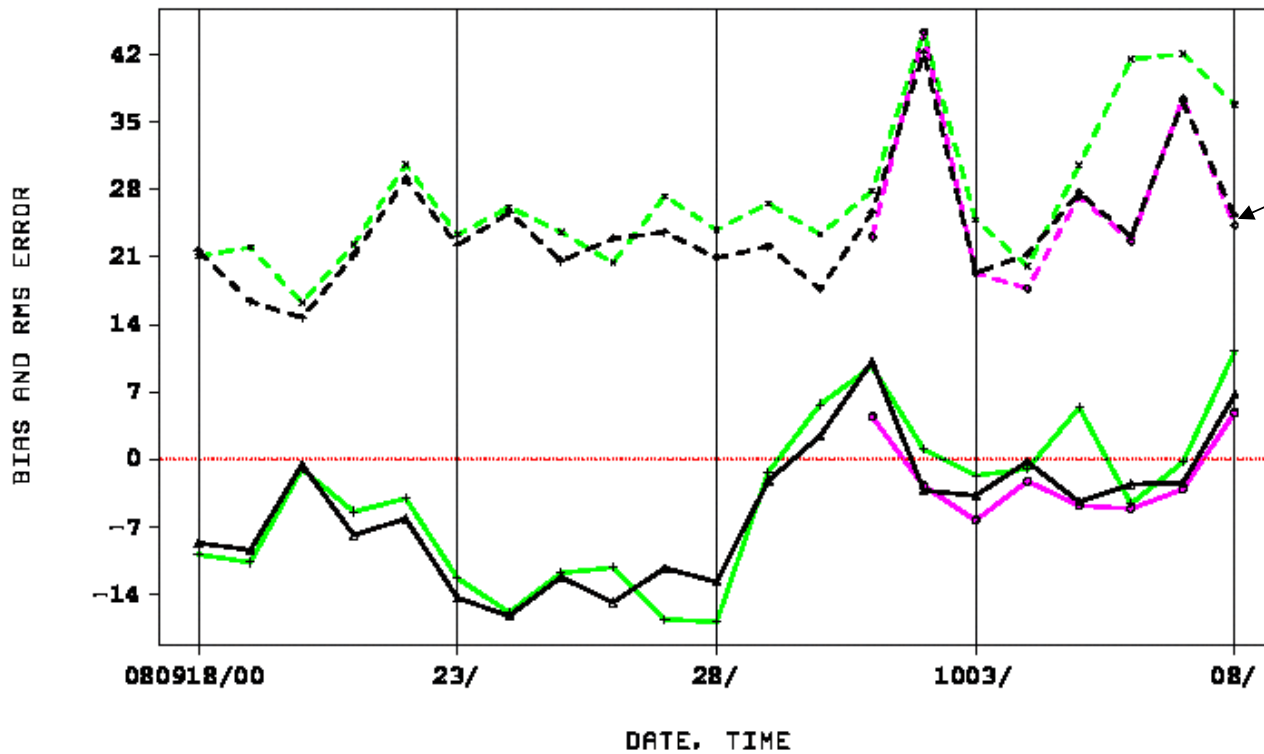
Results Summary

- Upper air stats are significantly better in both warm and cool seasons
- Precip is neutral (warm season) to slightly better (cool season) with somewhat lower biases in both seasons (helps if NAM bias is high and hurts if it is low – regime dependent)
- Surface stats generally better (see previous slide for Alaska) with daytime warm bias reduced in Eastern CONUS and nighttime cool bias reduced slightly in Western CONUS.

Eric's Slides from 16 October 2008

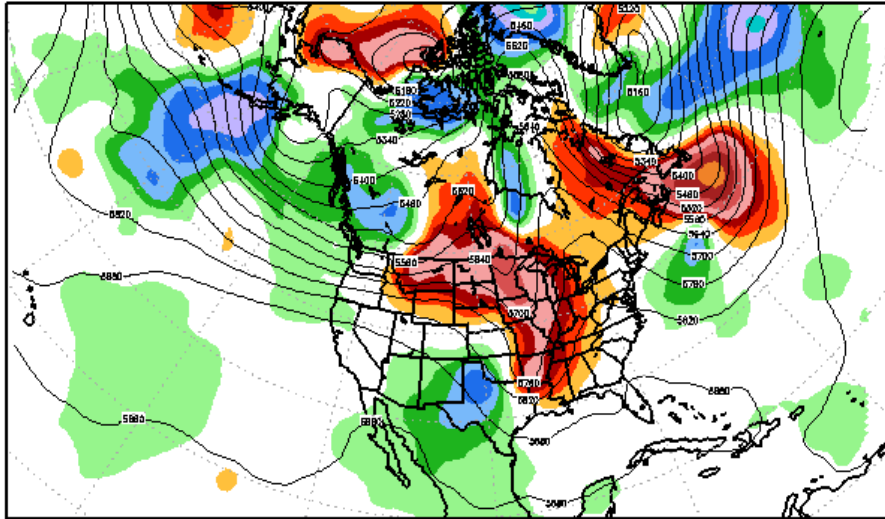
STAT=SL1L2 PARAM=Z FHOOR=72 V_ANL=ADPUA V_RGN=G236 LEVEL=P500 VHEMM=0000

- NAM BIAS ERROR; = -4.35202E+00
- NAMX BIAS ERROR; = -1.90093E+00
- NAMEXP BIAS ERROR; = MISSING
- - - NAM40 RMS ERROR; = 2.73290E+01
- - - NAMX RMS ERROR; = 2.69365E+01
- - - NAMEXP RMS ERROR; = MISSING

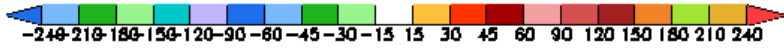
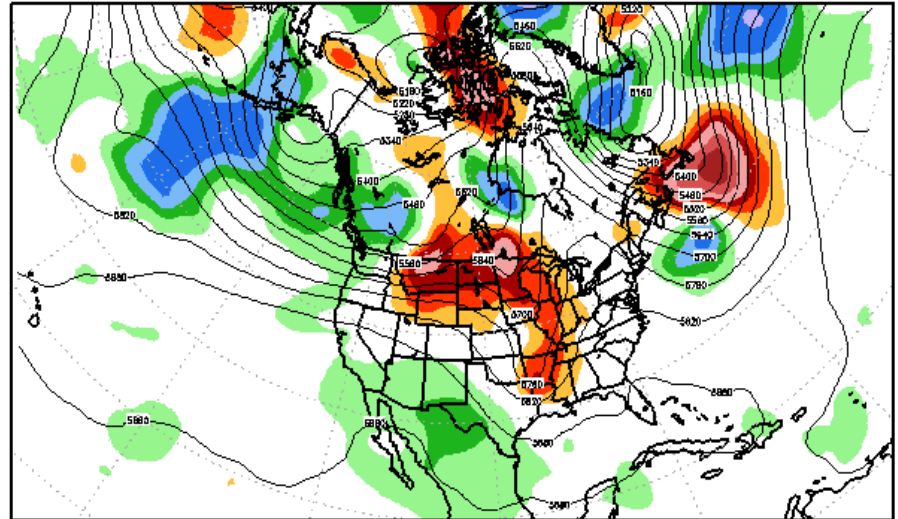


72-h fcst valid
00z 10/8;
parallel NAM
has ~1/3 lower
RMS height error
over CONUS

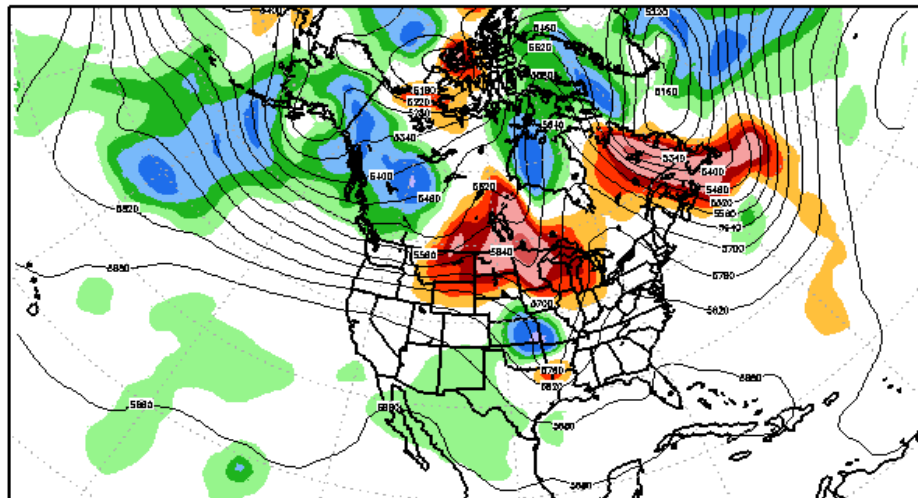
500MB NAM-GDAS ANL 72H FCST FROM 00Z 05 OCT 08



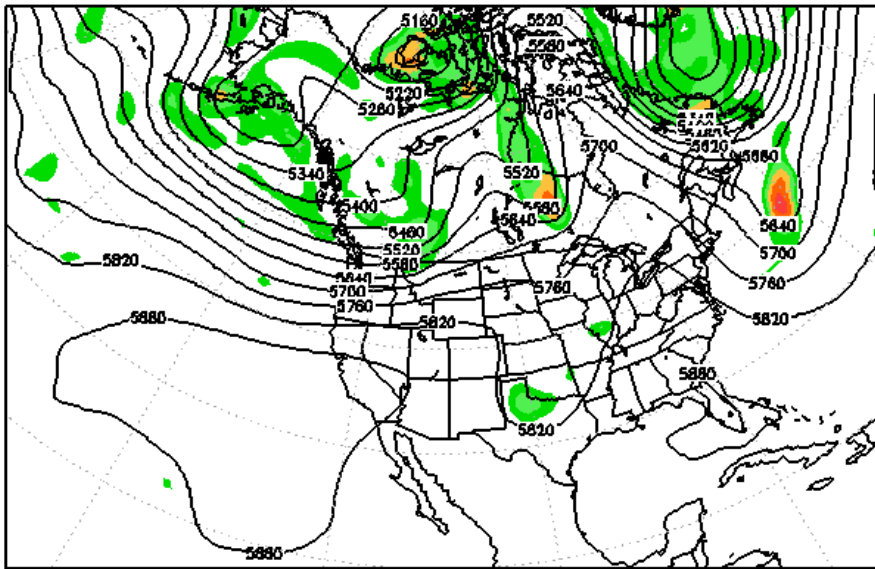
500MB NAMX-GDAS ANL 72H FCST FROM 00Z 05 OCT 08



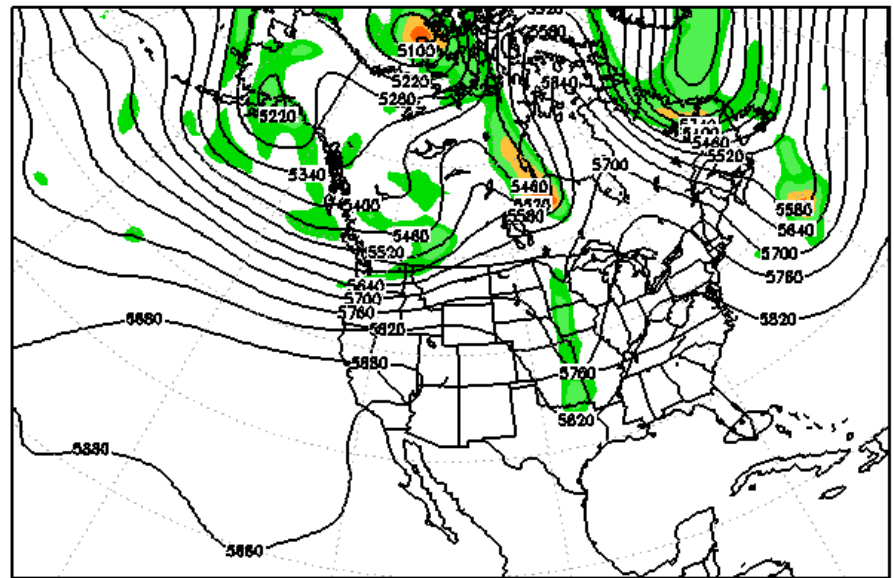
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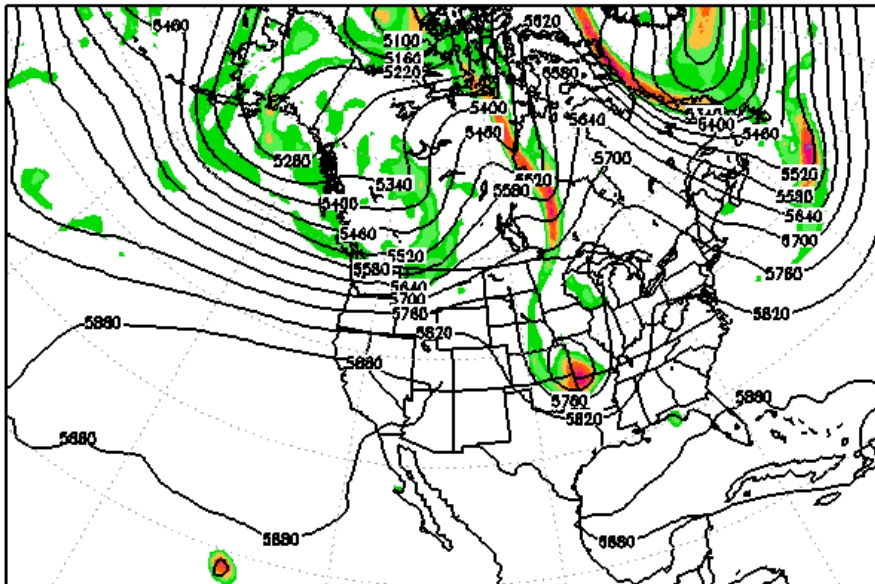
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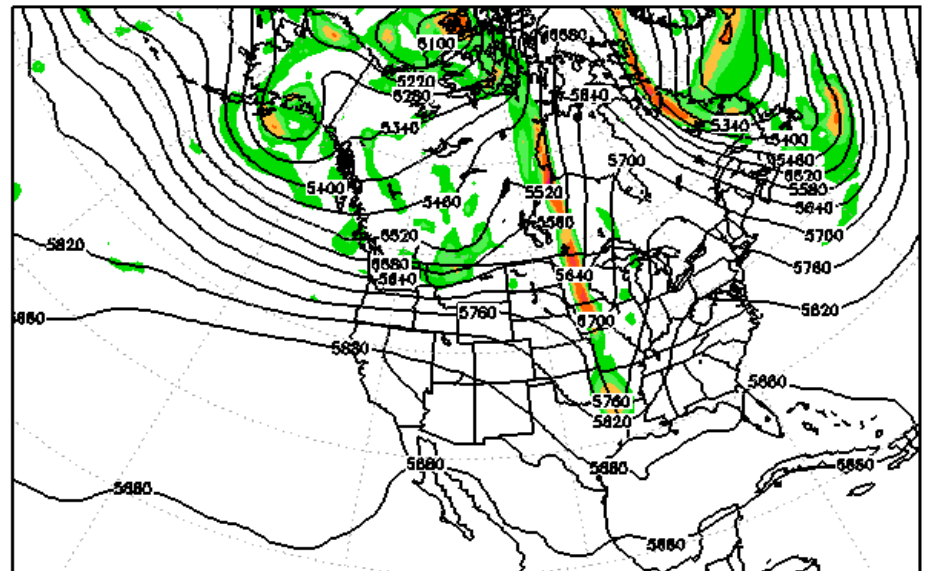
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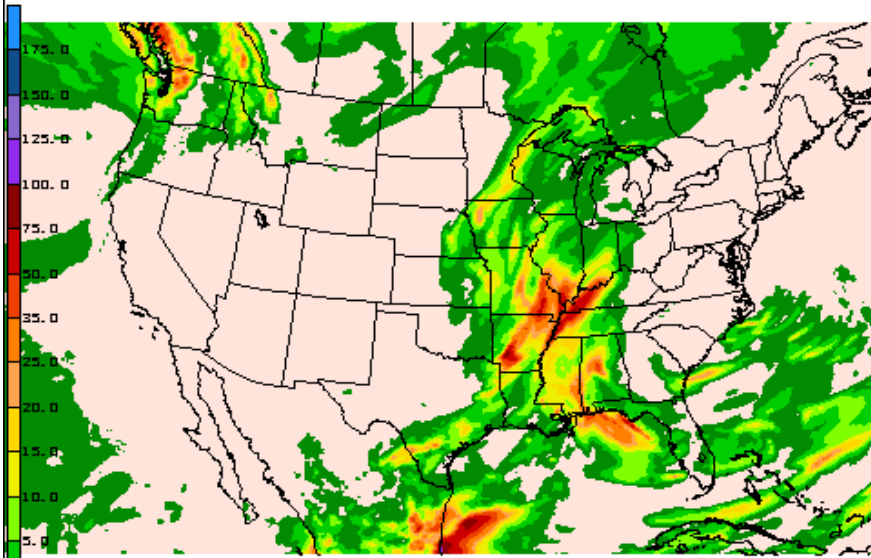


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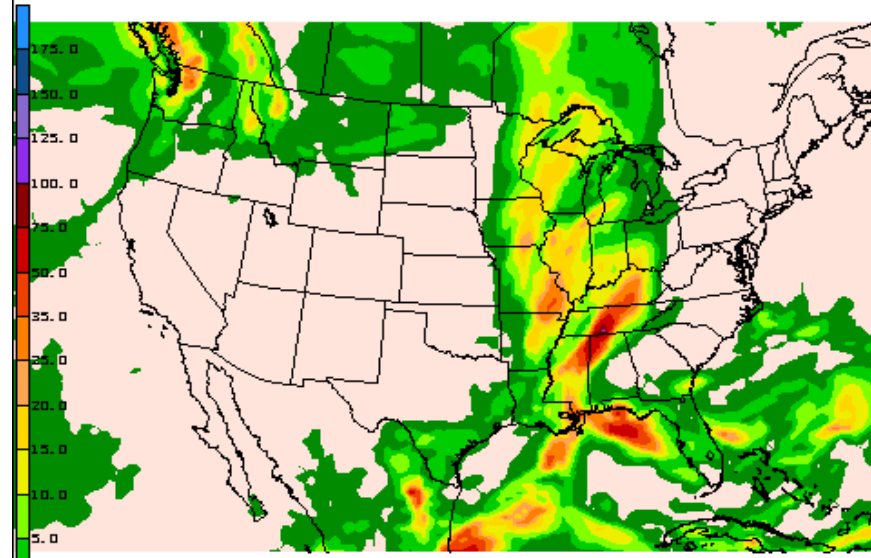


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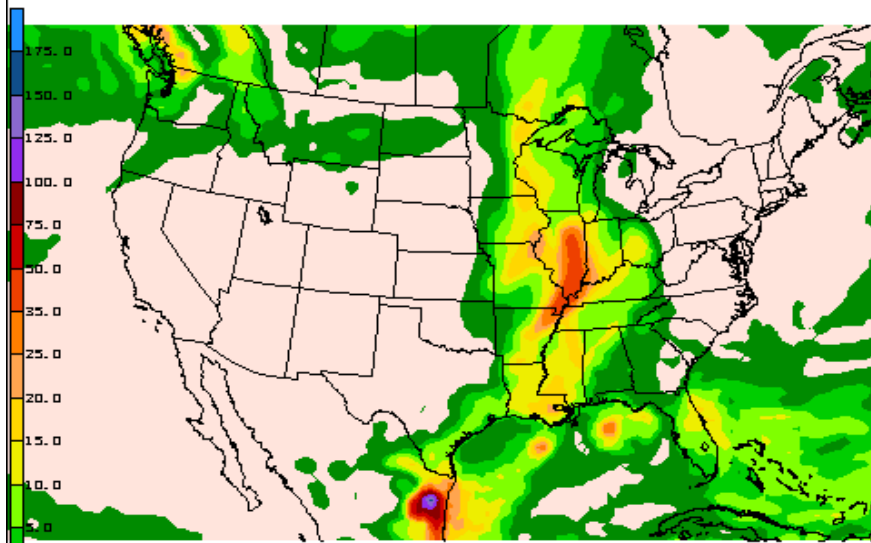




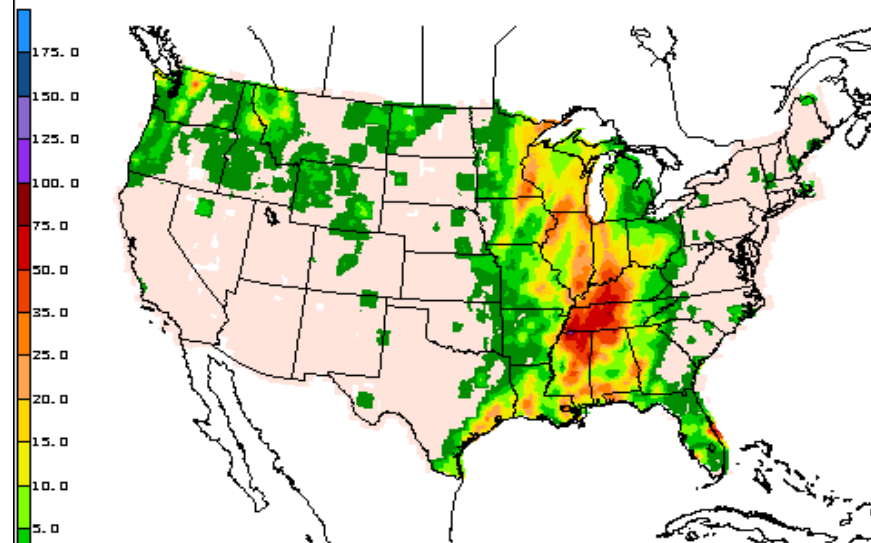
NAM 072h Forecast 24h Accum (mm) Ending 2008100812



NAMX 072h Forecast 24h Accum (mm) Ending 2008100812



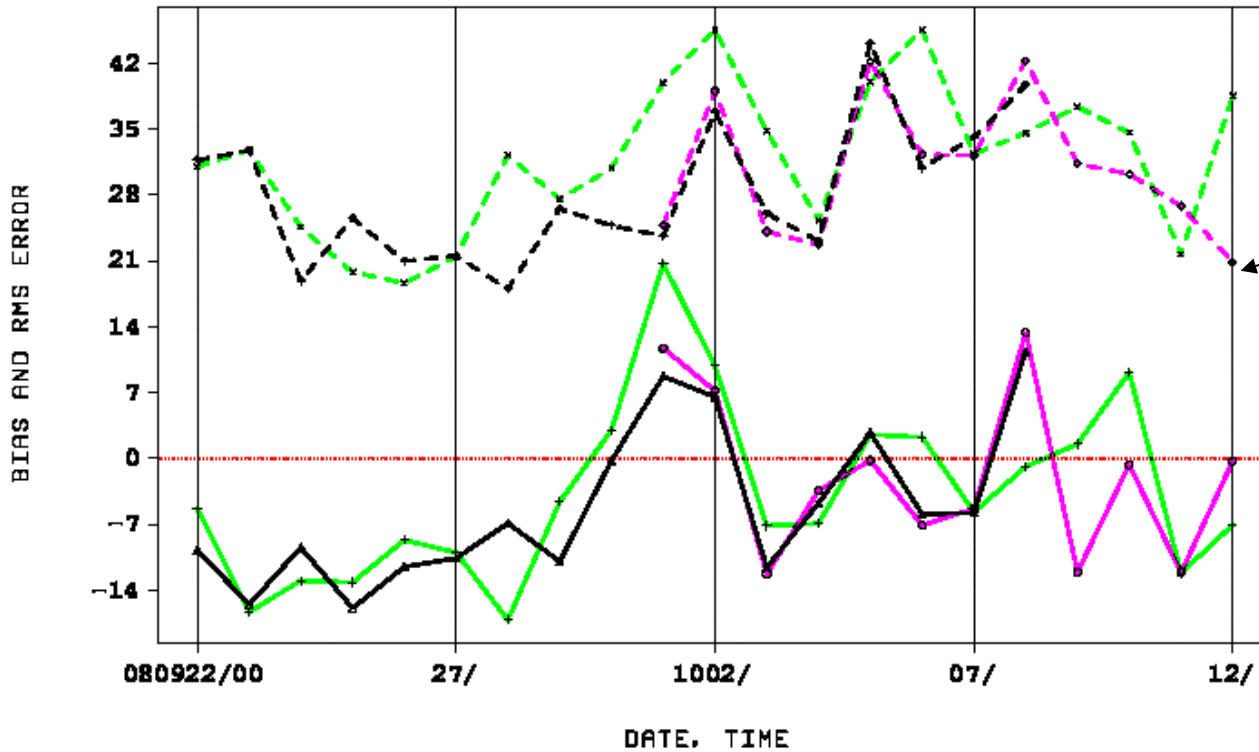
GFS 072h Forecast 24h Accum (mm) Ending 2008100812



CPC 1/8 deg Analysis 24h Accum (mm) Ending 2008100812

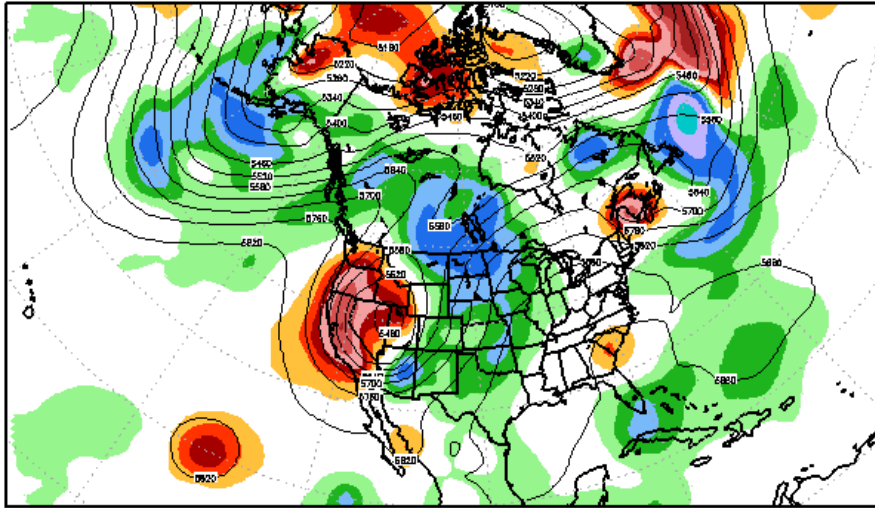
STAT-SL1L2 PARAM-Z F HOUR=84 V ANL-ADPUA V_RGN-G236 LEVEL-P500 VHEMM-0000

- NAM BIAS ERROR; = -3.73863E+00
- NAMX BIAS ERROR; = -1.77302E+00
- NAMY BIAS ERROR; = -5.25688E+00
- NAMEXP BIAS ERROR; = MISSING
- - - NAM40 RMS ERROR; = 3.18903E+01
- - - NAMX RMS ERROR; = 3.07304E+01
- - - NAMEY RMS ERROR; = 2.82003E+01
- - - NAMEXP RMS ERROR; = MISSING

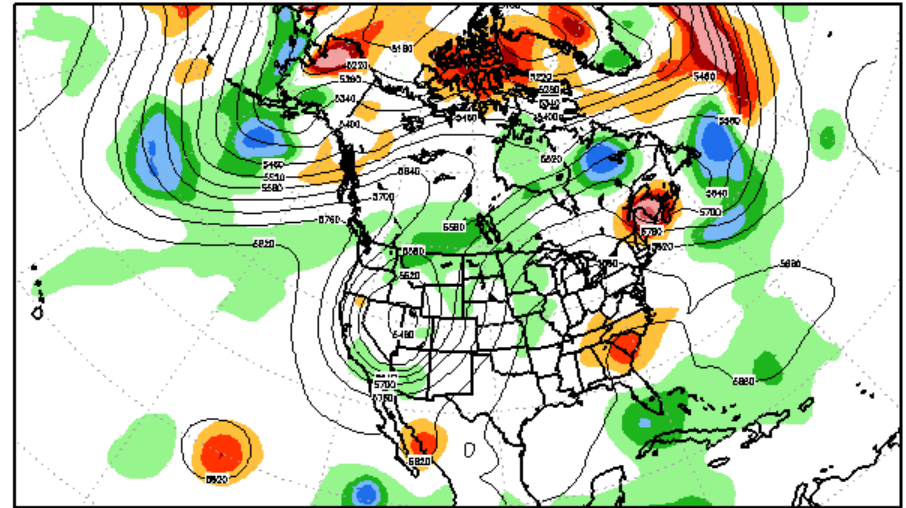


84-h fcst valid
00z 10/12;
parallel NAM
has ~1/2 lower
RMS height error
over CONUS

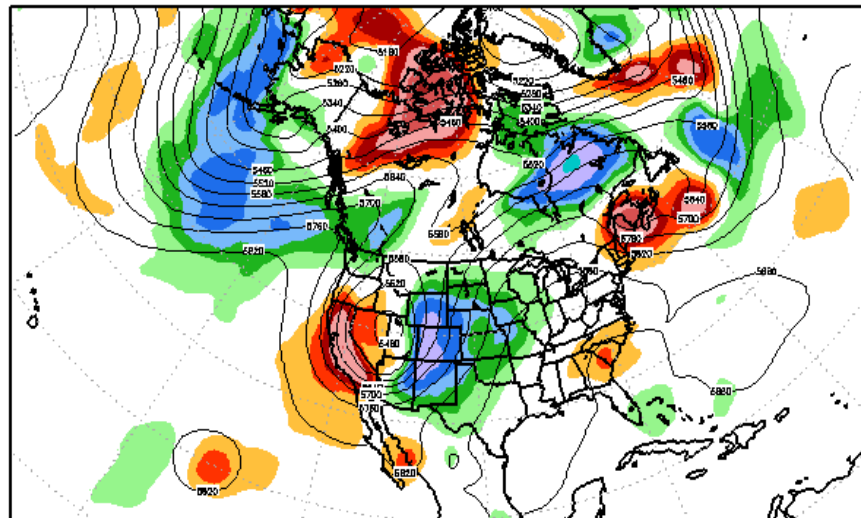
500MB NAM-GDAS ANL 84H FCST FROM 12Z 08 OCT 08



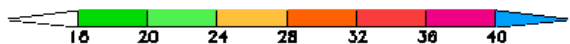
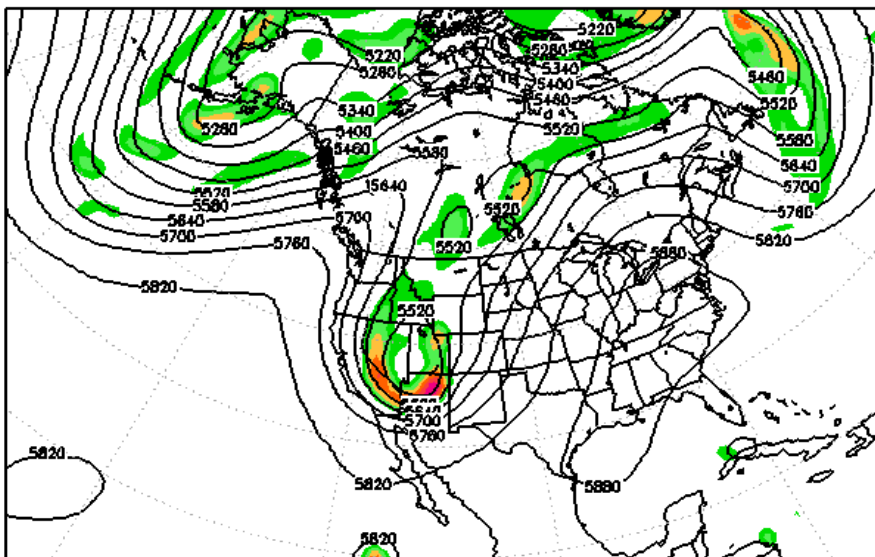
500MB NAMX-GDAS ANL 84H FCST FROM 12Z 08 OCT 08



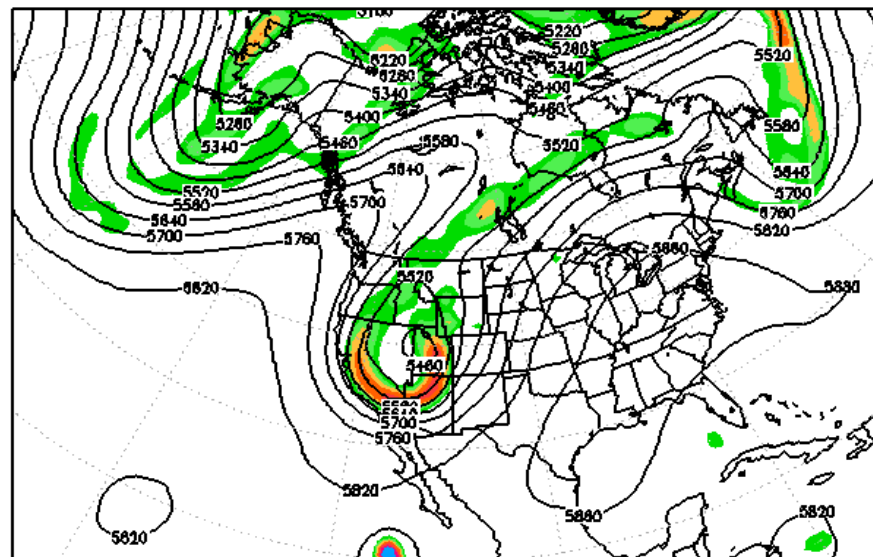
500MB GFS-GDAS ANL 84H FCST FROM 12Z 08 OCT 08



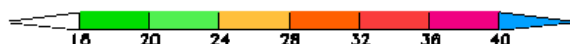
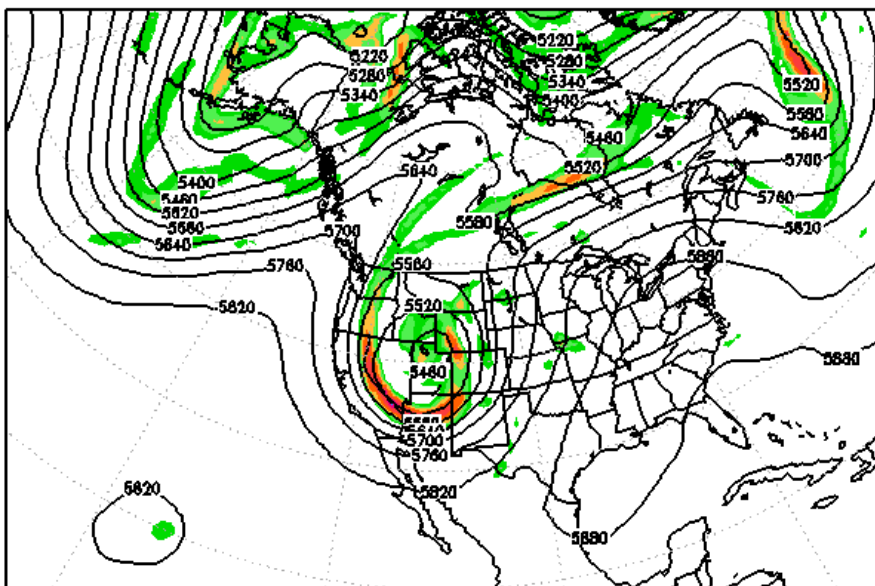
500MB Z-VORT NAM 84H FCST VALID 00Z 12 OCT 2008



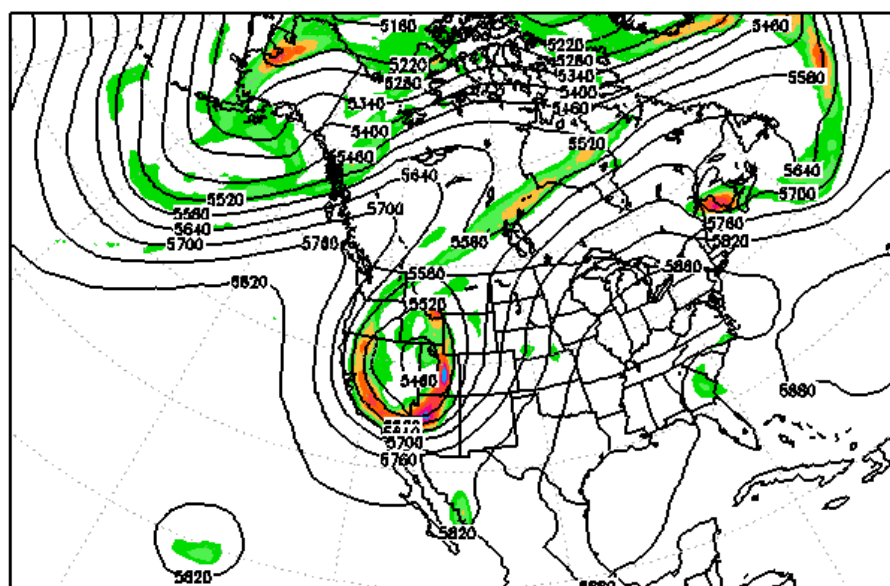
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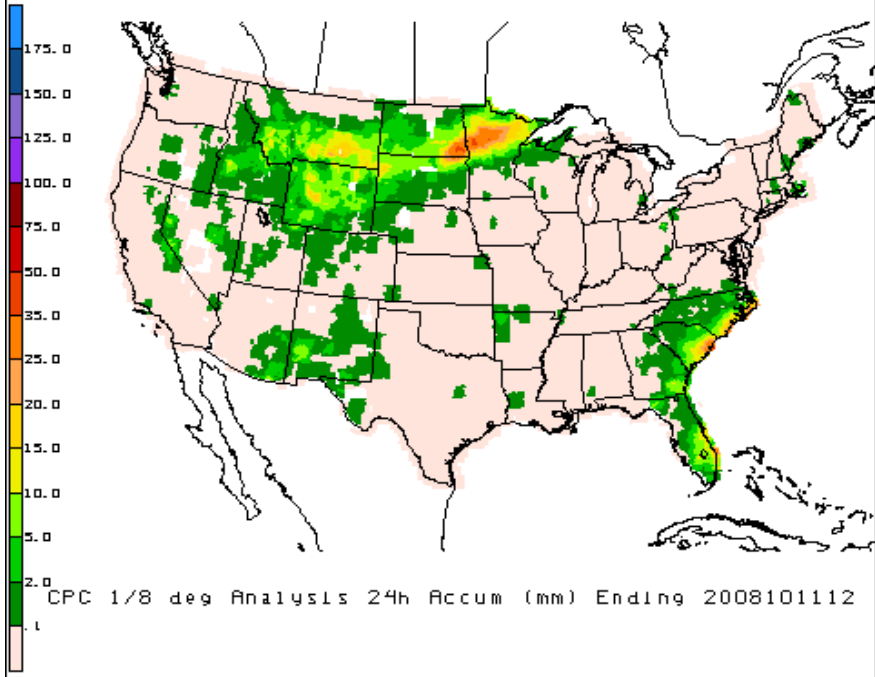
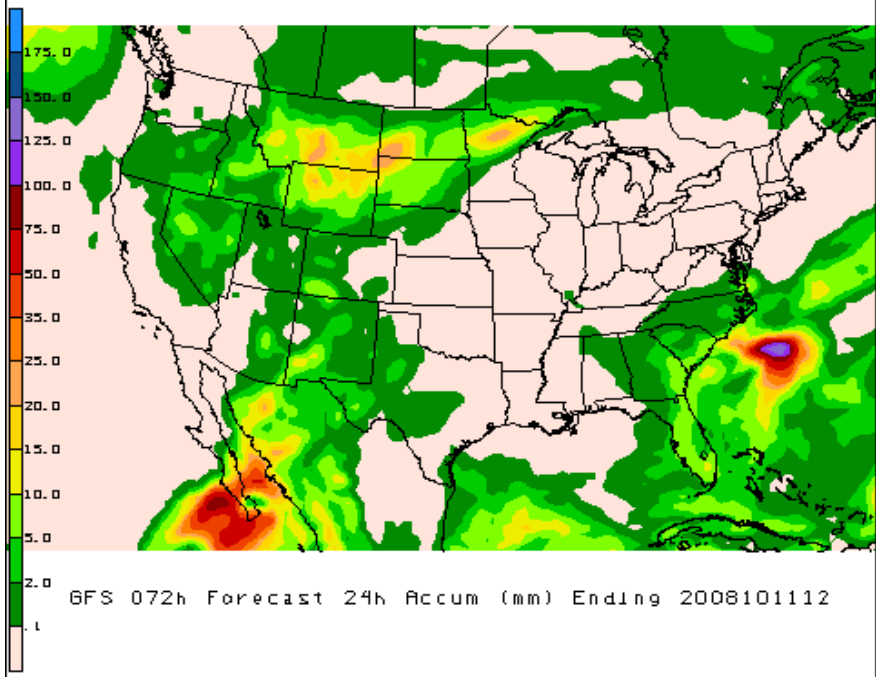
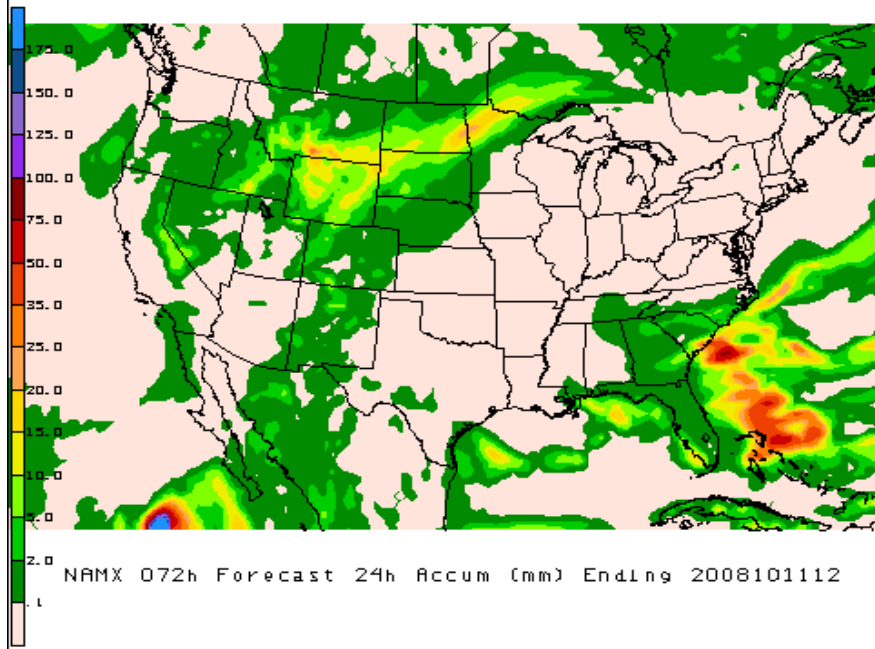
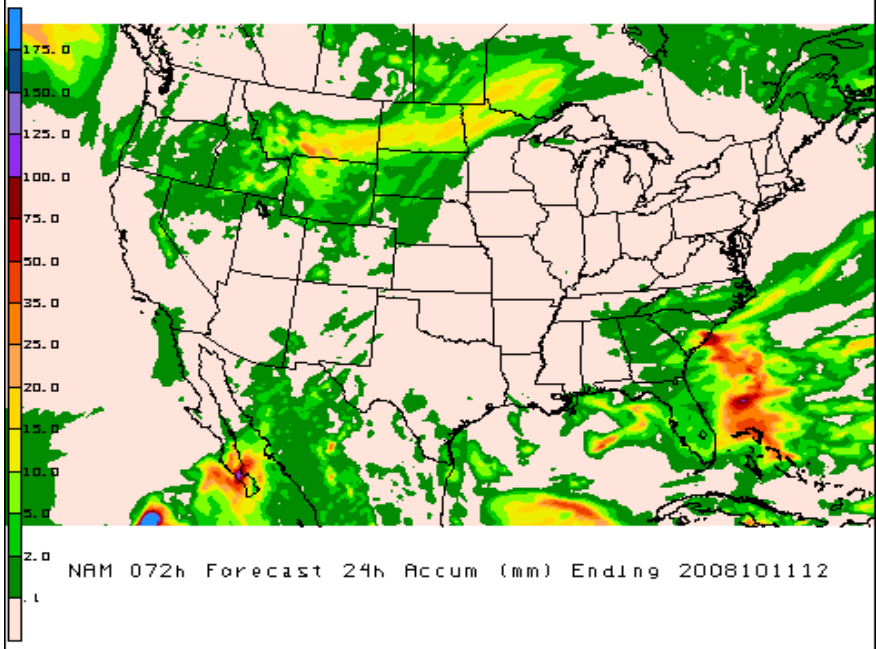


500MB Z-VORT GFS 84H FCST VALID 00Z 12 OCT 2008



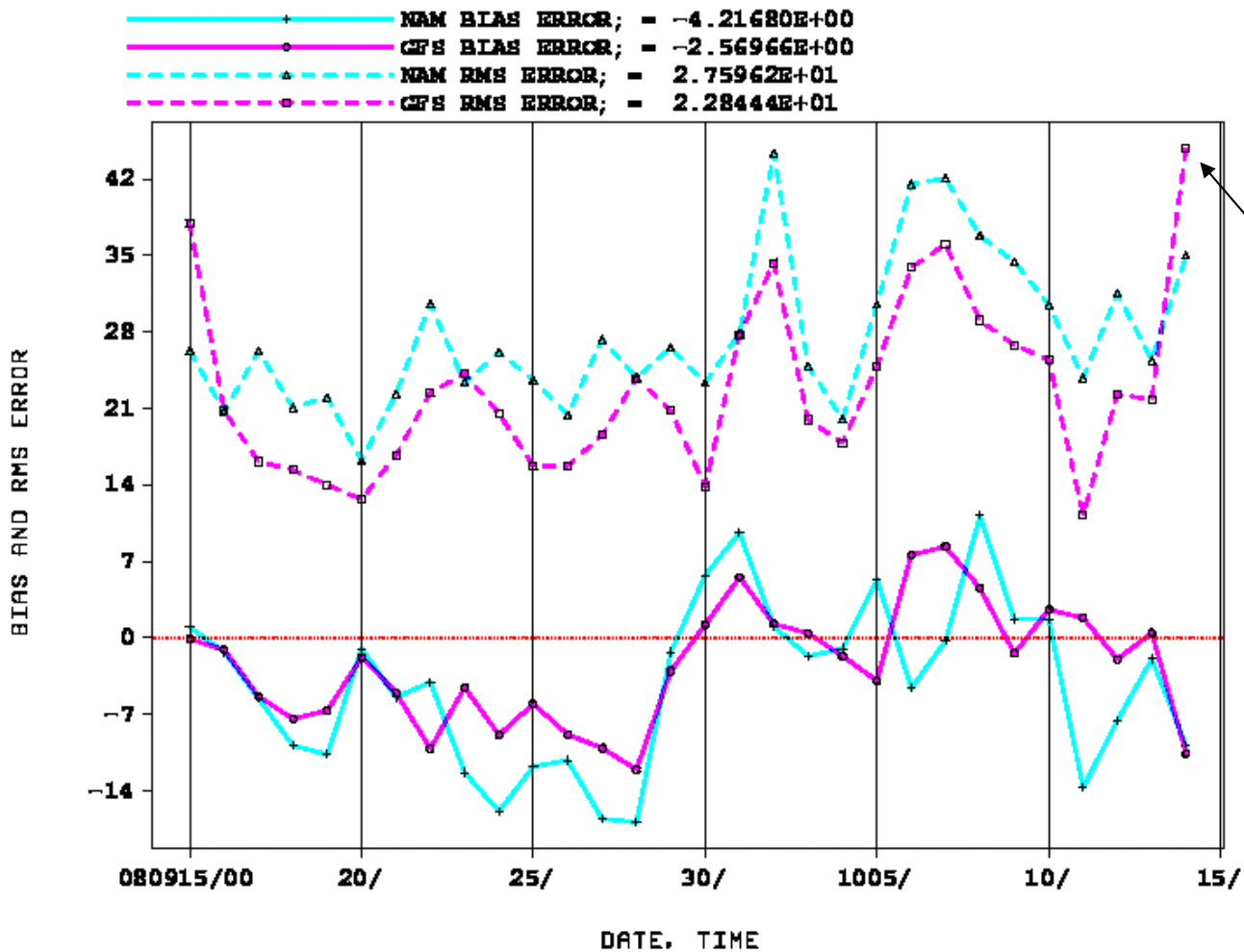
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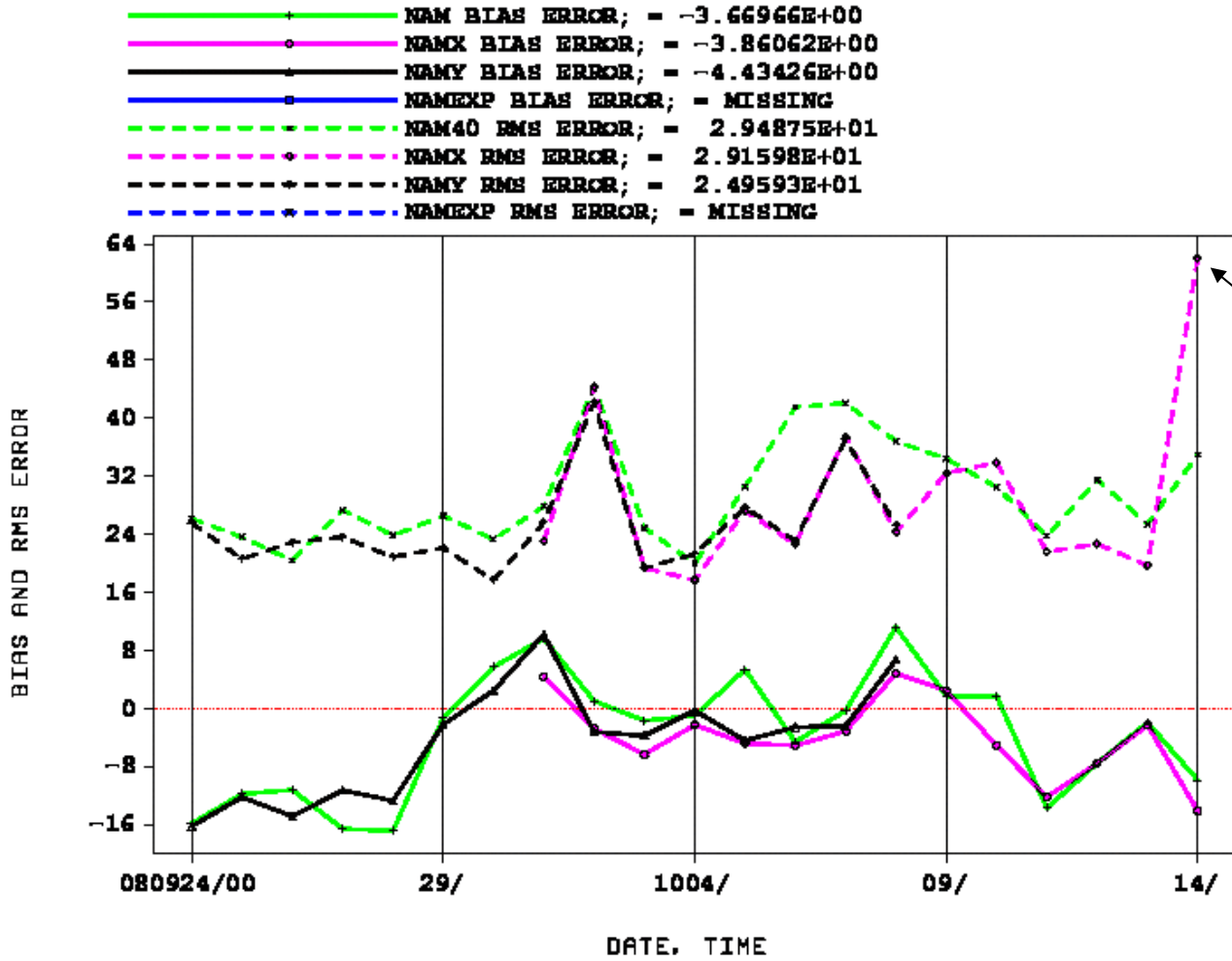


Bottom line: parallel NAM tends to look more like the GFS at days 2-3. However, while this is a good thing almost all the time, it is a bad thing if the GFS is experiencing a 'dropout'.

STAT-SL1L2 PARAM-Z FHCUR-72 V_ANL-ADPUA V_RGN-G236 LEVEL-P500 VHEMM-0000



STAT-SL1L2 PARAM-Z FHOOR-72 V_ANL-ADPUA V_RGN-G236 LEVEL-P500 VHEMM-0000



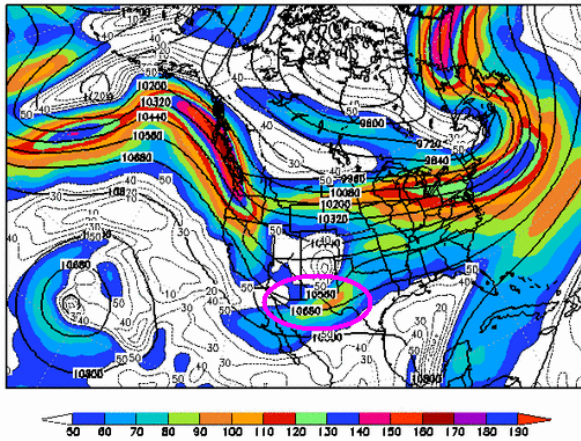
72-h fcst valid
00z 10/14;
parallel NAM
has 2x higher
RMS height error
over CONUS

Improved Real-Time Parallel (NAMX) Case

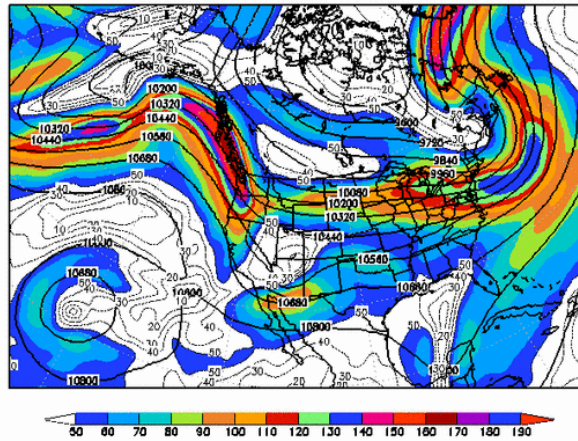
8-9 Dec. 2008 Brad Ferrier

250 mb Comparison

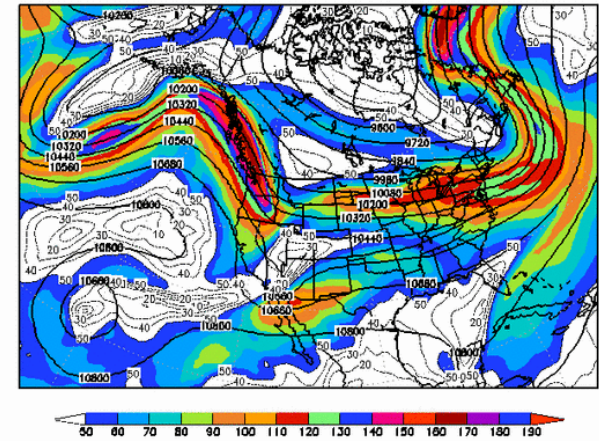
250MB Z-WIND NAM 66H FCST VALID 06Z 08 DEC 2008



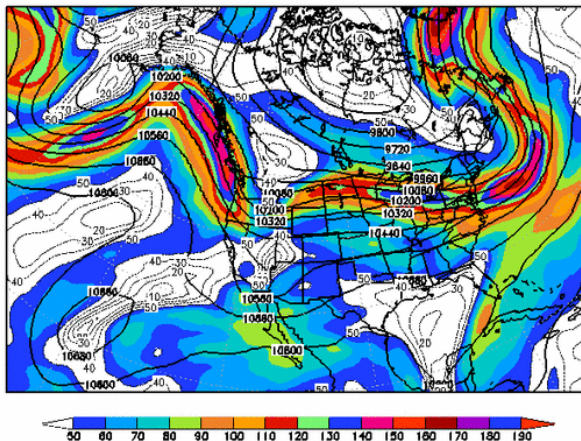
250MB Z-WIND NAMX 66H FCST VALID 06Z 08 DEC 2008



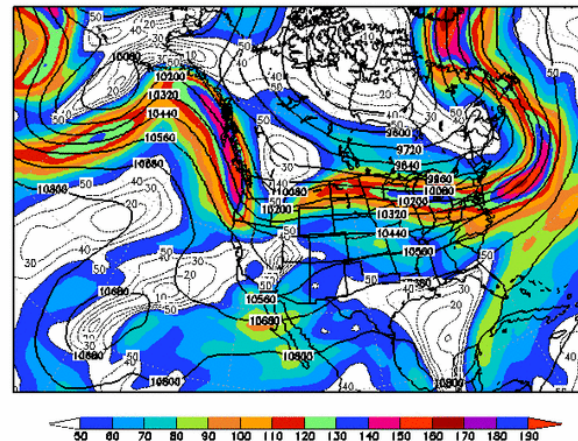
250MB Z-WIND GFS 66H FCST VALID 06Z 08 DEC 2008



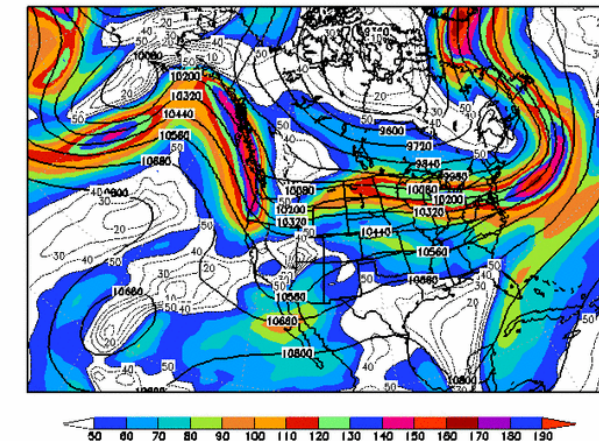
250MB Z-WIND NAM 00H FCST VALID 06Z 08 DEC 2008



250MB Z-WIND NAMX 00H FCST VALID 06Z 08 DEC 2008

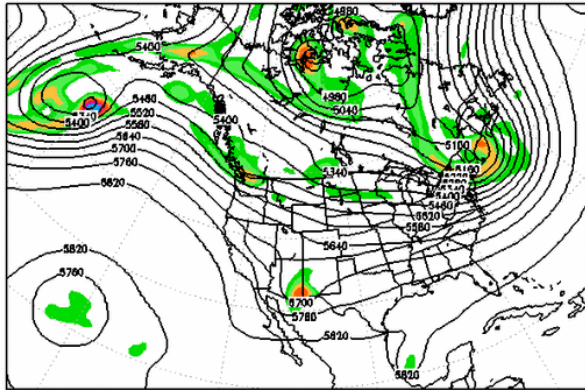


250MB Z-WIND GFS 00H FCST VALID 06Z 08 DEC 2008

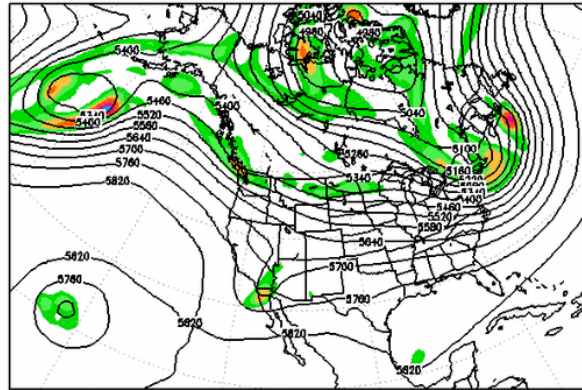


500 mb Comparison

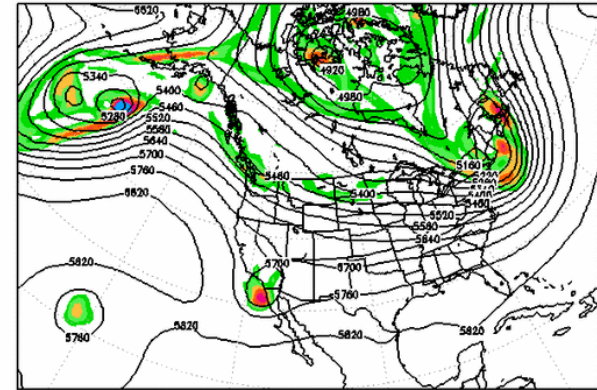
500MB Z-VORT NAM 60H FCST VALID 00Z 08 DEC 2008



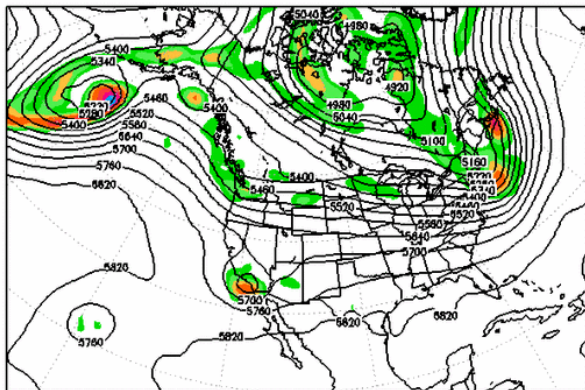
500MB Z-VORT NAMX 60H FCST VALID 00Z 08 DEC 2008



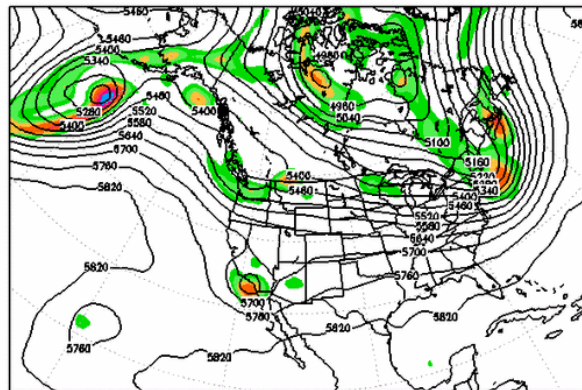
500MB Z-VORT GFS 60H FCST VALID 00Z 08 DEC 2008



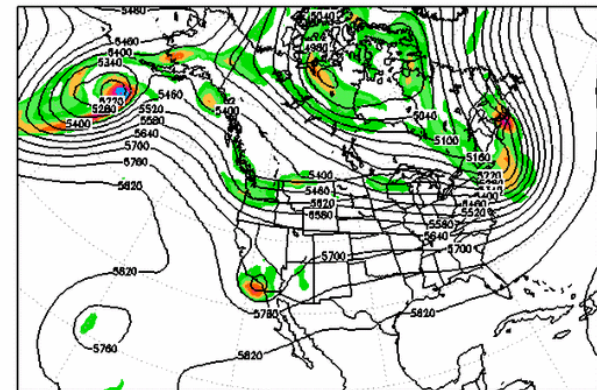
500MB Z-VORT NAM 00H FCST VALID 00Z 08 DEC 2008



500MB Z-VORT NAMX 00H FCST VALID 00Z 08 DEC 2008

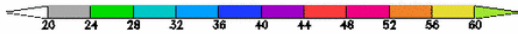
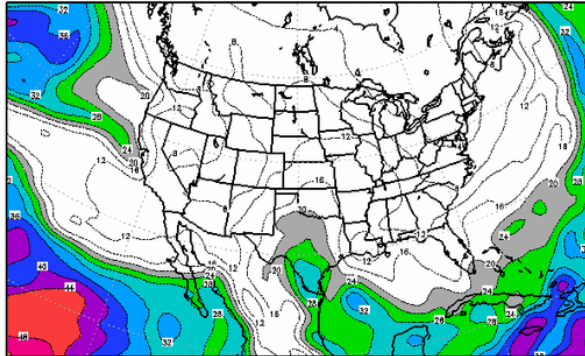


500MB Z-VORT GFS 00H FCST VALID 00Z 08 DEC 2008

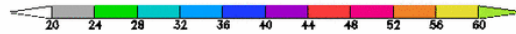
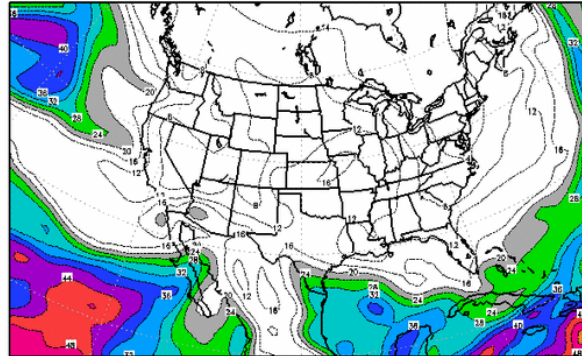


Precipitable Water Comparison

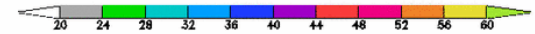
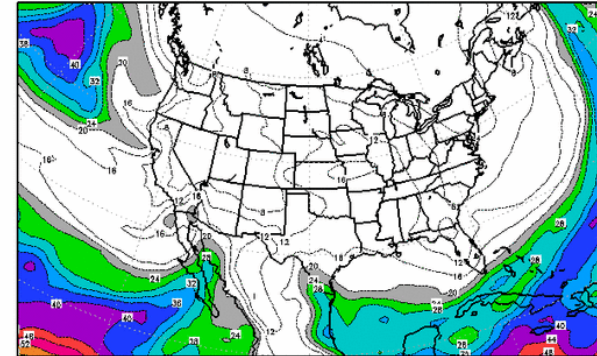
TOTAL COL PW NAM 66H FCST VALID 06Z 08 DEC 2008



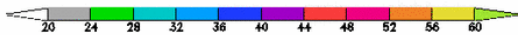
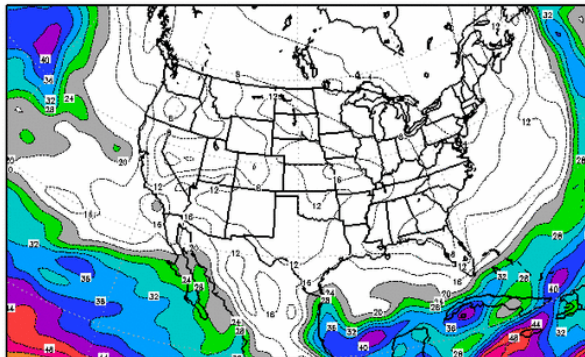
TOTAL COL PW NAMX 66H FCST VALID 06Z 08 DEC 2008



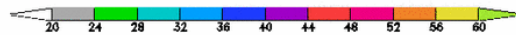
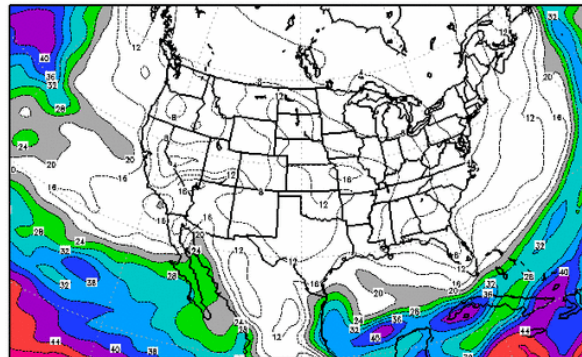
TOTAL COL PW GFS 66H FCST VALID 06Z 08 DEC 2008



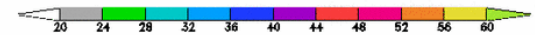
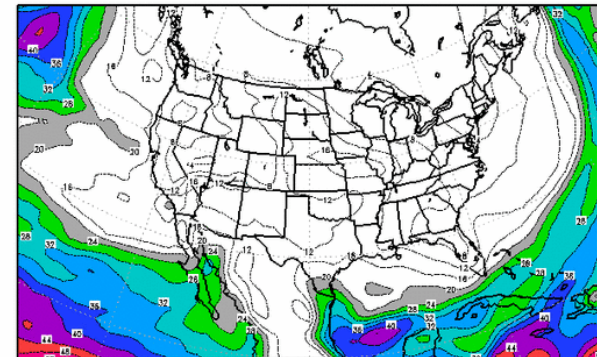
TOTAL COL PW NAM 00H FCST VALID 06Z 08 DEC 2008



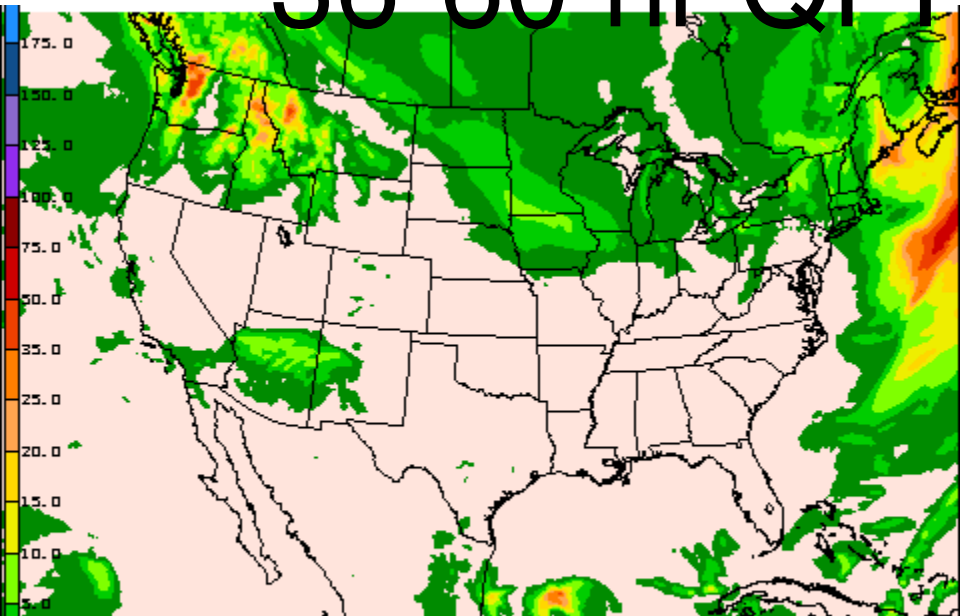
TOTAL COL PW NAMX 00H FCST VALID 06Z 08 DEC 2008



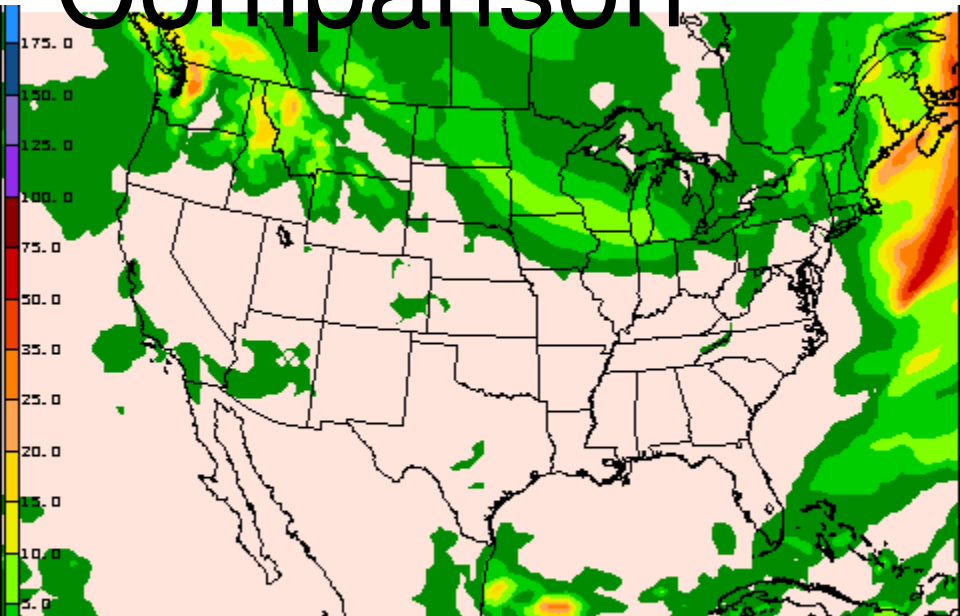
TOTAL COL PW GFS 00H FCST VALID 06Z 08 DEC 2008



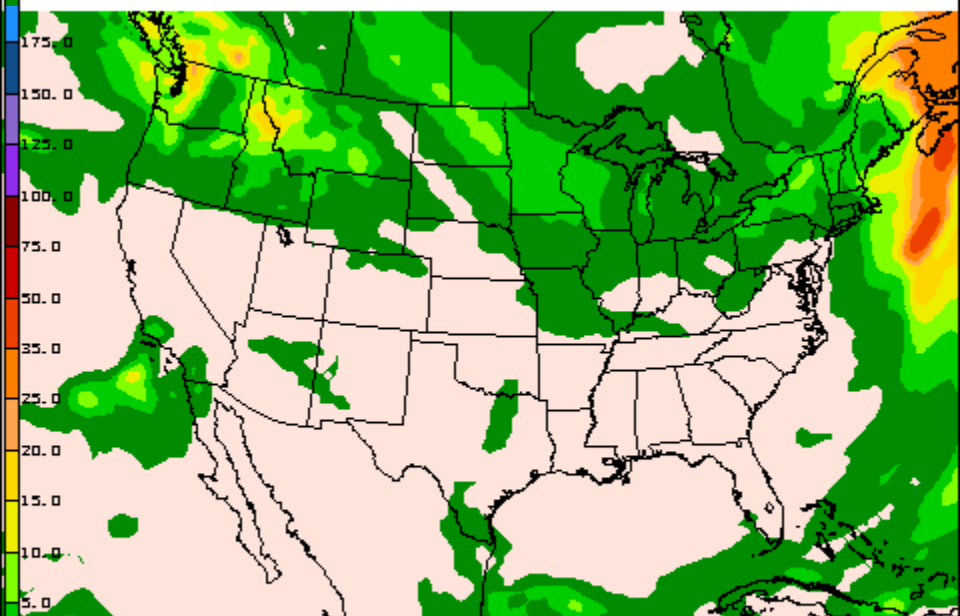
36-60 hr QPF Comparison



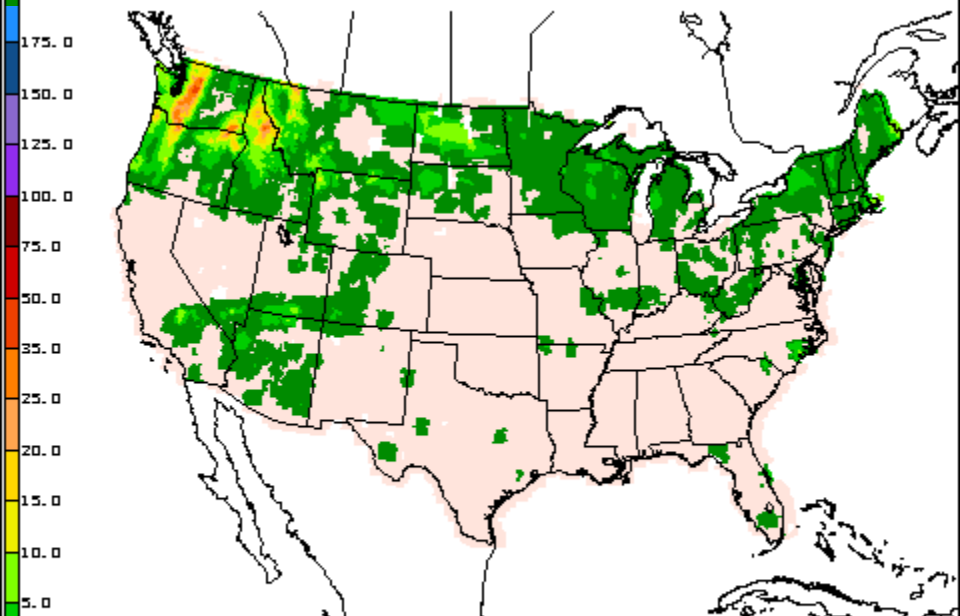
NAM 060h Forecast 24h Accum (mm) Ending 2008120812



NAMX 060h Forecast 24h Accum (mm) Ending 2008120812

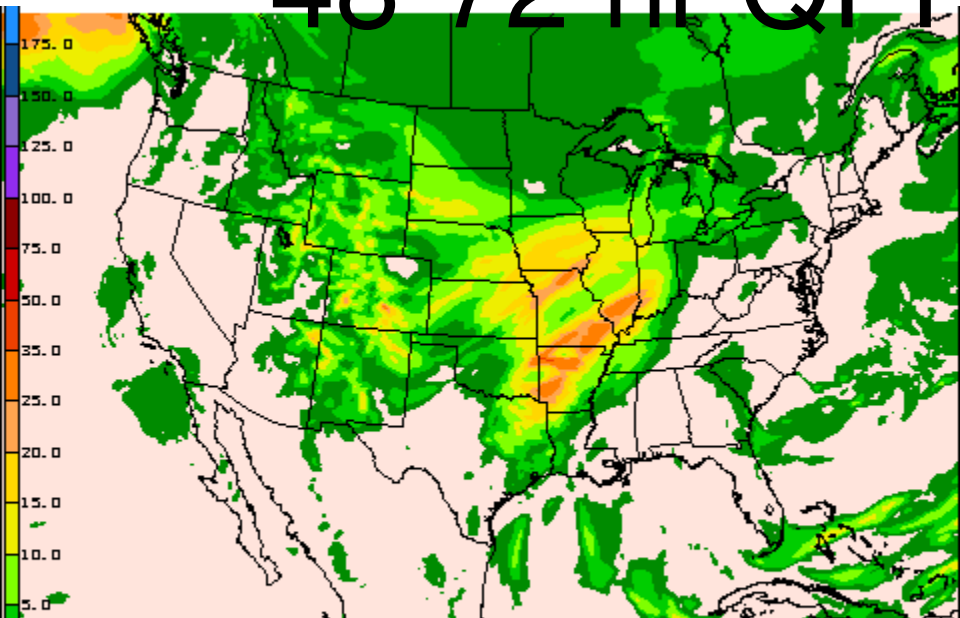


GFS 060h Forecast 24h Accum (mm) Ending 2008120812

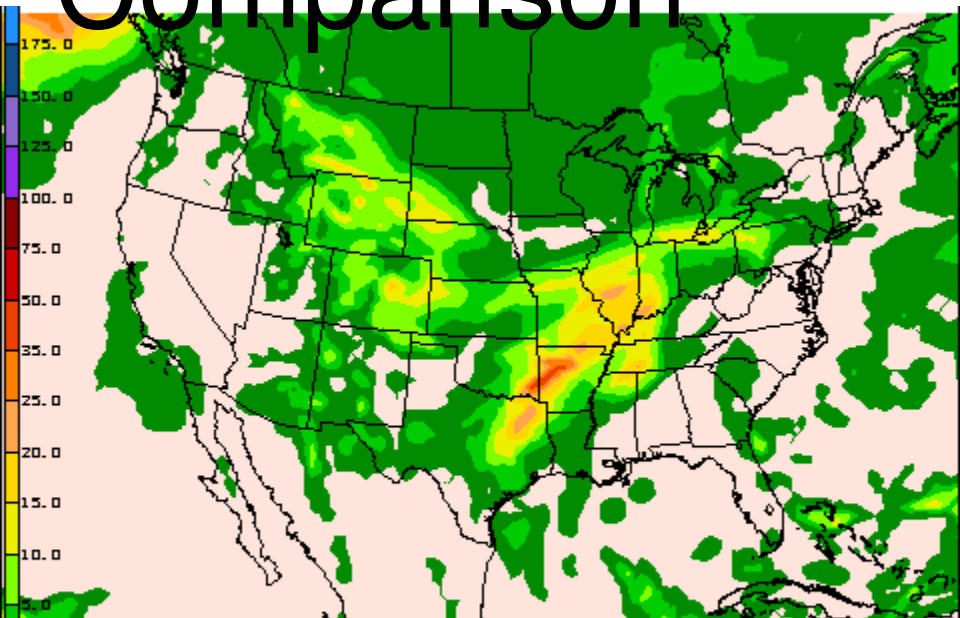


CPC 1/8 deg Analysis 24h Accum (mm) Ending 2008120812

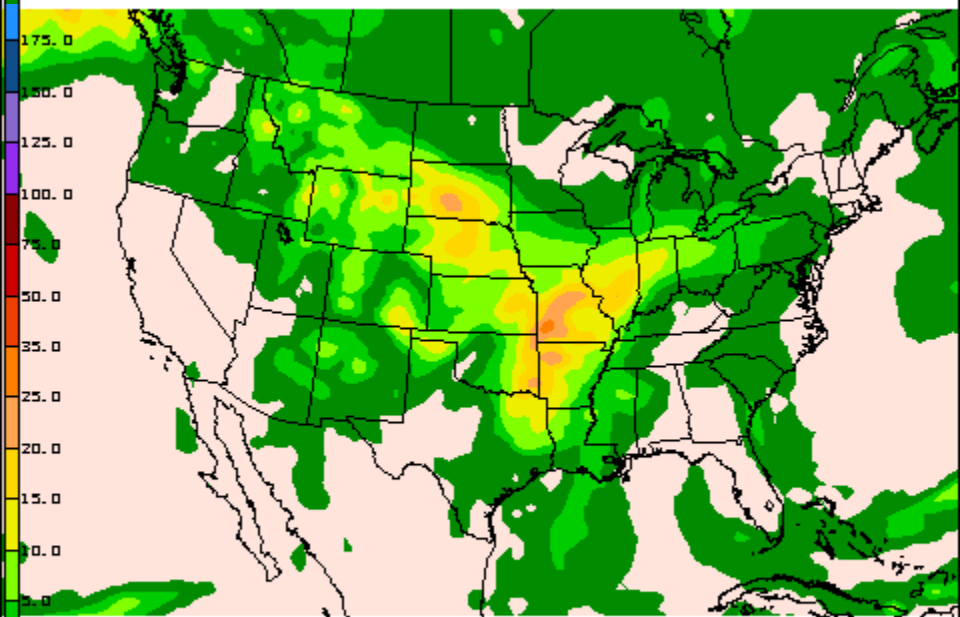
48-72 hr QPF Comparison



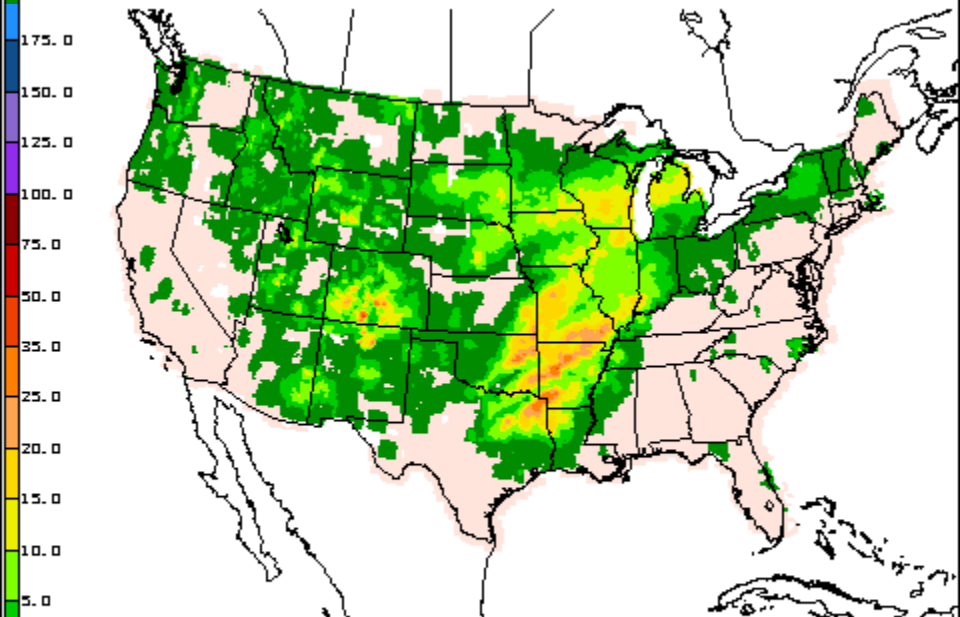
NAM 072h Forecast 24h Accum (mm) Ending 2008120912



NAMX 072h Forecast 24h Accum (mm) Ending 2008120912



GFS 072h Forecast 24h Accum (mm) Ending 2008120912



CPC 1/8 deg Analysis 24h Accum (mm) Ending 2008120912

HPC Real-Time Evaluation & Recommendation 1. Mike Bodner

- Our forecasters made frequent use of the NAMP and provided mostly positive feedback.
- The only negative feedback was that the NAMP did not improve on the NAM on a few occasions.
- There were no occasions where the NAMP performed worse than the operational NAM.
- On two specific events over the central plains, I received extensive feedback (see next slide).
- In both cases, the NAMP influenced forecaster reasoning on shift.
- Therefore, the HPC gives a "thumbs up" in moving forward with new NAM implementation.

HPC Real-Time Evaluation & Recommendation 2. Mike Bodner

- 1st Case: October 21, 2008 at the 12Z cycle
 - The NAMP was further north than the operational NAM with a deep closed low over the central plains.
 - This positioning clustered well with the 12Z CMC GEM and the NCEP GFS as well as the 00Z ECMWF.
 - The NAMP performed well in both positioning and precipitation type of the comma-head banding over central and western Nebraska.
- 2nd Case: November 9, 2008 at the 00Z cycle
 - The NAMP trended faster than the operational NAM in moving a 500 hPa low across the central plains after 60 hours.
 - Once again the NAMP moved into closer clustering with the 00Z ECMWF and CMC.

AWC Evaluation of Dec 2008 NAM Parallel 5 Dec 2008

Dr. Steverino Silberberg, Andy Fischer and Bruce Entwistle

- NAM-Parallel basic meteorological fields equivalent to NAM-Operational, some parallel fields slightly better than operational
- New post-process lowest freezing level height algorithm is a significant improvement over operational algorithm
 - Using 2 m temperature instead of surface temperature
 - Thank you Hui-ya Chuang and Eric Rogers!

AWC Recommendation & Suggestion

- AWC recommends operational implementation of NAM-Parallel
- Thank you to:
 - EMC for development
 - and NCO for dataflow
- Suggestion: Please notify AWC 3 weeks before parallel dataflow begins because AWC requires:
 - Configuration Control Board Approval for DBNet and NAWIPS configuration changes to acquire, configure, compute, and render AWC-specific diagnostics
 - Implementation of AWC-specific model evaluation procedure

SPC NAM Evaluation:

December 3, 2008 Steven Weiss

- SPC Evaluation Procedures
 - SPC examined several real-time parallel NAM runs during the 30 day evaluation period when there were enhanced severe storm threats
 - Comparisons were made between operational (NAM) and parallel (NAMp) versions for synoptic pattern evolution and several parameters used for severe thunderstorm forecasting
 - RUC 00-hr grids for fields aloft and SPC Mesoscale Analysis fields for surface parameters were used as “truth”
 - Unfortunately, severe weather days have been infrequent during the evaluation period. November 5 and November 14 severe weather cases were examined in more detail
- Examples / case study slides are provided in full in the Backup Section

SPC Recommendation

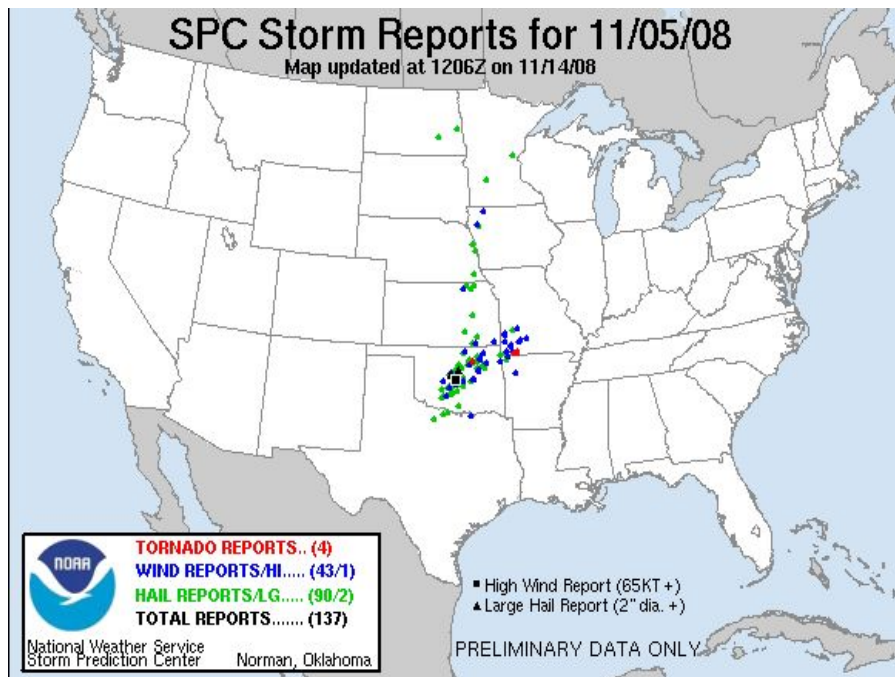
- **Parallel NAM provided guidance for severe convective weather forecasting that is as good or better than operational NAM**
 - Based primarily on close examination of two November severe weather cases
- SPC was also involved in aspects of a late summer “pre-evaluation”, and discussions at that time clearly showed parallel NAM performance was considerably improved based on nearly all statistical measures
 - Improved physics/dynamics
 - Partial cycling and use of WPS
 - GSI upgrade
- **Summary - SPC gives a “thumbs up” for implementation**

Backup

Section

Real-Time NAM Model Runs for November 5, 2008

- Cool Season Severe Storms over the Central U.S.
 - 4 tornadoes (OK and MO) and 2 injuries
 - Considerable hail damage around central Oklahoma



Severe Storms – 4 Tornadoes (OK; MO)

Golf ball and larger hail (Norman, OK)

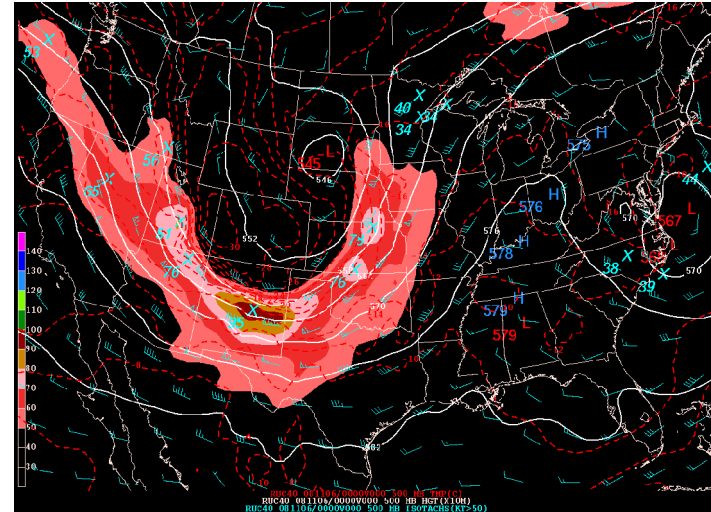
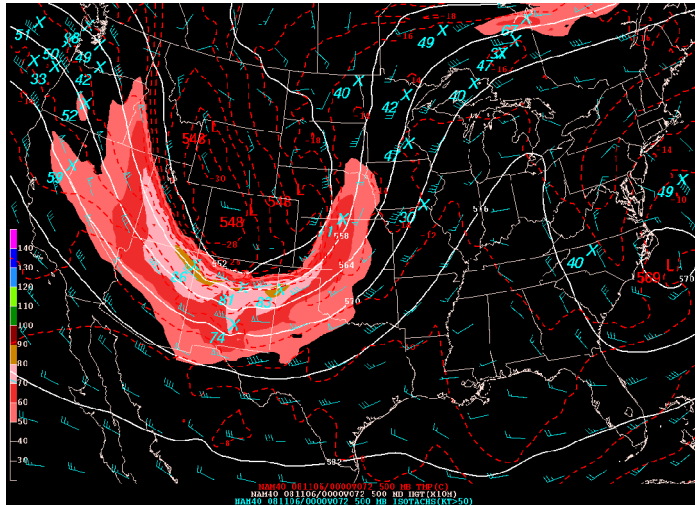
NAM and NAMp Synoptic Pattern Forecasts

500 mb, 850 mb, and EMSL/Dew Point
Forecasts from Day 3, Day 2, and Day 1
Valid 00z 6 November

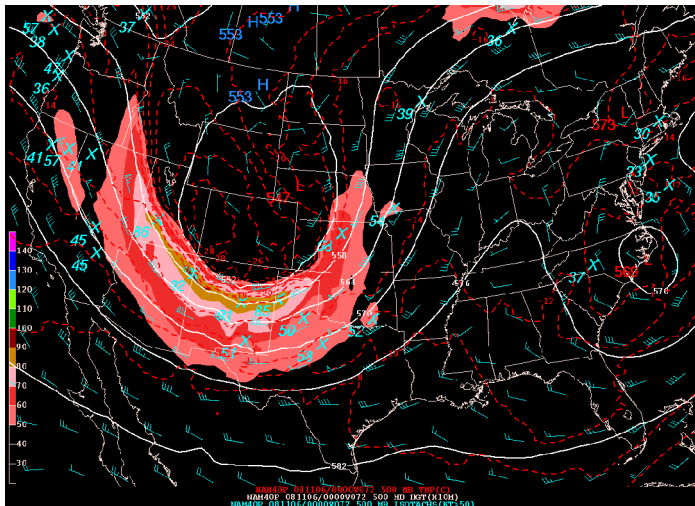
Day 3 NAM 00z 3 Nov 2008

72-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



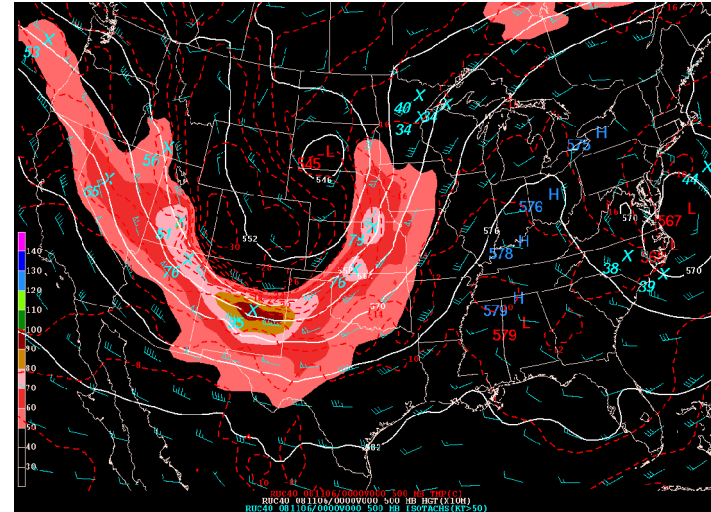
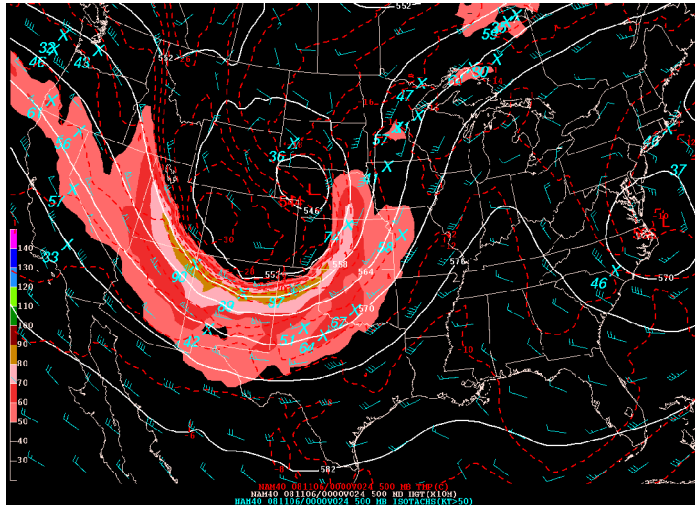
NAM and NAMp Forecasts of
500 mb Height, Temperature,
and Wind Barbs/Isotachs

NAMp was better indicating
more eastward position and
closing off of single upper low
over the High Plains.

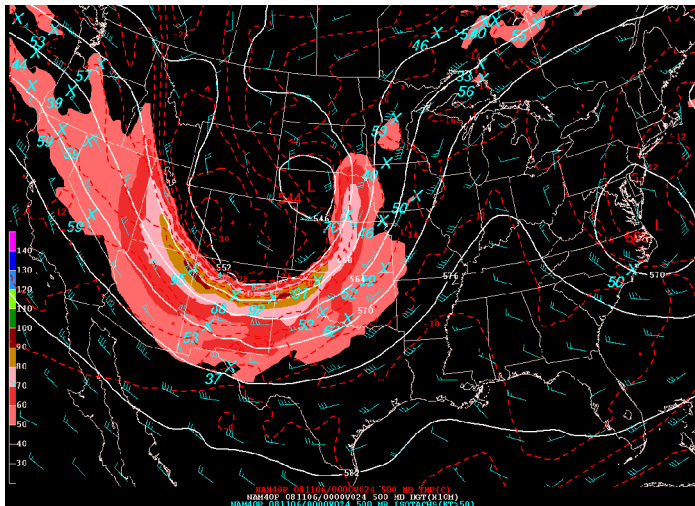
Day 1 NAM 00z 5 Nov 2008

24-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



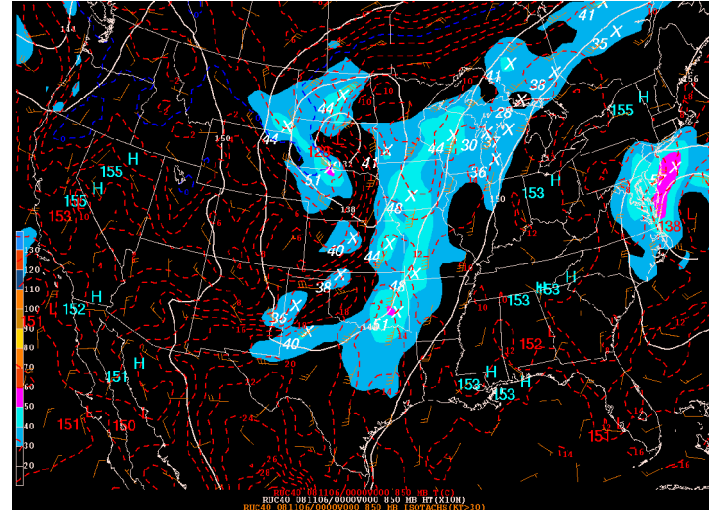
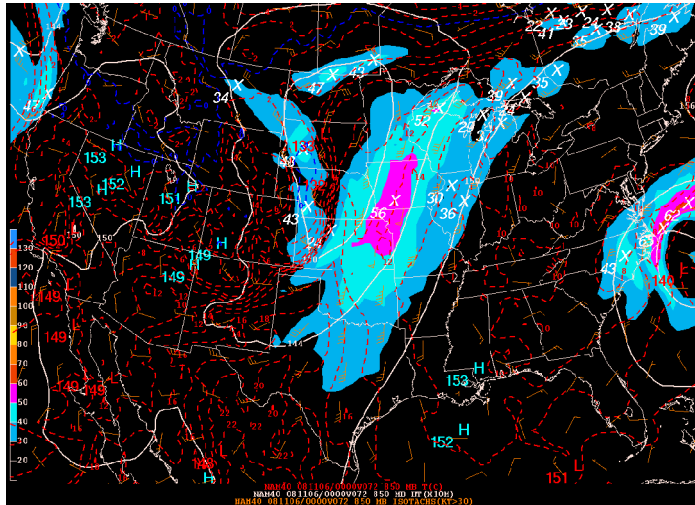
NAM and NAMp Forecasts of 500 mb Height, Temperature, and Wind Barbs/Isotachs

NAM and NAMp upper low solutions very similar, trending toward verification pattern with time. NAMp was better with slightly stronger winds in base of trough.

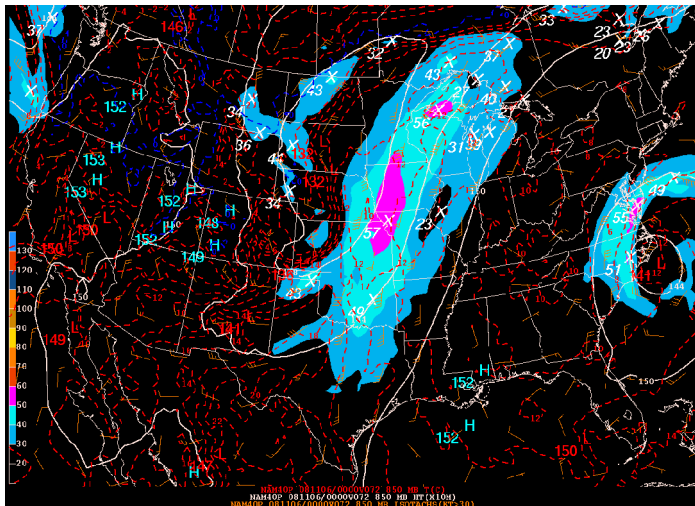
Day 3 NAM 00z 3 Nov 2008

72-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



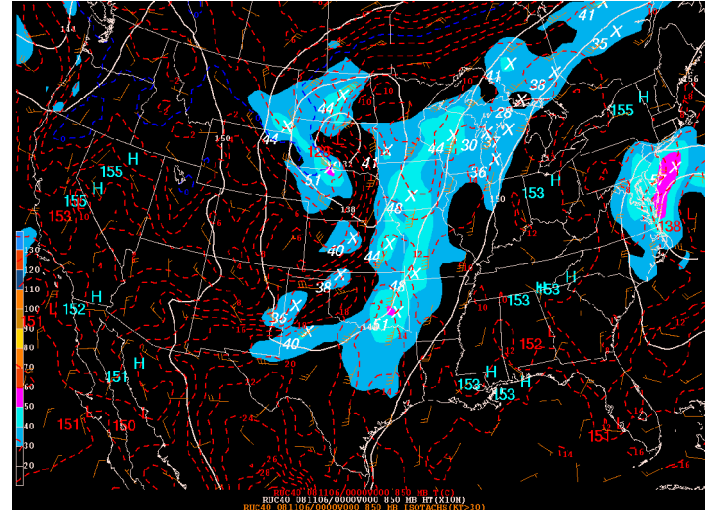
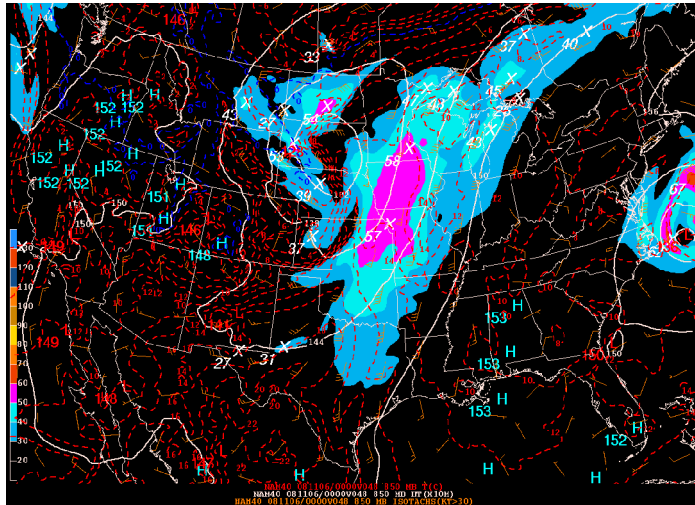
NAM and NAMp Forecasts of 850 mb Height, Temperature, and Wind Barbs/Isotachs

NAM and NAMp solutions both predicted max winds too strong, but southward extent of stronger winds in NAMp extending to Red River verified better.

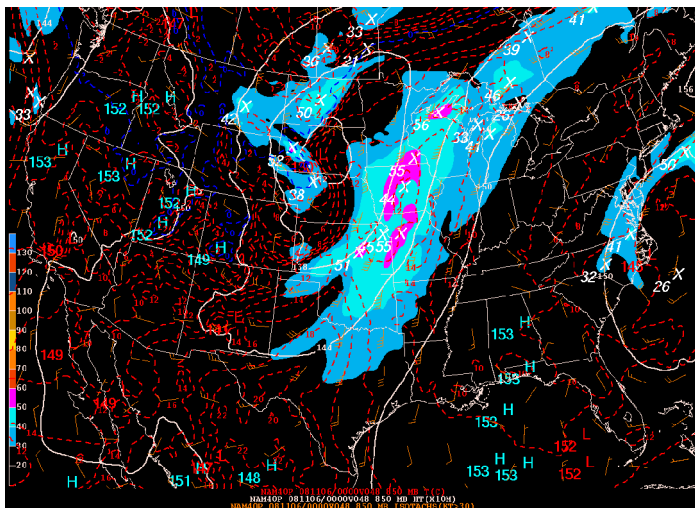
Day 2 NAM 00z 4 Nov 2008

48-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



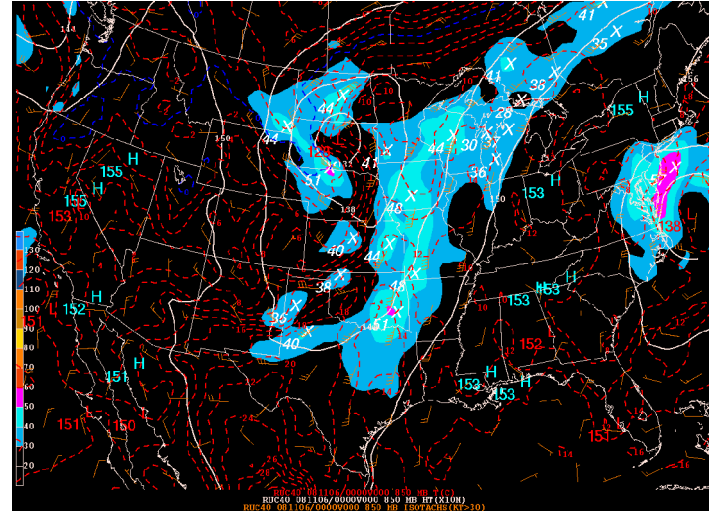
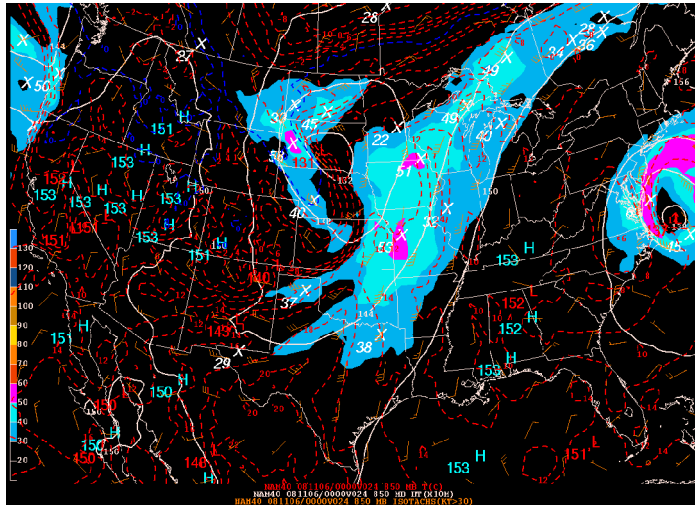
NAM and NAMp Forecasts of 850 mb Height, Temperature, and Wind Barbs/Isotachs

Smaller areal coverage of NAMp strongest winds verified better than NAM forecast.

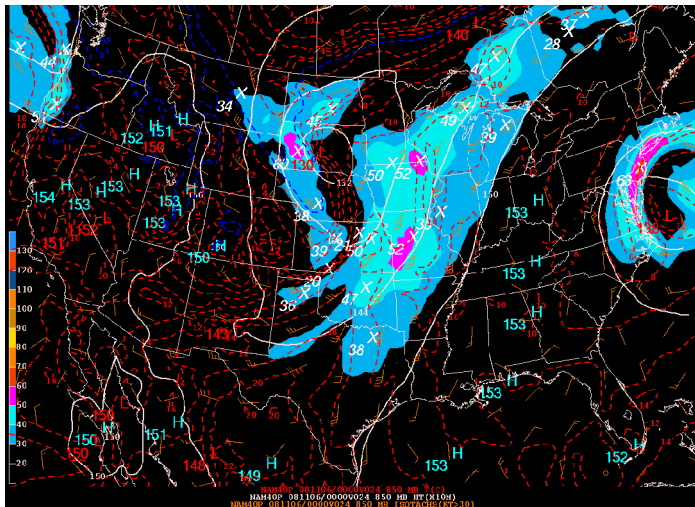
Day 1 NAM 00z 5 Nov 2008

24-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



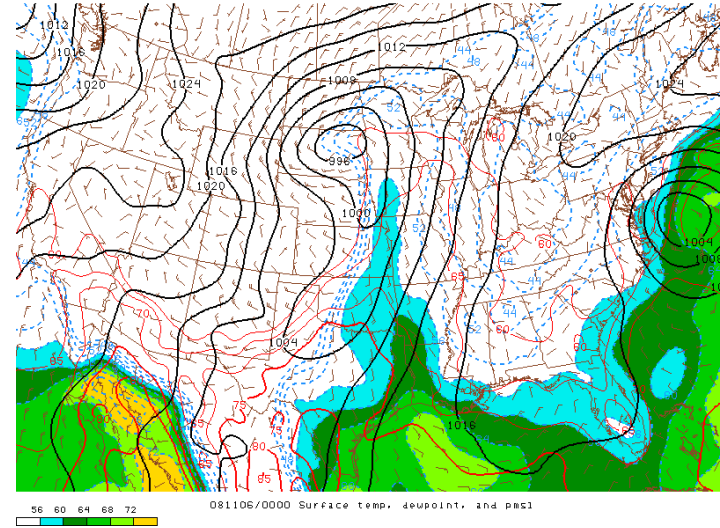
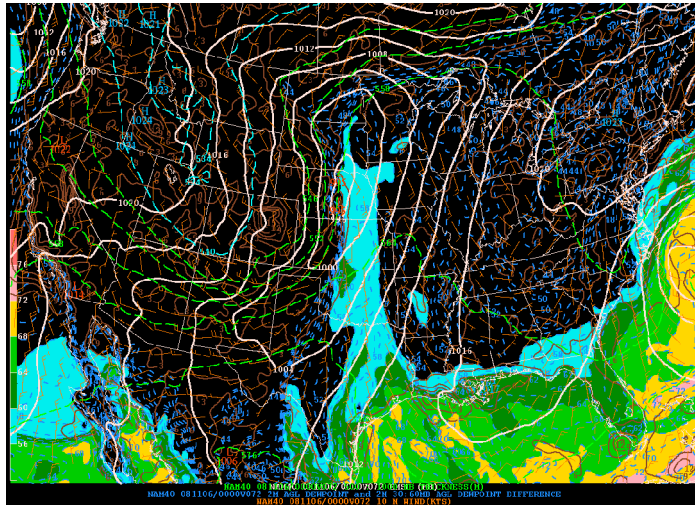
NAM and NAMp Forecasts of
850 mb Height, Temperature,
and Wind Barbs/Isotachs

SREF and SREFp solutions very
similar, trending toward
verification pattern with time.

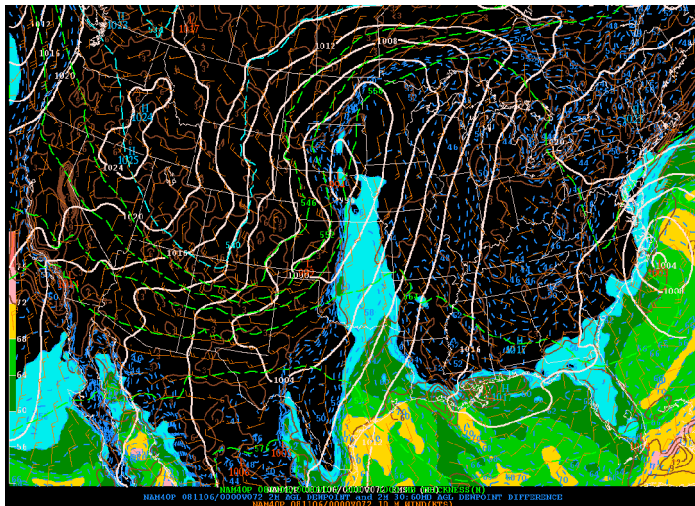
Day 3 NAM 00z 3 Nov 2008

72-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



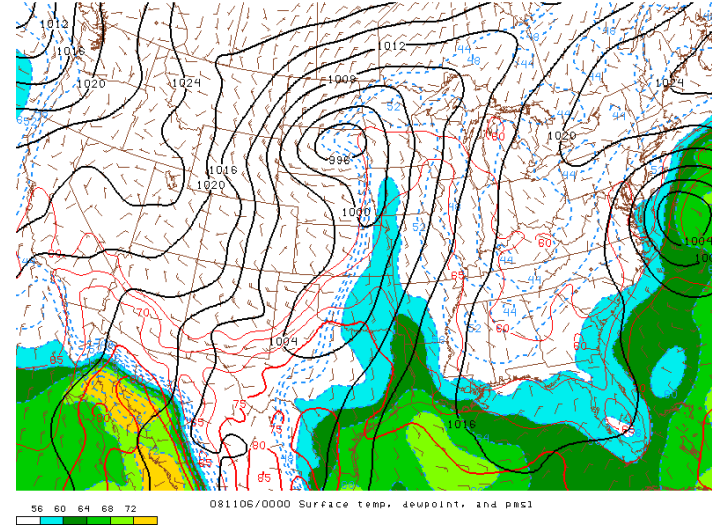
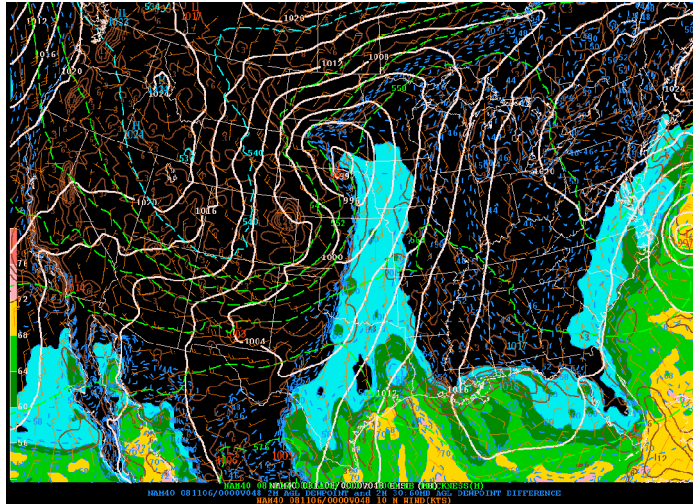
NAM and NAMp Forecasts of EMSL, 2m Dewpoint, 10m Winds, and Thickness

NAMp forecast slightly better, especially with 60F dewpoint axis across east TX.

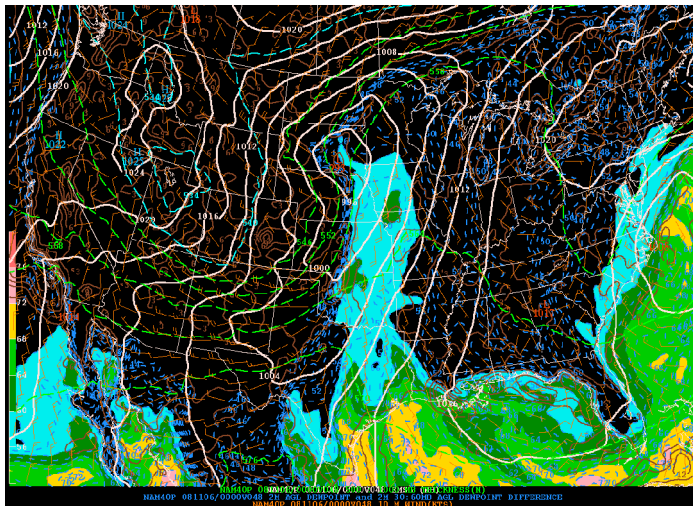
Day 2 NAM 00z 4 Nov 2008

48-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



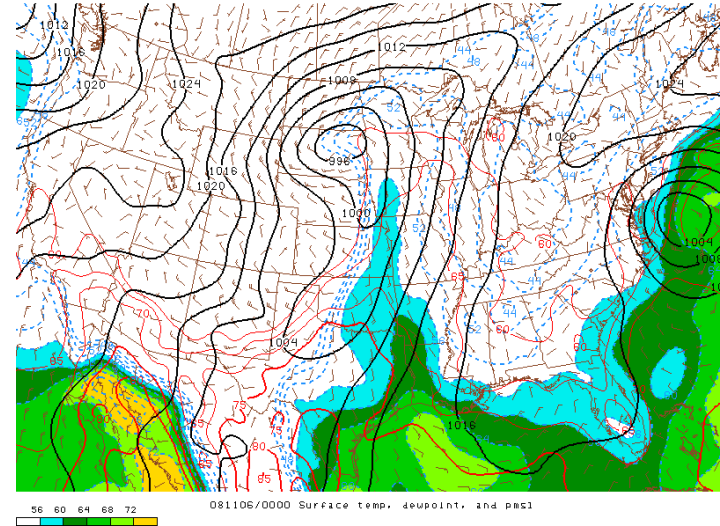
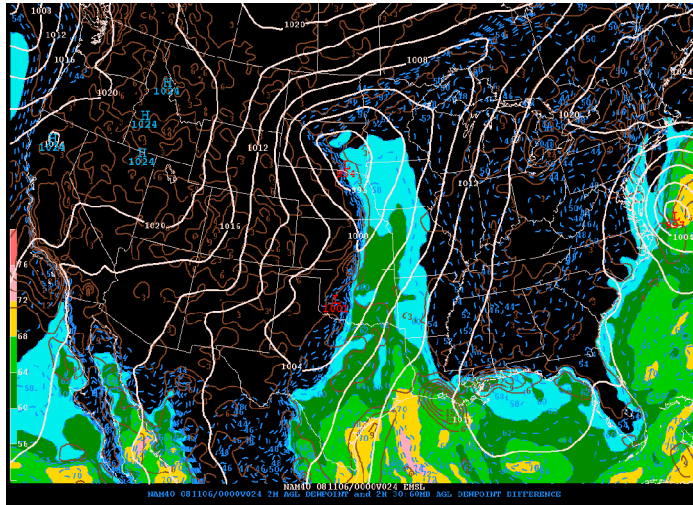
NAM and NAMp Forecasts of EMSL, 2m Dewpoint, 10m Winds, and Thickness

NAMp similar to NAM forecast but with larger regions of excessively high dewpoint values in OK and IA.

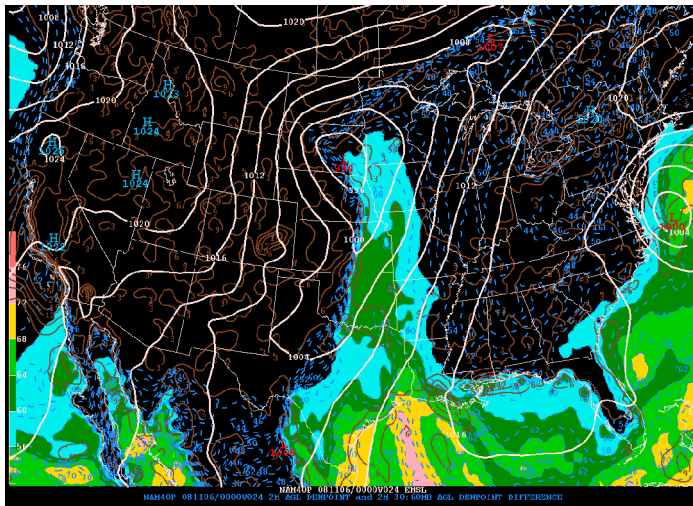
Day 1 NAM 00z 5 Nov 2008

24-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



NAM and NAMp Forecasts of EMSL, 2m Dewpoint, 10m Winds, and Thickness

NAM and NAMp both predicted excessively wide moist axis with 60F values too far north.

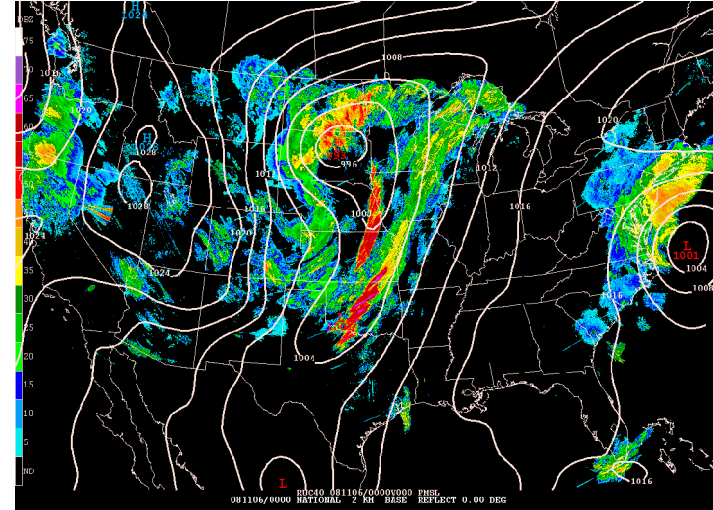
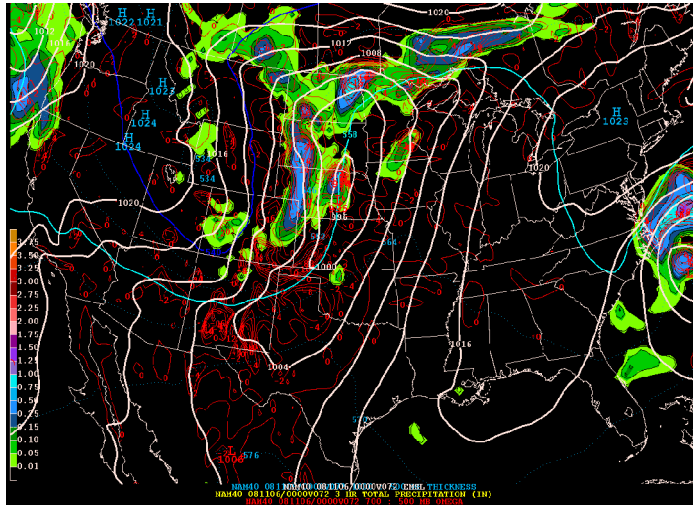
NAM and NAMp Precipitation Forecasts

3-hr Accumulated Precipitation Forecasts
from Day 3, Day 2, and Day 1
Valid 00z 6 November 2008

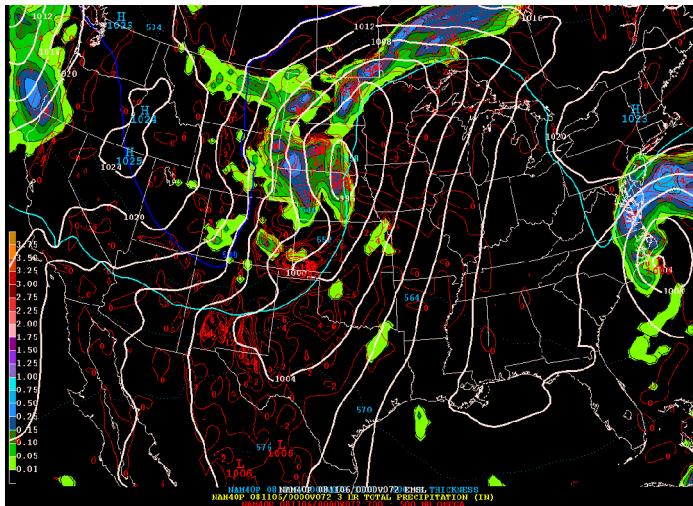
Day 3 NAM 00z 3 Nov 2008

72-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



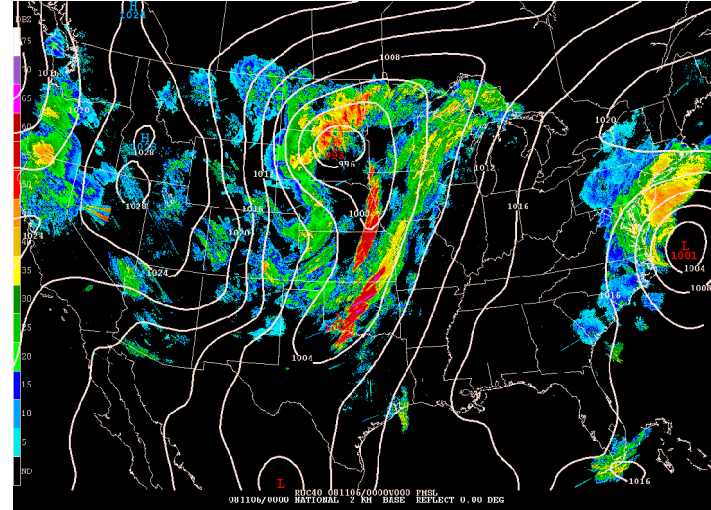
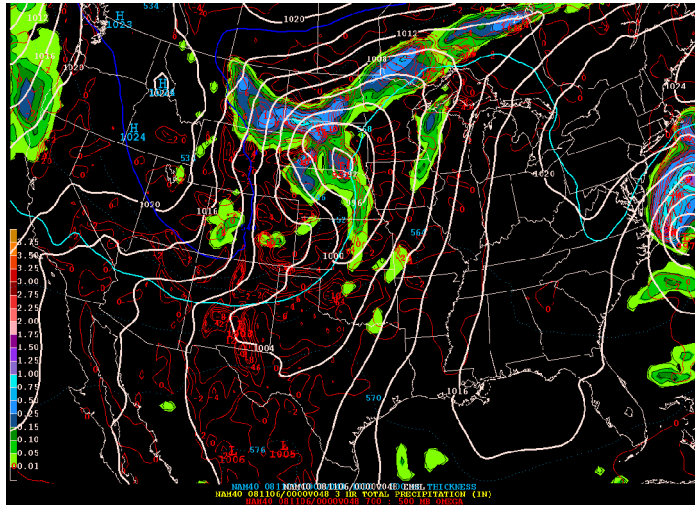
NAM and NAMp Forecasts of
3-hr Accumulated Precipitation

Both failed to predict linear
convective segments from MO
into OK, although NAMp
showed small bands over
northeast KS and north TX.

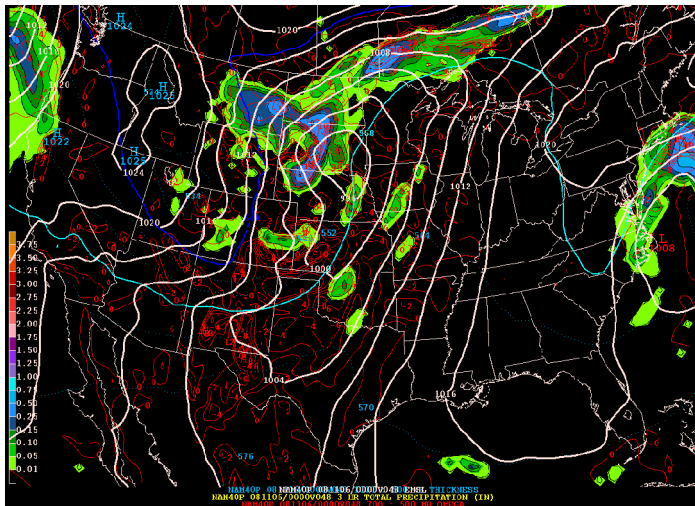
Day 2 NAM 00z 4 Nov 2008

48-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



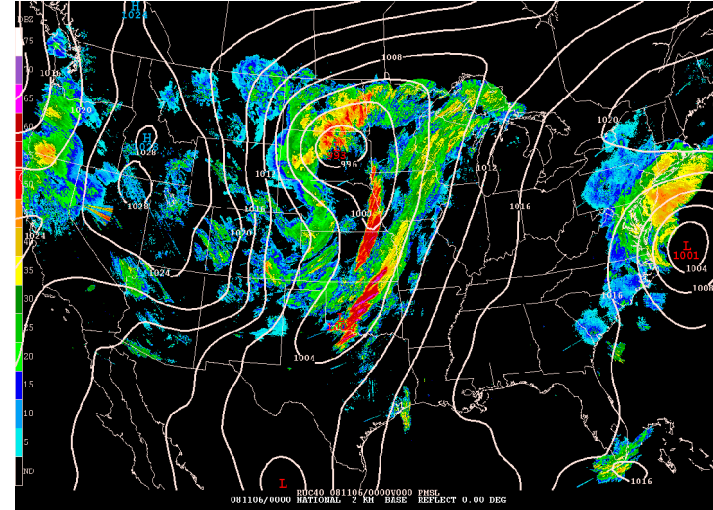
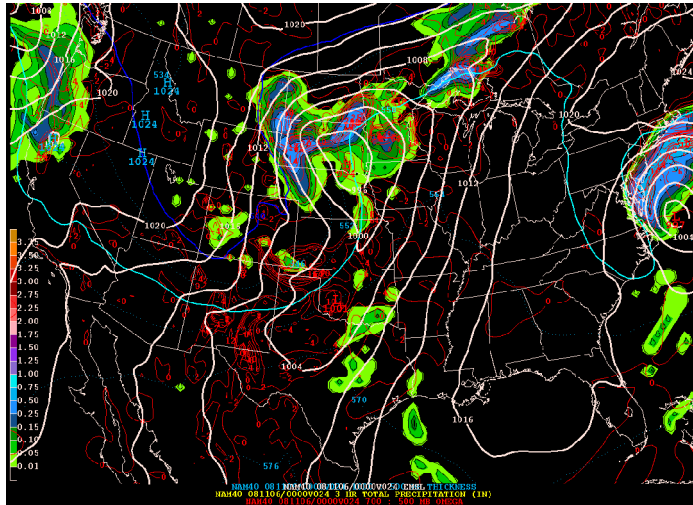
NAM and NAMp Forecasts of 3-hr Accumulated Precipitation

NAM better with band across eastern NE into KS, while NAMp perhaps better indicating heavier rain potential in OK but coverage/orientation incorrect.

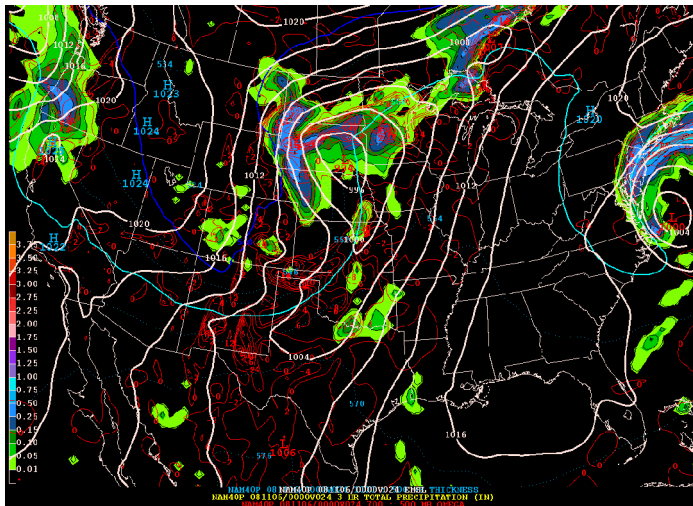
Day 1 NAM 00z 5 Nov 2008

24-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



NAM and NAMp Forecasts of
3-hr Accumulated Precipitation

NAM and NAMp very similar,
failing to capture linear structure
in OK. NAMp did not predict
pcpn in central TX and was
better than NAM this area.

NAM and NAMp Supercell Composite Parameter Forecasts

SCP Combines MUCAPE, 0-6 km Shear and 0-3 km Helicity into a
Non-Dimensional Parameter

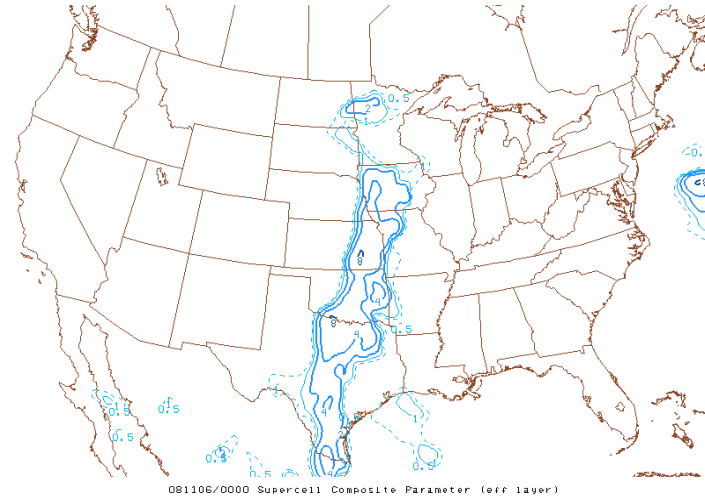
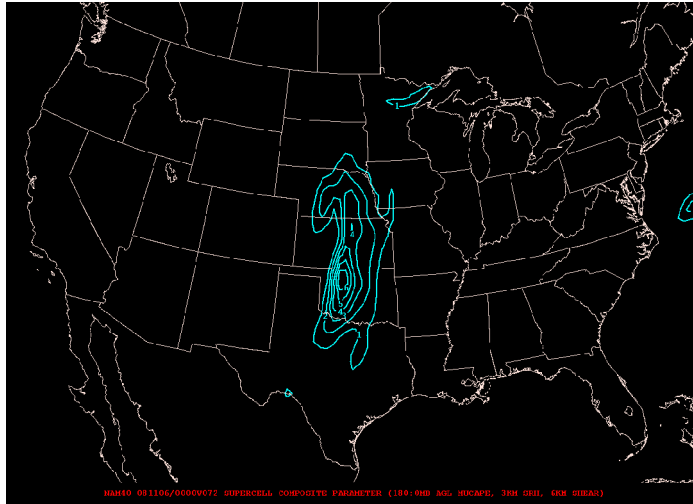
SCP Values > 1 Indicate Increasing Threat for Supercell
Thunderstorms

From Day 3, Day 2, and Day 1
Valid 00z 6 November 2008

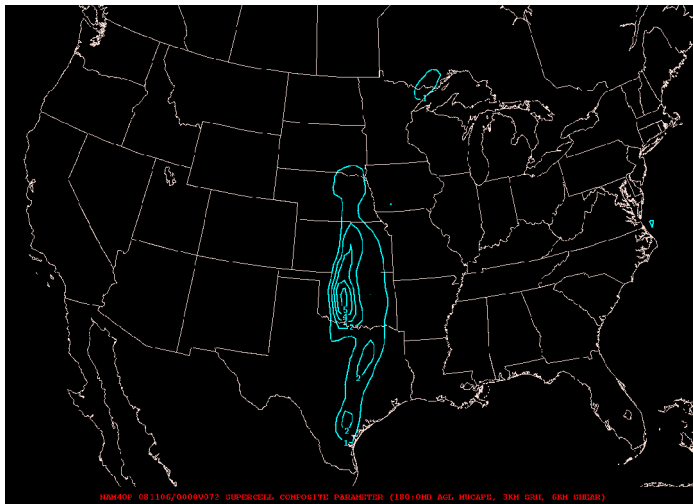
Day 3 NAM 00z 3 Nov 2008

72-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



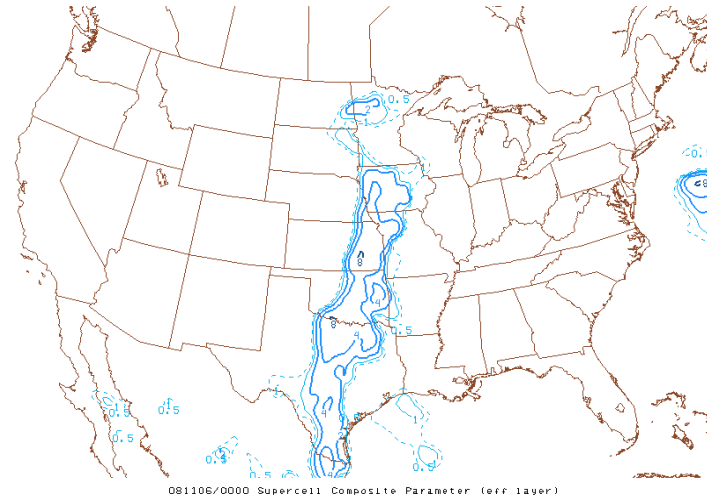
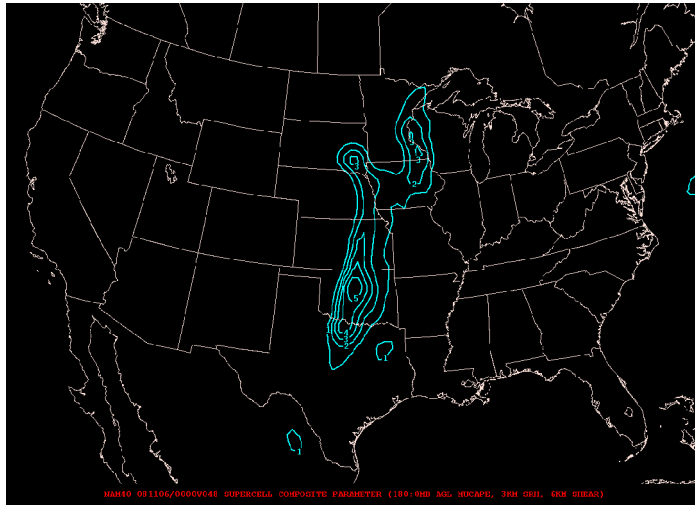
NAM and NAMp Forecasts of Supercell Composite Parameter (function of MUCAPE, 0-6 km Shear, and 0-3 km Helicity)

Both forecasts focused highest values in OK, but NAMp was better in TX and central NE.

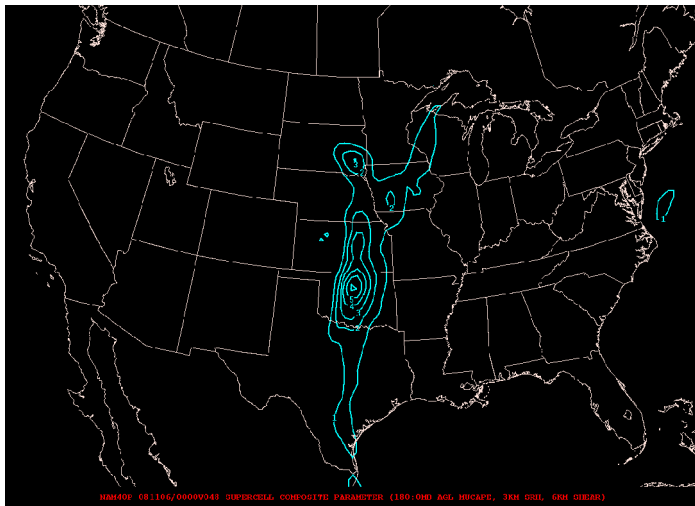
Day 2 NAM 00z 4 Nov 2008

48-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp



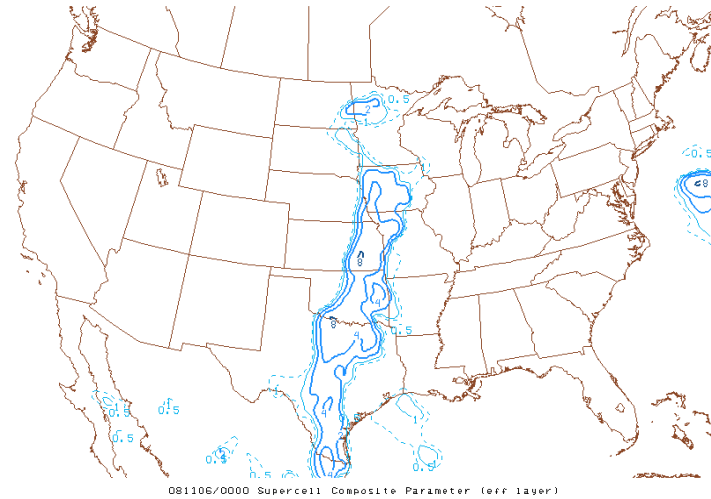
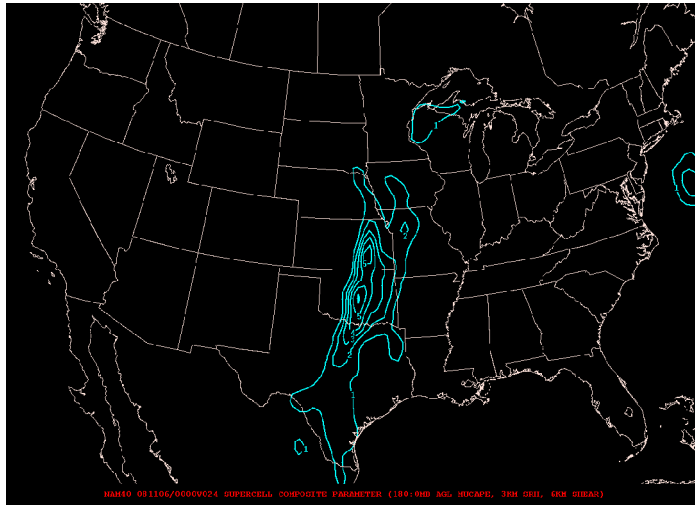
NAM and NAMp Forecasts of
Supercell Composite Parameter
(function of MUCAPE, 0-6 km
Shear, and 0-3 km Helicity)

Both forecasts focused highest
values in OK, but NAMp better
in TX and upper MS Valley.

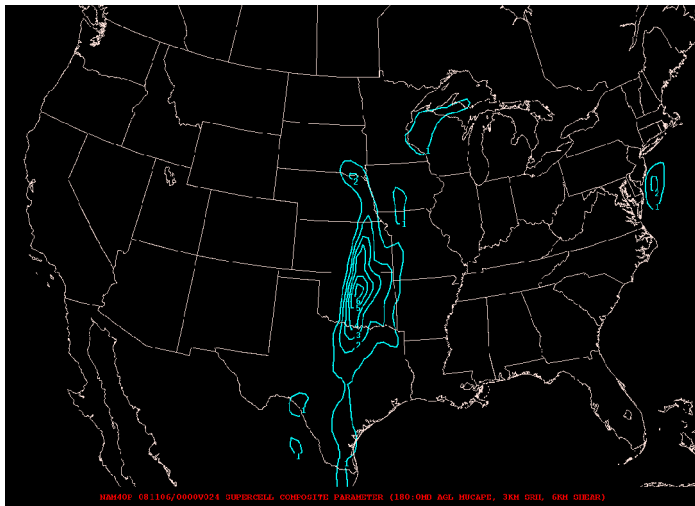
Day 1 NAM 00z 5 Nov 2008

24-hr Forecasts Valid 00 UTC 6 Nov 2008

NAM



NAMp

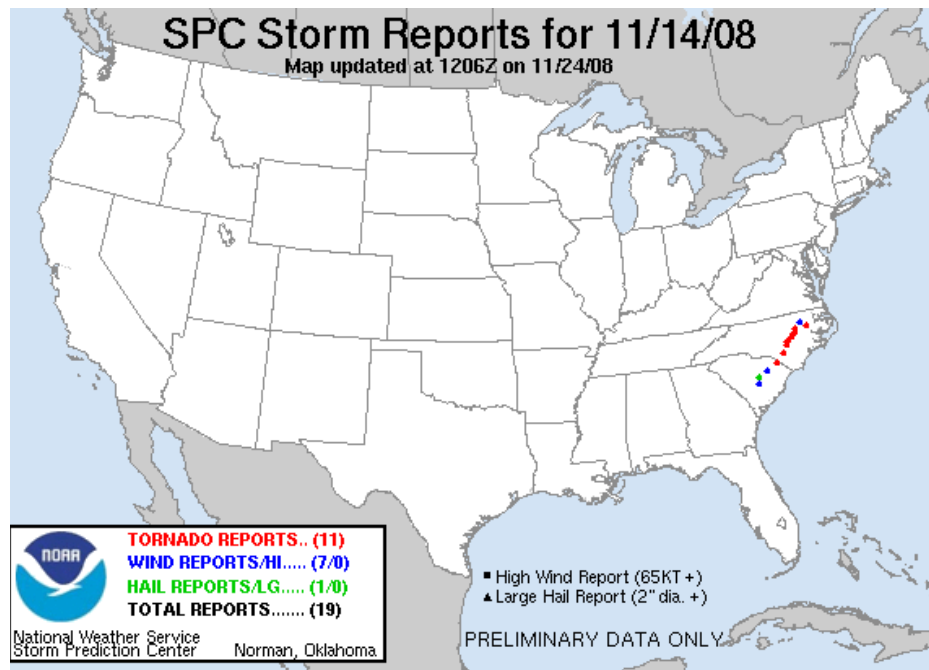


NAM and NAMp Forecasts of
Supercell Composite Parameter
(function of MUCAPE, 0-6 km
Shear, and 0-3 km Helicity)

Both forecasts similar, but NAMp
maintained primary focus in OK
whereas NAM displayed second
maxima in KS.

Real-Time NAM Model Runs for November 15, 2008

- Cool Season Severe Storms over the Eastern U.S.
 - Nocturnal Long-Track Tornadic Supercells over the Carolinas
 - 2 Tornado Fatalities in North Carolina Between 08-09z



Nocturnal Severe Storms in Carolinas

EF-2 Tornado Damage (Kenly, NC)
81

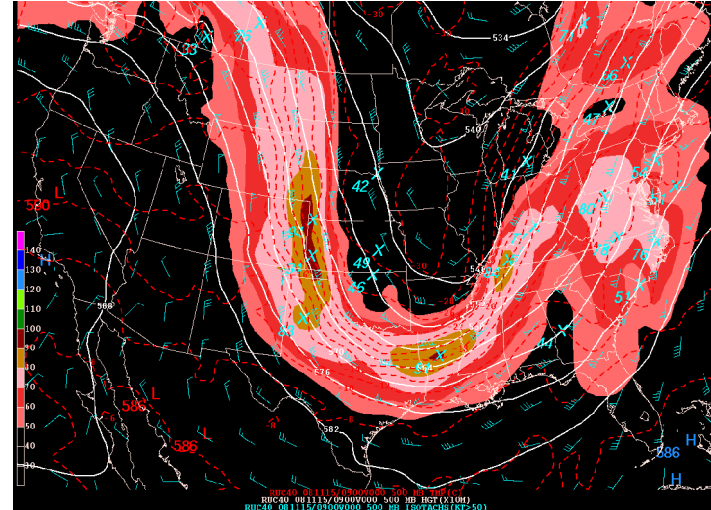
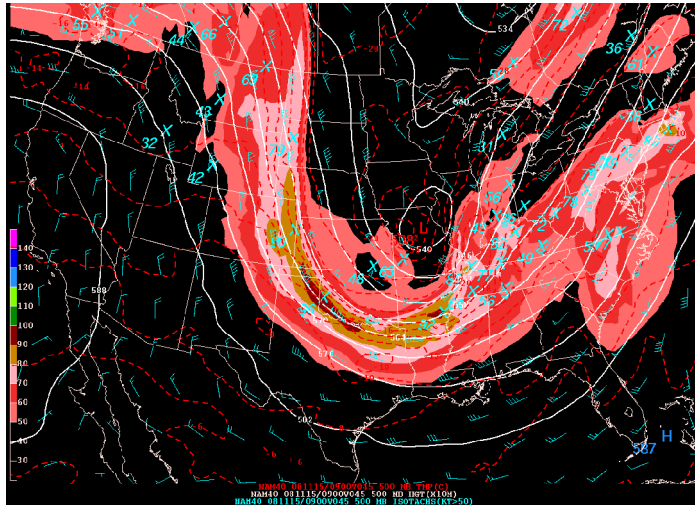
NAM and NAMp Synoptic Pattern Forecasts

500 mb, 850 mb, and EMSL/Dew Point
Forecasts from Day 2 and Day 1
Valid 09z 15 November

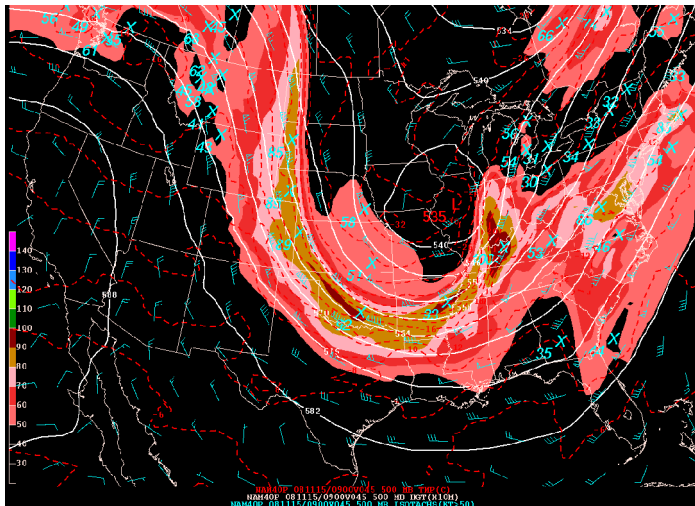
Day 2 NAM 12z 13 Nov 2008

45-hr Forecasts Valid 09 UTC 15 Nov 2008

NAM



NAMp



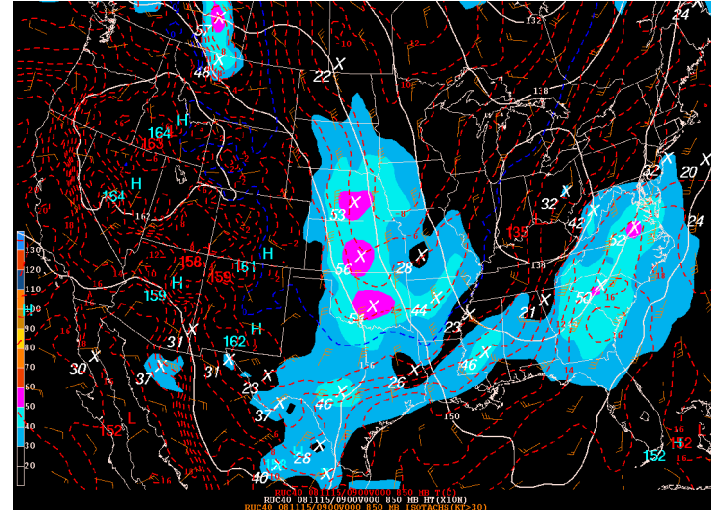
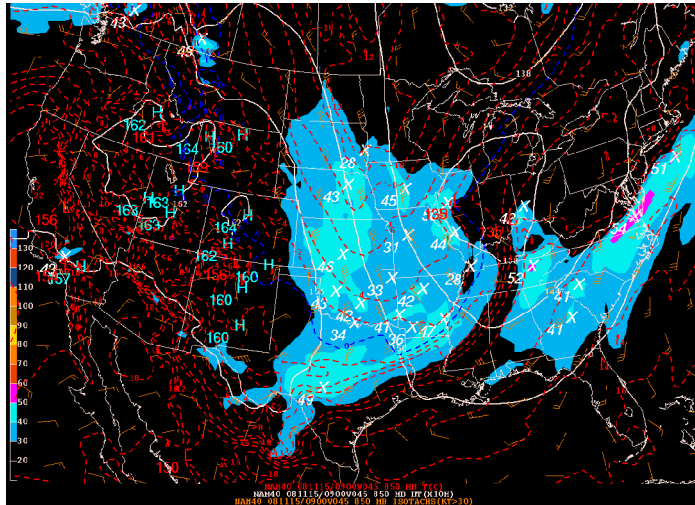
NAM and NAMp Forecasts of 500 mb Height, Temperature, and Wind Barbs/Isotachs

NAM and NAMp large scale solutions generally similar, but NAMp more clearly depicted subtle short-wave trough lifting northeast across GA and northeast Gulf.

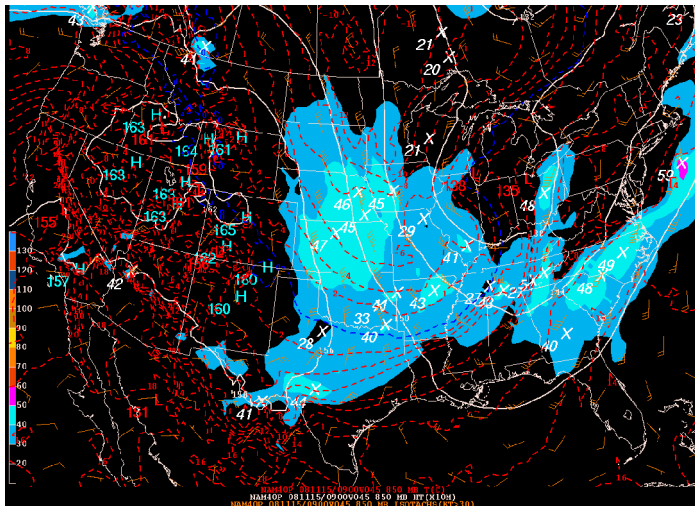
Day 2 NAM 12z 13 Nov 2008

45-hr Forecasts Valid 09 UTC 15 Nov 2008

NAM



NAMp



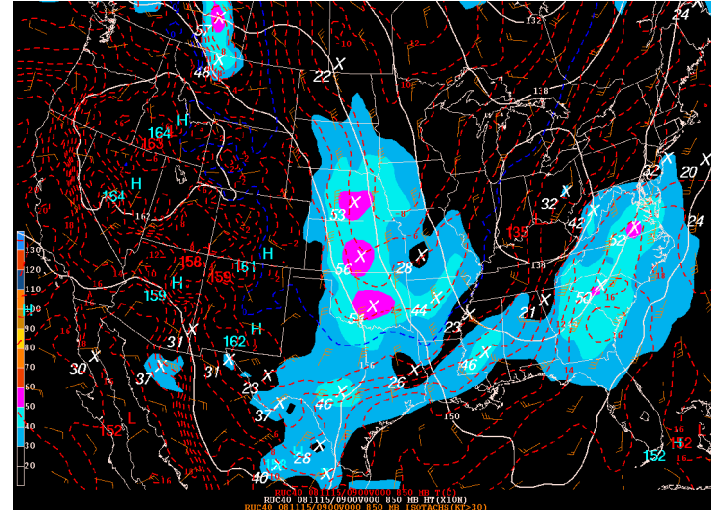
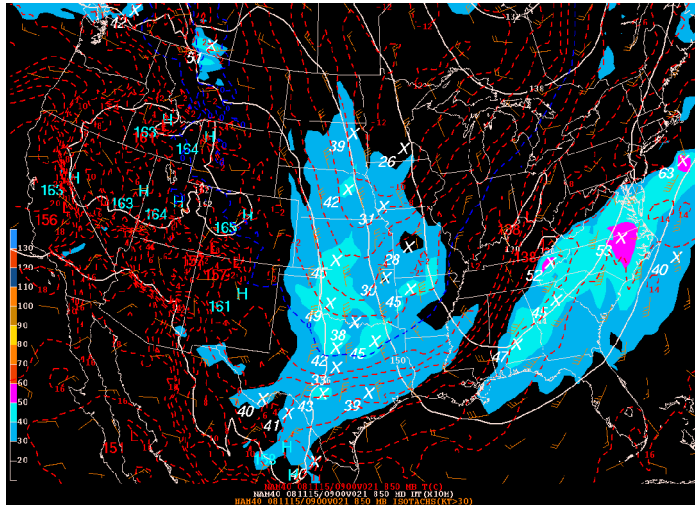
NAM and NAMp Forecasts of 850 mb Height, Temperature, and Wind Barbs/Isotachs

SREF and SREFp solutions similar, but NAMp more correctly extended 40-50 kt isotach axis across SC into northeast GA.

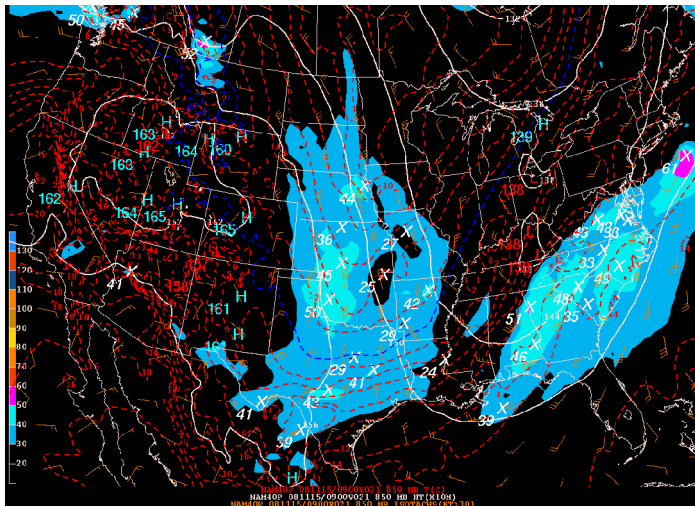
Day 1 NAM 12z 14 Nov 2008

21-hr Forecasts Valid 09 UTC 15 Nov 2008

NAM



NAMp



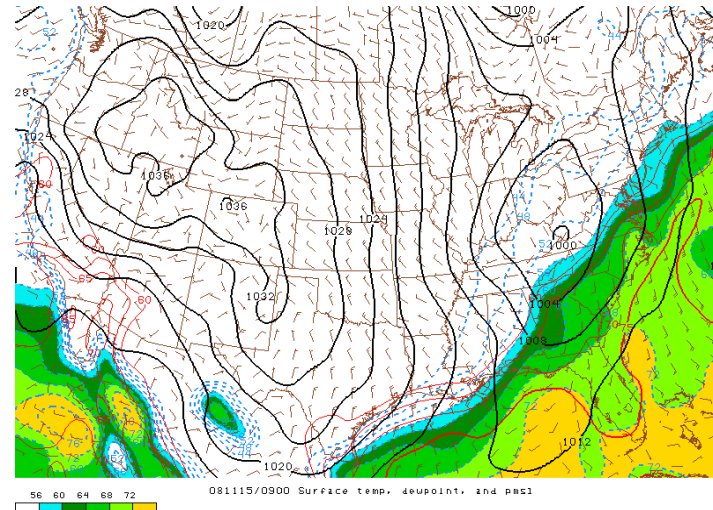
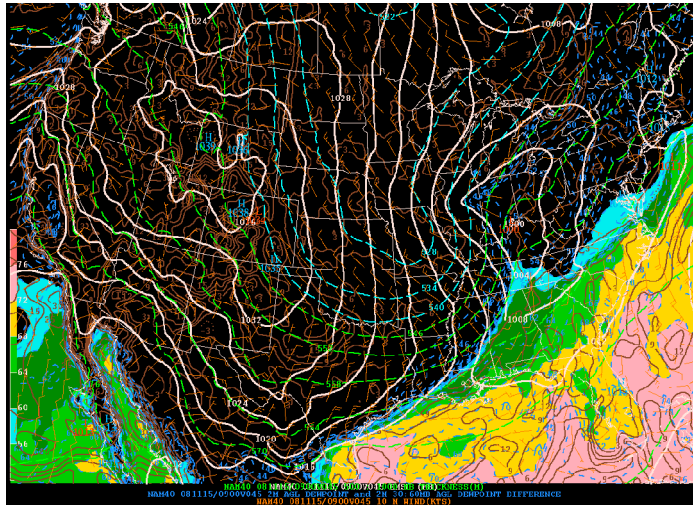
NAM and NAMp Forecasts of 850 mb Height, Temperature, and Wind Barbs/Isotachs

NAM and NAMp solutions similar, although NAM predicted stronger 850 mb jet core NC/VA border.

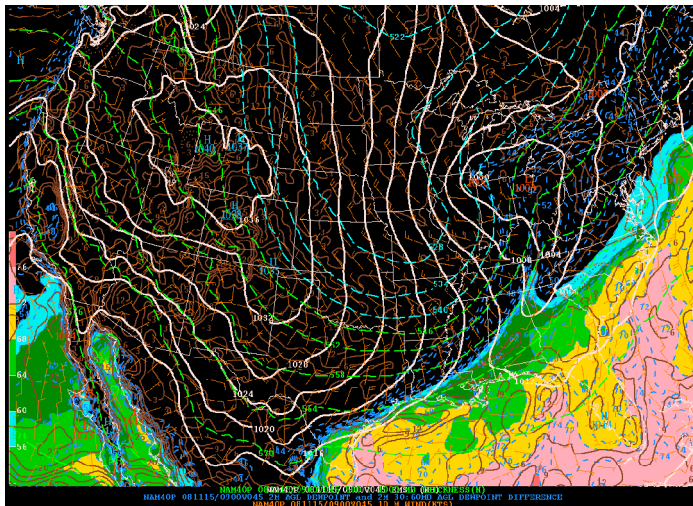
Day 2 NAM 12z 13 Nov 2008

45-hr Forecasts Valid 09 UTC 15 Nov 2008

NAM



NAMp



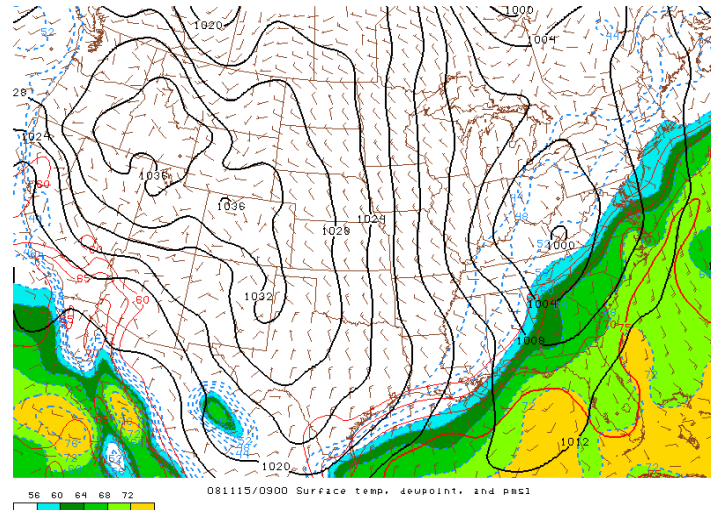
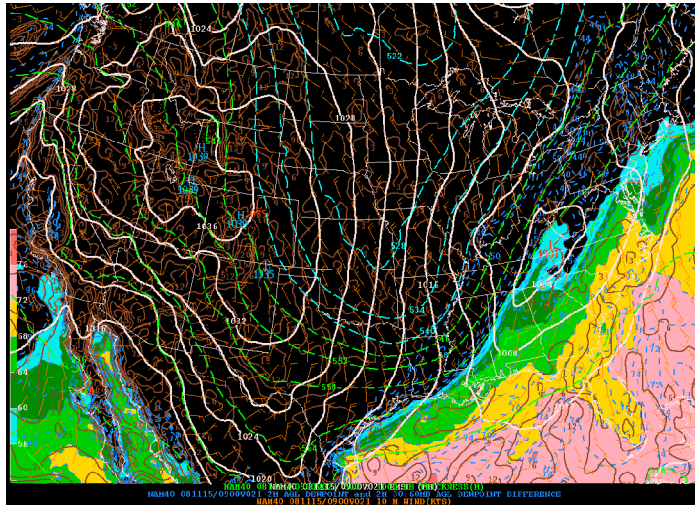
NAM and NAMp Forecasts of EMSL, 2m Dewpoint, 10m Winds, and Thickness

Both NAM and NAMp over-predicted dewpoint values into coastal Carolinas. NAM surface forecast of single low in OH Valley appeared better.

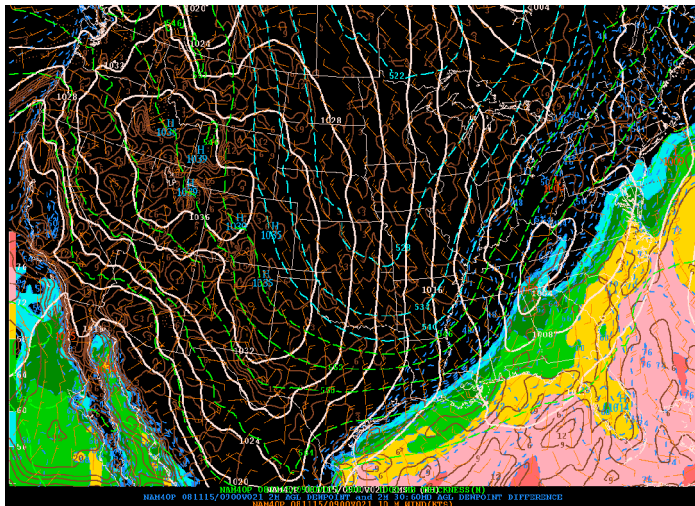
Day 1 NAM 12z 14 Nov 2008

21-hr Forecasts Valid 09 UTC 15 Nov 2008

NAM



NAMp



NAM and NAMp Forecasts of EMSL, 2m Dewpoint, 10m Winds, and Thickness

NAM and NAMp surface low solutions were similar to verifying field, but both continued to over-predict dewpoints in eastern Carolinas.

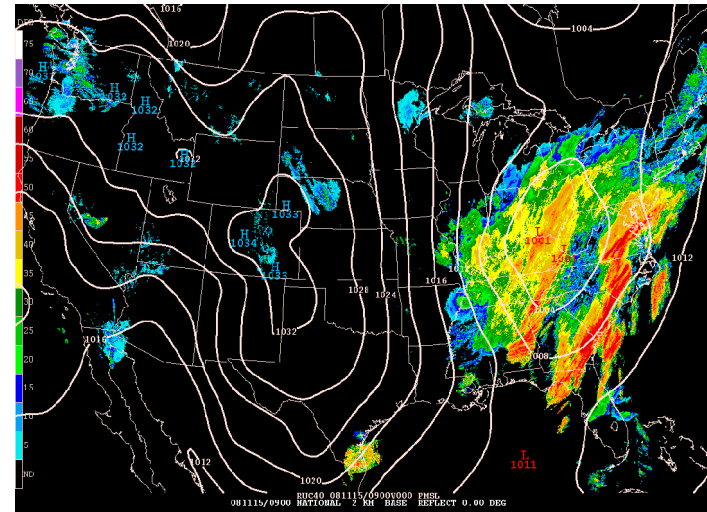
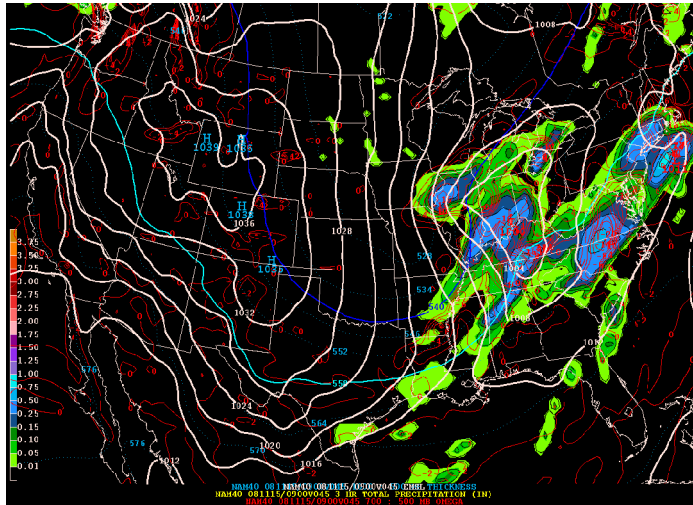
NAM and NAMp Precipitation Forecasts

3-hr Accumulated Precipitation Forecasts
from Day 2 and Day 1
Valid 09z 15 November 2008

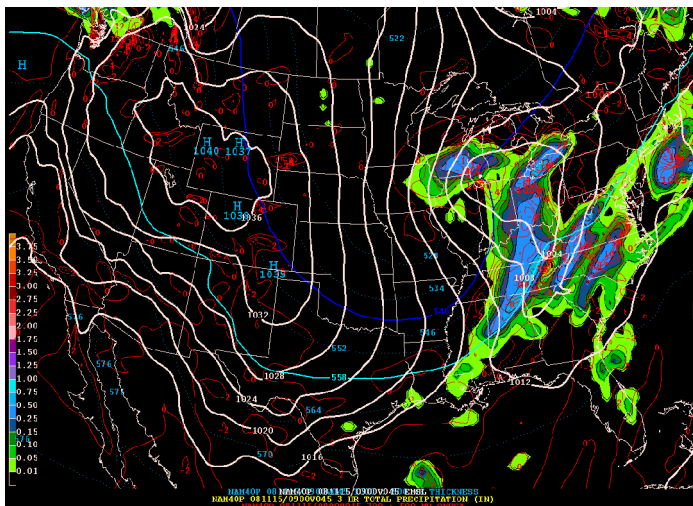
Day 2 NAM 12z 13 Nov 2008

45-hr Forecasts Valid 09 UTC 15 Nov 2008

NAM



NAMp



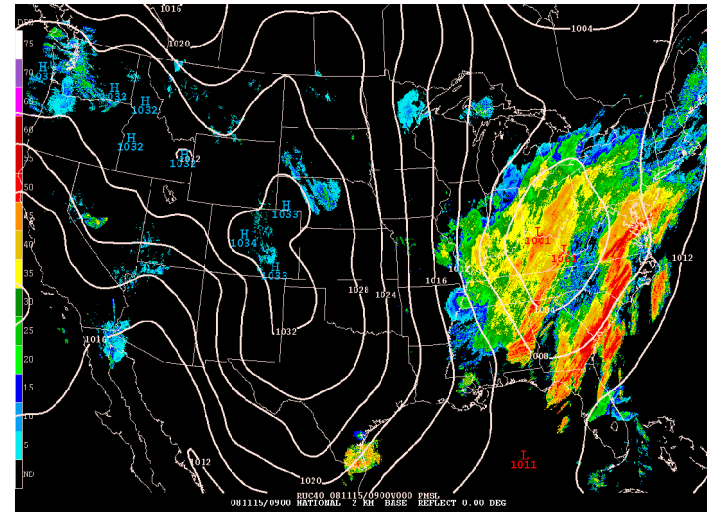
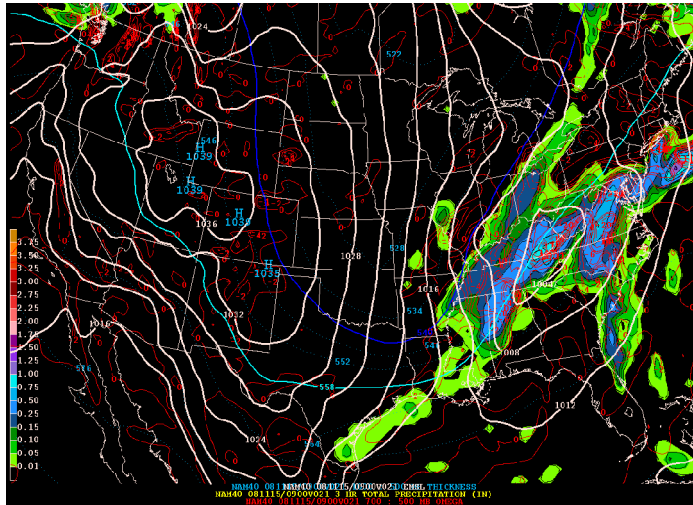
NAM and NAMp Forecasts of 3-hr Accumulated Precipitation

NAMp banded structure over Carolinas verified better, but both failed to extend the band southwest to the Gulf coast.

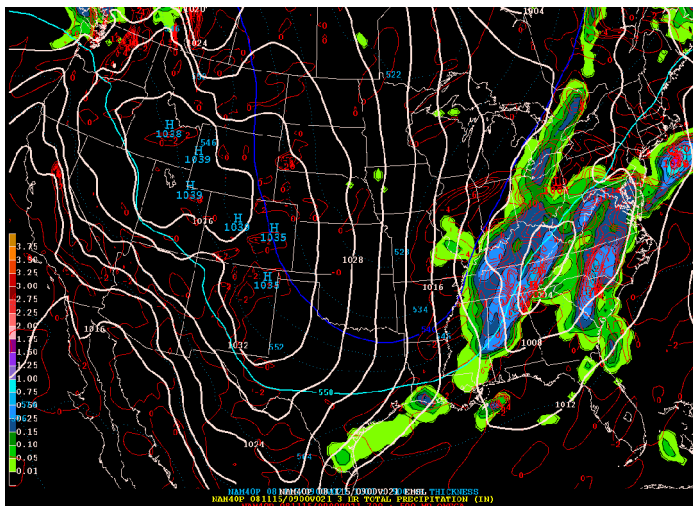
Day 1 NAM 12z 14 Nov 2008

21-hr Forecasts Valid 09 UTC 15 Nov 2008

NAM



NAMp



NAM and NAMp Forecasts of
3-hr Accumulated Precipitation

NAMp banded structure
extended farther southwest
across SC into east central GA;
this was better than NAM, but
both failed to extend the band
into the northeast Gulf.

NAM and NAMp Significant Tornado Parameter Forecasts

STP Combines MLCAPE, 0-6 km Shear, 0-1 km Helicity, MLCIN, and MLLCL into a Non-Dimensional Parameter

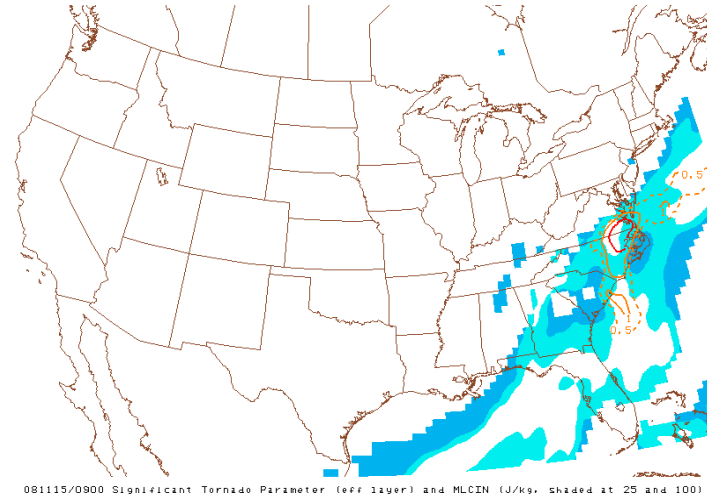
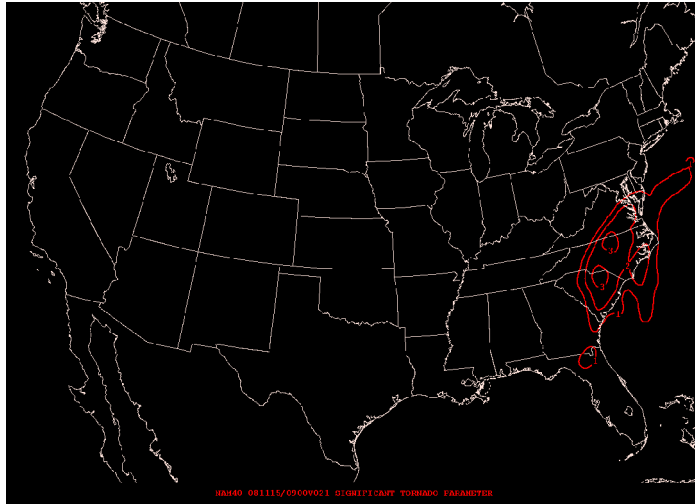
STP Values > 1 Indicate Increasing Threat for Significant Tornadoes

Forecasts from Day 1

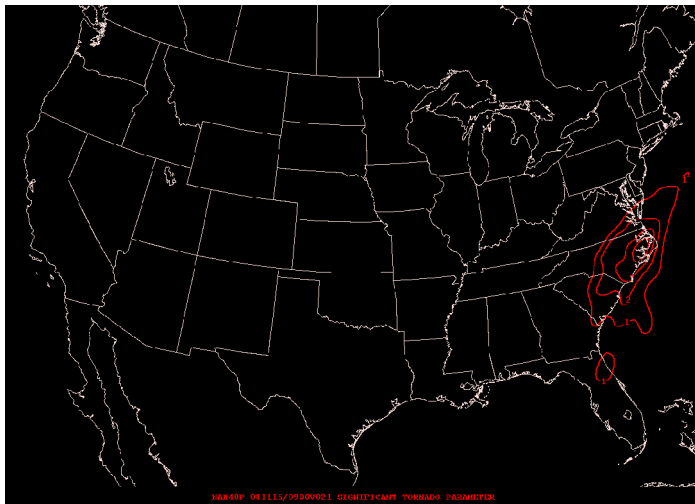
Day 1 NAM 12z 14 Nov 2008

21-hr Forecasts Valid 09 UTC 15 Nov 2008

NAM



NAMp



NAM and NAMp Forecasts of Significant Tornado Parameter (function of MLCAPE, MLCIN, MLLCL, 0-6 km Shear and 0-1 km Helicity)

NAMp focused highest values over coastal region, whereas NAM focused over Piedmont. Both predicted sig. ₉₃ tornado threat.