RTMA/URMA Q3FY15 Implementation Briefing

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April 2015

Outline

- Background improvements for CONUS (HRRR/NAM-CONUSNEST)
  - Examples of feedback from the field
- New variable: GSI-based sky cover (legacy NESDIS product)
- Terrain-aware gross error check and Buddy check
- Precip analysis improvements
- Unified code for all domains

RTMA/URMA has been designated the Analysis of Record for the National Blend of Global Models project!

We are working with the field

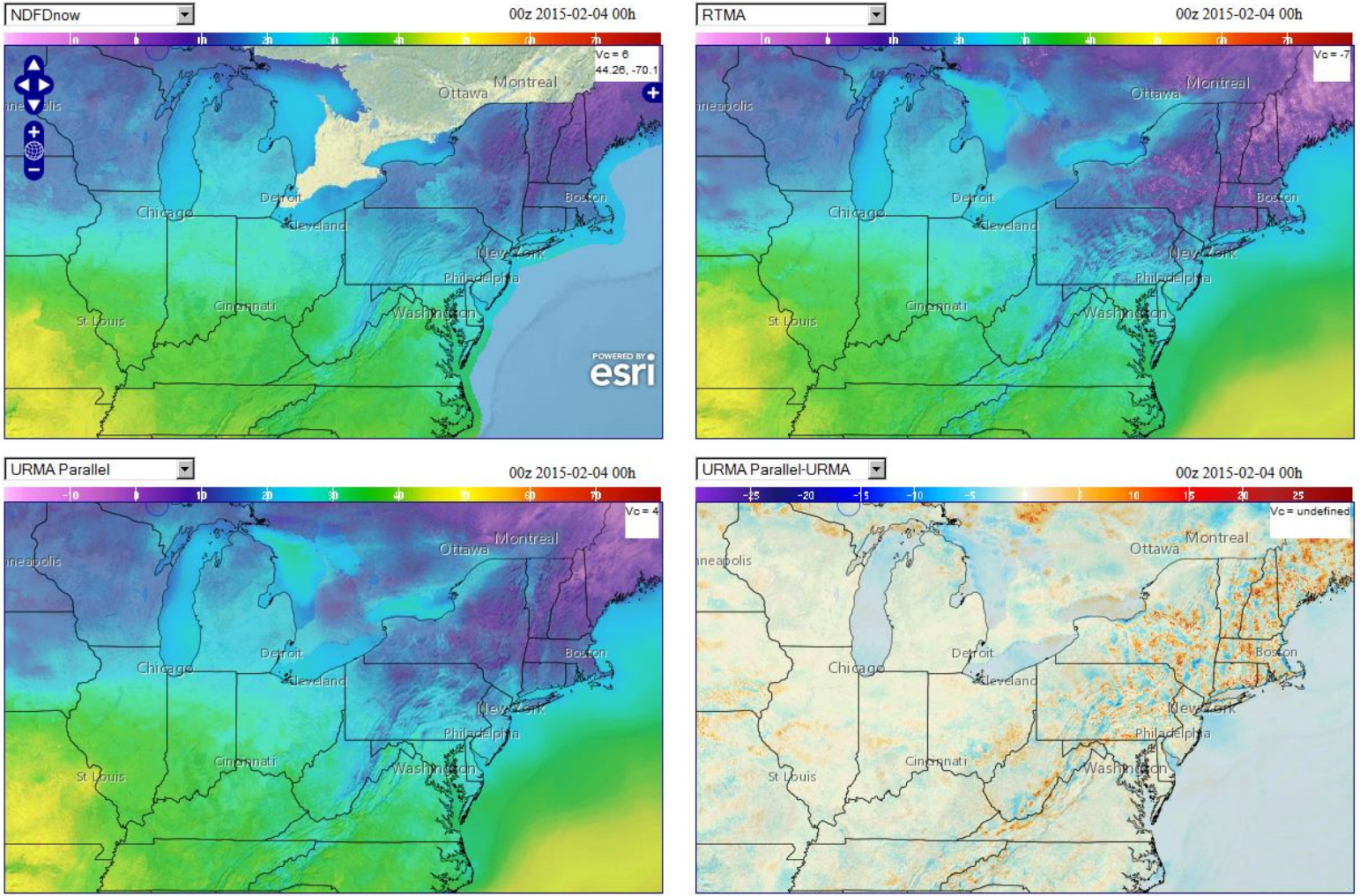
- RTMA listserv (aor-rtma@infolist.nws.noaa.gov)
  - Used to solicit feedback from field, give updates on implementations/parallels, coordinate development
- Monthly conference calls
- Briefings/webinars to DOH/SOO's from Eastern, Western and Central Regions
- EMC and MDL websites used for evaluation

MDL Interactive/Google Website

Viewer can be assessed from following link using your NOAA email name and password:
http://www.mdl.nws.noaa.gov/~blend/blender.prototype.php

List of most recent enhancements can be found at:
http://www.mdl.nws.noaa.gov/~blend/NewFeatures.dev.html

Major thanks to Daniel Plumb (MDL) for development and maintenance of this website!


NDFDnow
00z 2015-02-04 00h
Vc = 6
44.26, -70.1
RTMA
00z 2015-02-04 00h
Vc = -7
URMA Parallel
00z 2015-02-04 00h
Vc = 4
URMA Parallel-URMA
00z 2015-02-04 00h
Vc = undefined
Ottawa
Montreal
Detroit
Chicago
Cleveland
Boston
Philadelphia
Cincinnati
St Louis
Washington
POWERED BY esri

Background Improvements

RTMA/URMA: CONUS: Use 13 km RAP 1 hour forecast, downscaled to 2.5 km using "SmartInit" to create background field. 13 km model does not resolve terrain-induced features (eg valley cold pools). Use of single model makes RTMA susceptible to RAP biases (eg temperatures over snow cover).

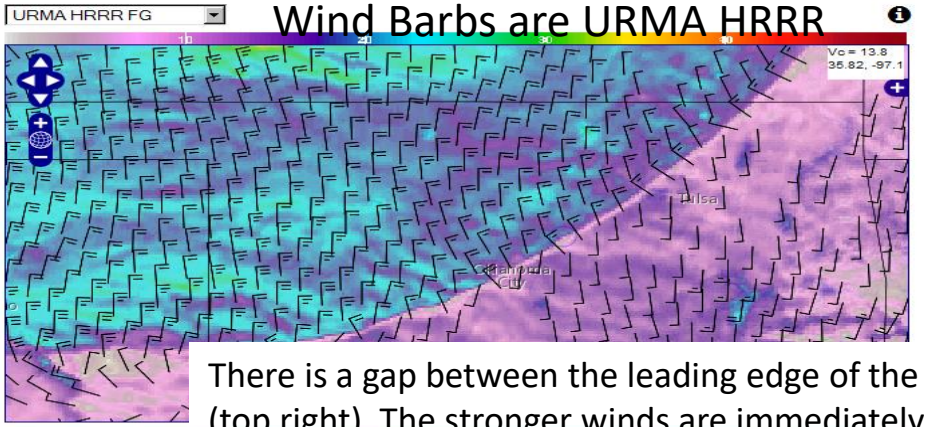
Planned upgrade for Q3FY15: Generate background from blend of HRRR (3 km) and CONUS NAM nest (4 KM). Higher resolution models and land/sea mask will allow for less extreme effects from downscaling and resolve more mesoscale features than RAP. Blending will prevent a bust in one model from affecting RTMA/URMA.

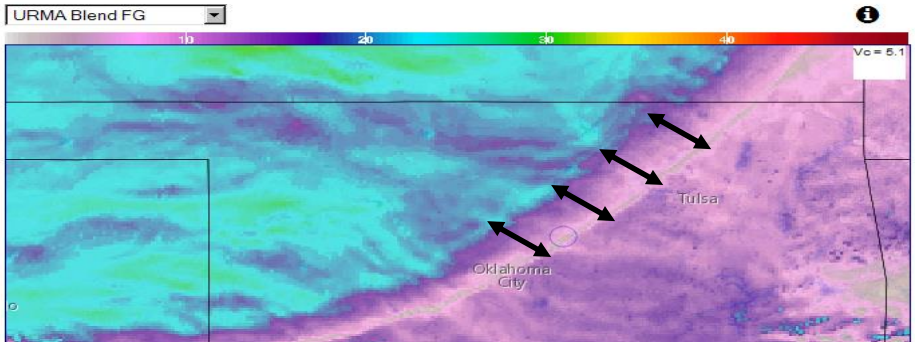
Use of RAP will still be necessary due to RTMA domain size, northward extension

Based on field feedback, HRRR only will be used as background for visibility and winds.

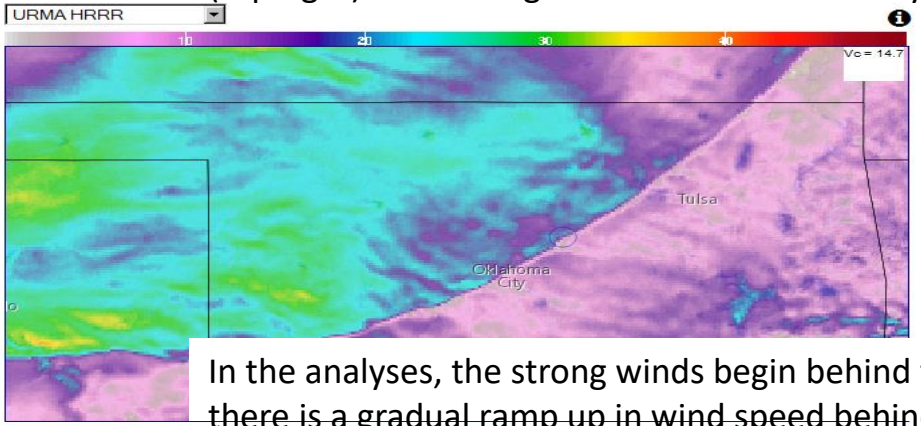
These changes have been strongly encouraged by the field!

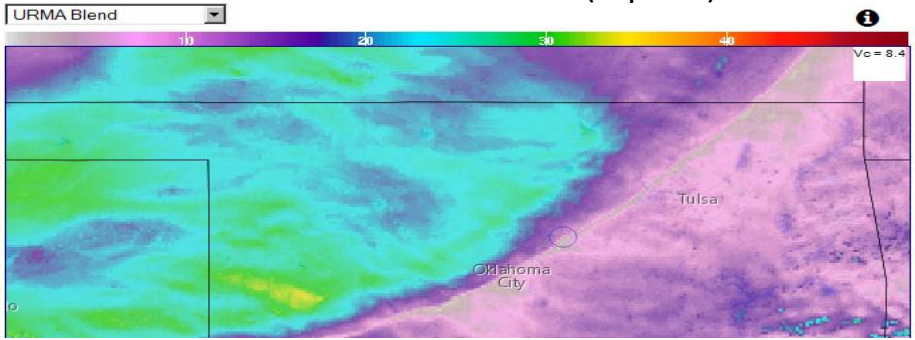
2014-11-11 0200 UTC





There is a gap between the leading edge of the arctic front and the stronger winds in the URMA Blend FG (top right). The stronger winds are immediately behind the front in the URMA HRRR FG (top left).



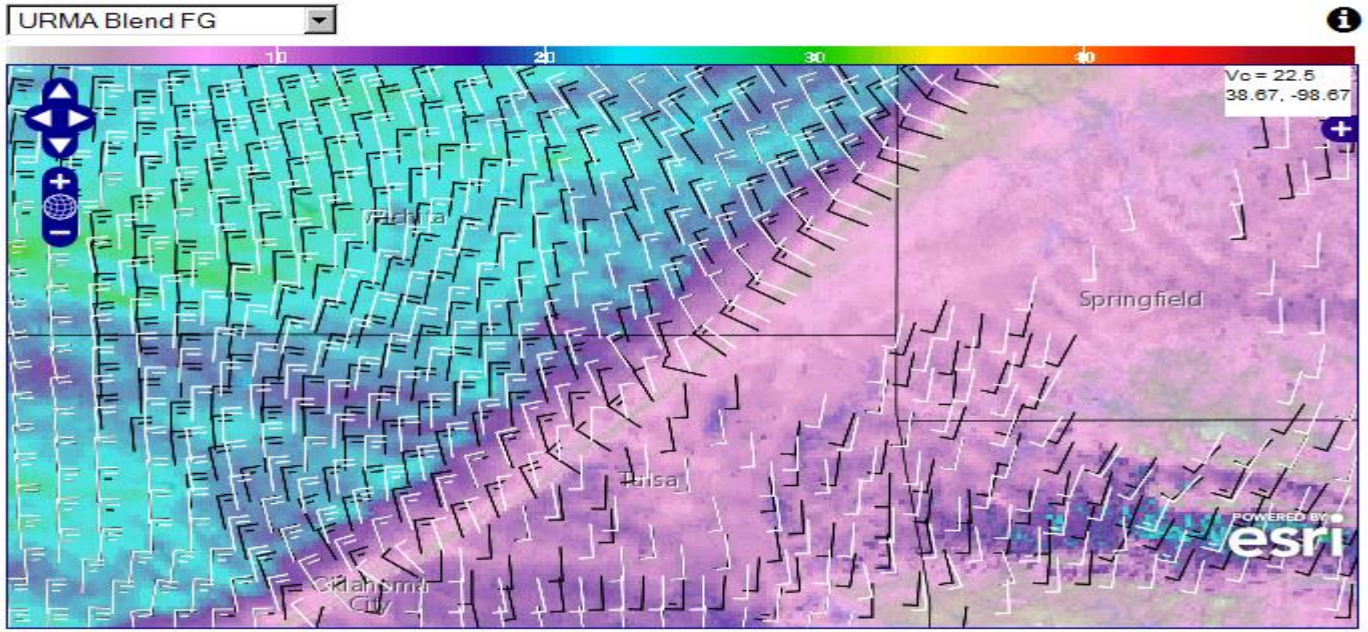


In the analyses, the strong winds begin behind the front in the URMA HRRR (lower left). In the URMA Blend, there is a gradual ramp up in wind speed behind the front (lower right).

Wind Barbs:
URMA Blend (white)
URMA HRRR (black)

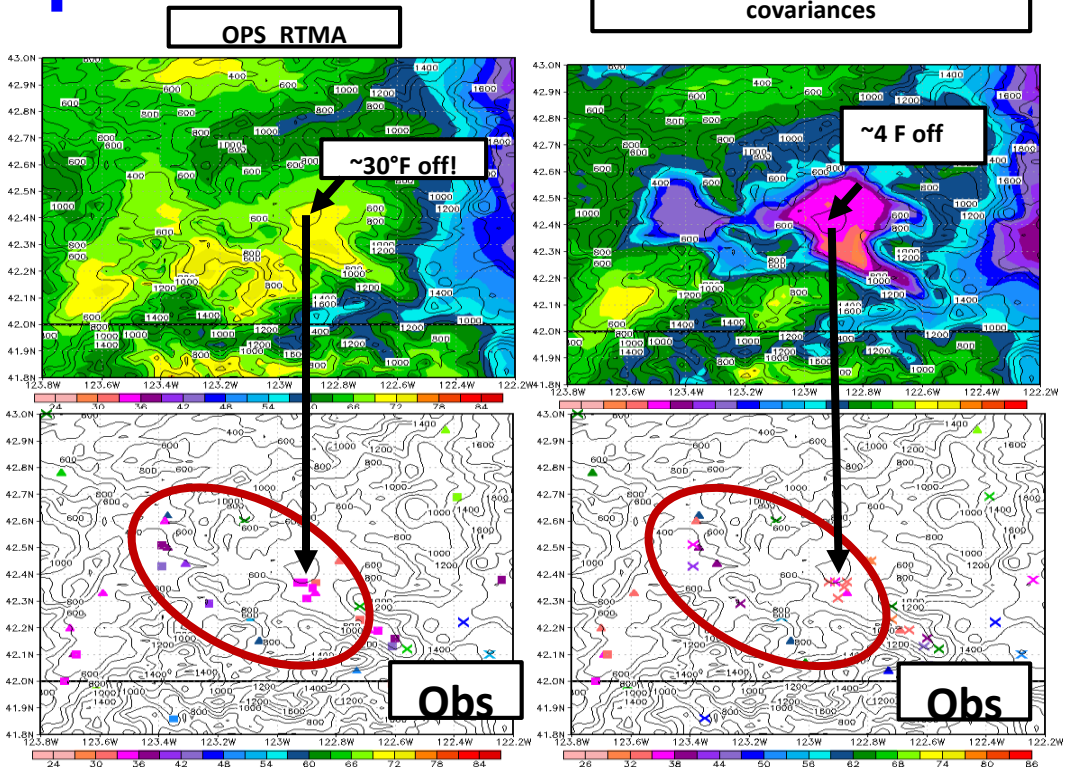
Barbs are plotted for winds >= 10 kts

A quick glance suggests the barbs are similar from both parallels, however there are some 10-20 degree differences along the front.



Observation Quality Control & Analysis of Valley Coldpools

- **Current RTMA often misses valley cold pools** (l.h.s slides)!
  - Associated with the background field being too warm, thus triggering the gross error checking and rejecting good observations
- **Improved results with use of smart, terrain-aware gross error check** (r.h.s slides).
- But could potentially lead to bad obs getting in the analysis. Solution: Buddy-check & Variational Observation Quality Control (varQC). Work in progress.
  - **varQC:** Ob weights vary based on current O-A. No ob is completely rejected based on O-B.



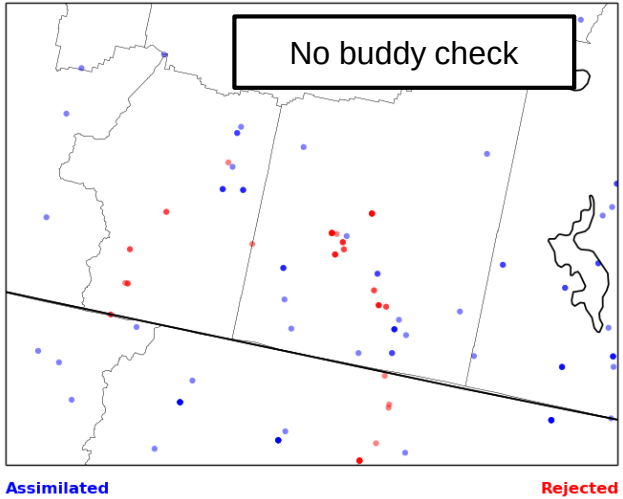
2m-T (F) VALID 22Z 16 JAN 2014 near Medford, OR

cross ==>assimilated ; square==> rejected by gross error check; triangles⇒ rejected via blacklist

Buddy Check Development: Example application to Medford, Oregon Case

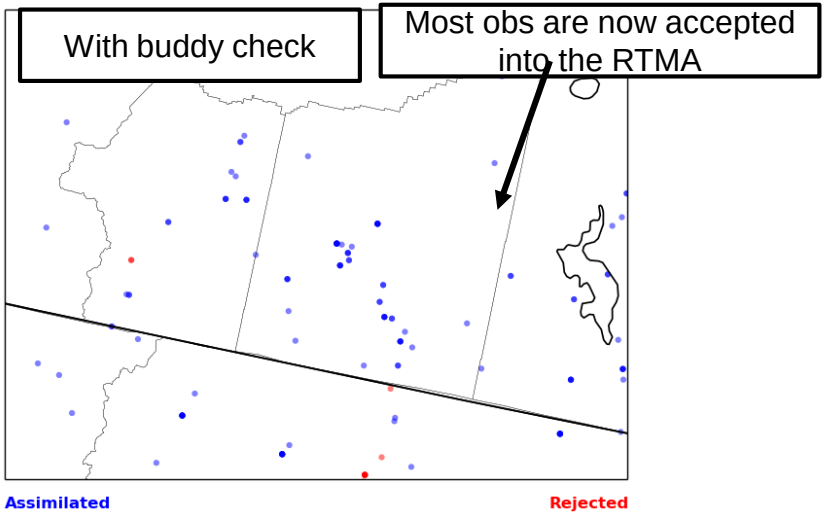
2 m Temperature Observations Used / Rejected in Current Configuration w/ Terrain Check

RTMA Assim/Rejected 2 m Temperature Observations



2 m Temperature Observations Used / Rejected with Terrain and *Buddy Check*

RTMA Assim/Rejected 2 m Temperature Observations



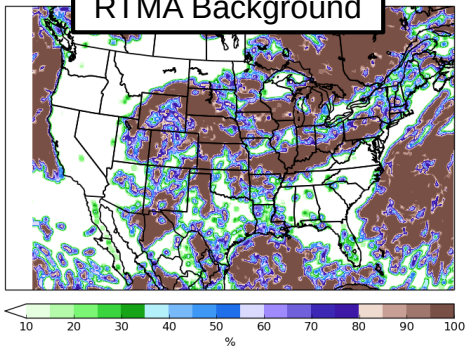
For this example - reject lists have been disabled

We are also pursuing a more sophisticated Variational QC approach.

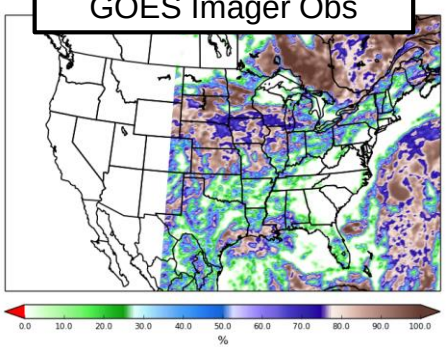
RTMA/URMA - Sky Cover Analysis Development (NEW)

- Collaboration with J. Gerth of Univ. Wisconsin/CIMSS
  - Establishing NCEP data feed for GOES Imager Sky Cover data produced via GOESR algorithms for use in RTMA/URMA

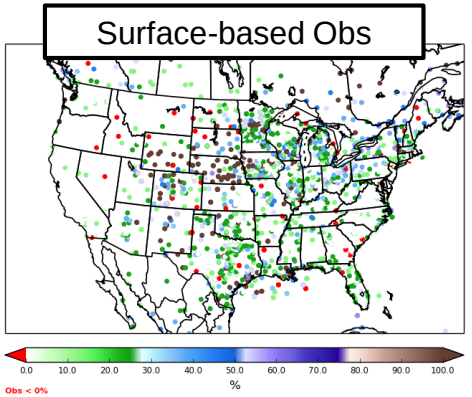
RTMA Background



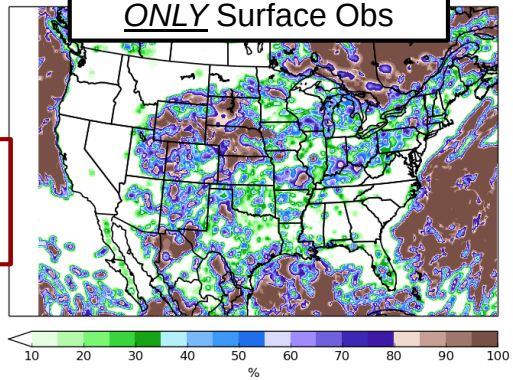
GOES Imager Obs



Surface-based Obs

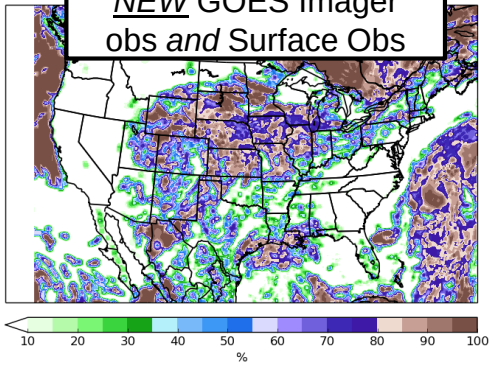


RTMA Analysis with *ONLY* Surface Obs



Large reduction in sky cover over central US

RTMA Analysis with *NEW* GOES Imager obs *and* Surface Obs



Sky Cover better matches GOES Imager data when assimilated → more realistic/plausible analysis

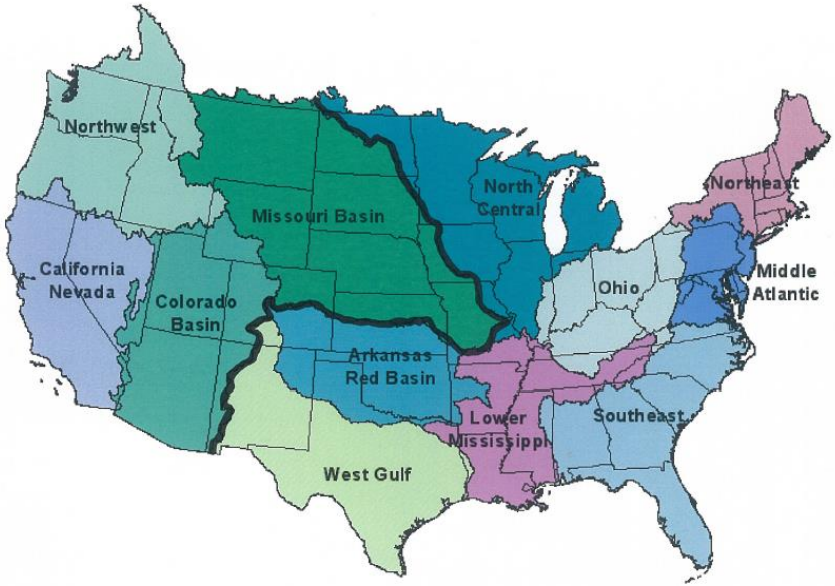
Precipitation URMA

6-hourly multi-sensor precipitation estimates from the 12 CONUS River Forecast Centers(RFCs) are mosaicked into a national product (the NCEP Stage IV) and remapped to the CONUS and Northwest NDFD grids for URMA.

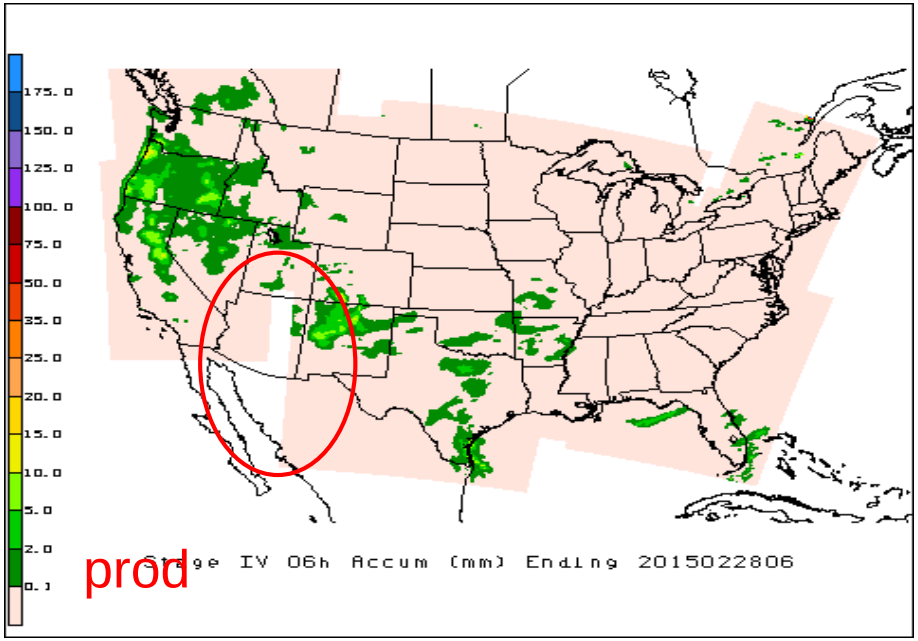
Upcoming URMA upgrade

Additional re-mosaics for 6-hourly Stage IV /precip URMA will be made at 1/3/5/7 days after ending of the accumulation time (a simplified/streamlined database for incoming QPE implemented by NCO in Nov 2014 made extended look-back period possible).

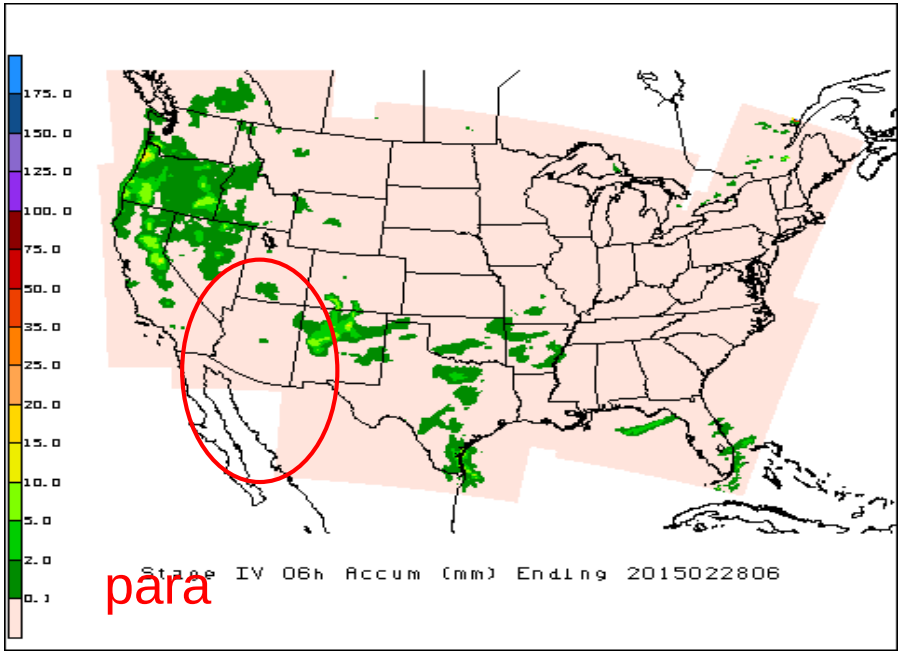
Hourly QPEs from the 8 Eastern/Central RFCs are first summed into 6-hourly totals, then combined with 6-hourly QPEs from the four Western RFCs, to take into account of regional differences in base (primary) analysis.



Example 1: 00-06Z 28 Feb 2015



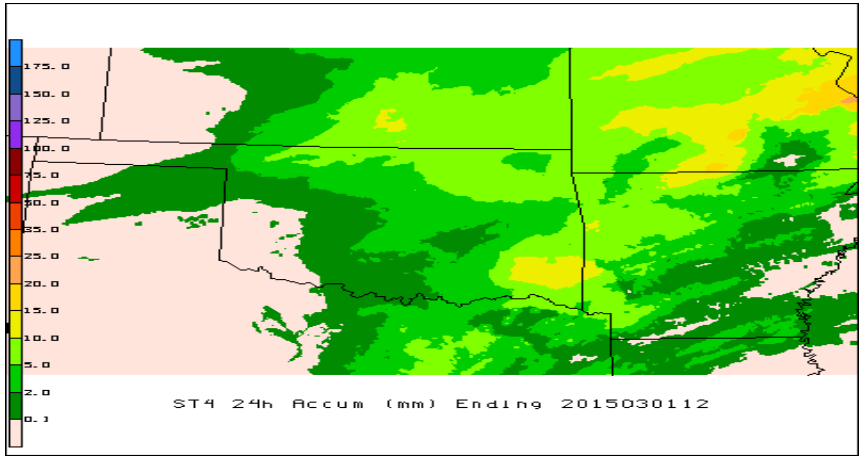
prod



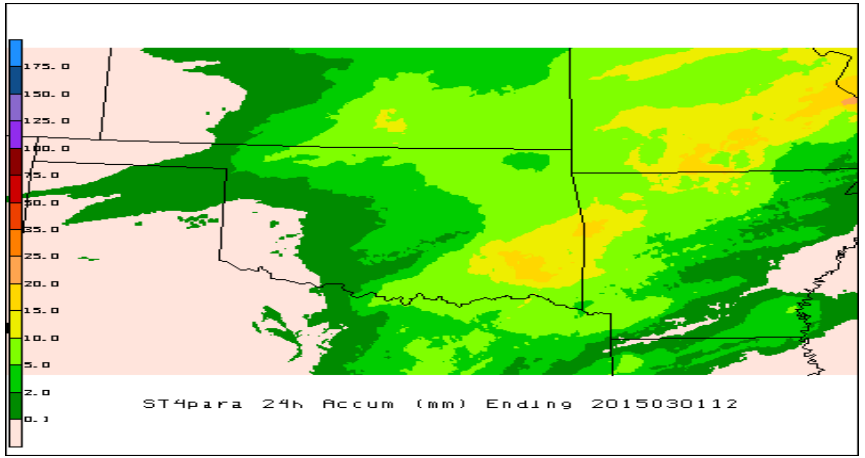
para

QPE from CBRFC did not arrive until 15:26Z 1 Mar. The late update was included in the parallel run.

Example 2: 24h accum ending 12Z 1 Mar 2015



prod

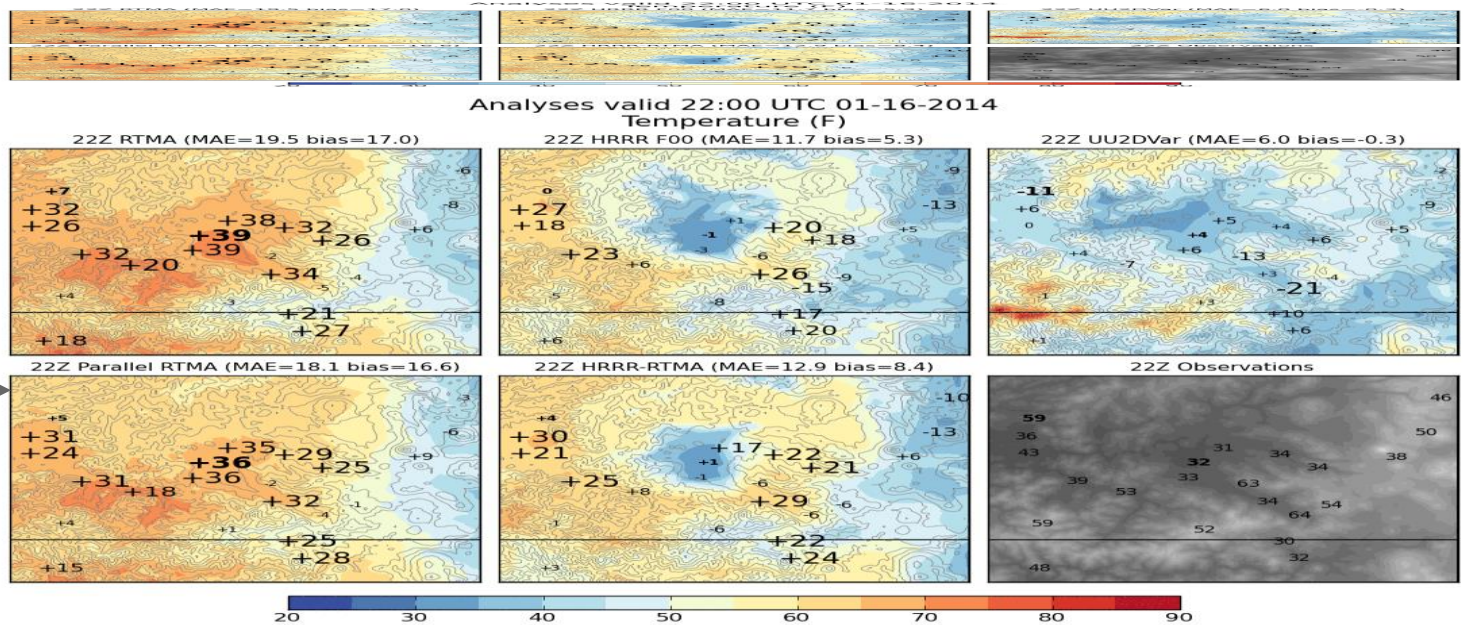


para

New 6-hourly mosaics (para) included hourly updates from ABRFC and LMRFC 5-6 days later. No late updates on 6-hourly QPEs were received.

Medford, OR Analysis Problems

Current Oper RTMA



- Case presented by Trevor Alcott (WR SSD) at time of last upgrade (Q1FY14)
- Large O-A differences (text values on map) over Medford, OR area
- Issue was not solved by previous upgrade

What went wrong

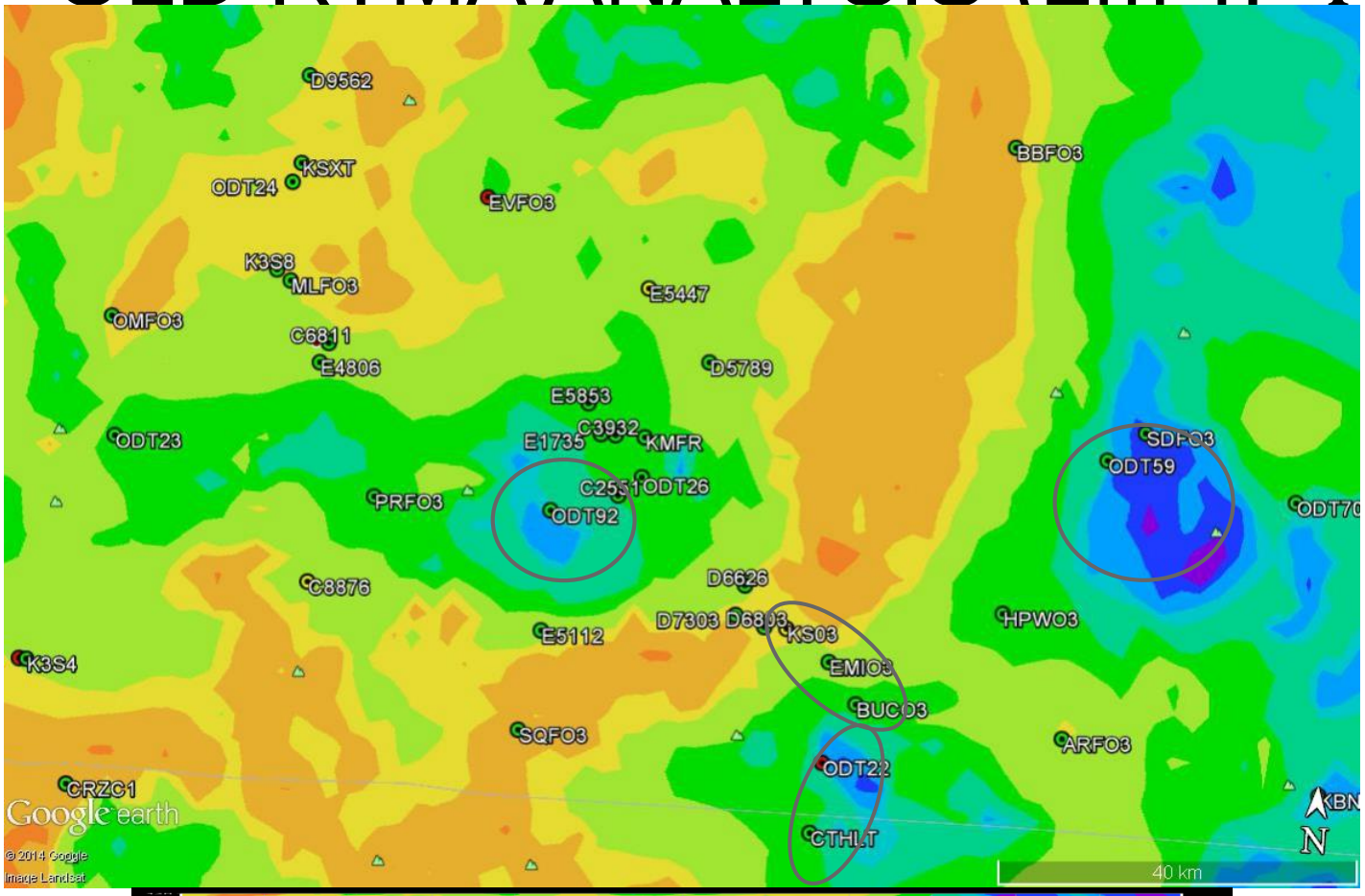
- RAP background mixed out inversion too early in the morning
- 13 km resolution RAP did not properly resolve complex terrain features
- Many mesonet obs in the area were on a WFO/region provided reject list
- Obs not on reject list generally failed gross error check due to large (>30 F+) O-B innovation

What we've done about it

- Relaxed gross error check over complex terrain, buddy check to "save" obs previously thrown out
- Removal of obsolete WFO-provided reject lists (RTMA-August 2014, URMA-May 2014)
- Background now blend of HRRR (3 km) and CONUS NAM nest (4 km)

OLD RTMA ANALYSIS (2m T, °F)

10/3/14
10Z



Ob Key:

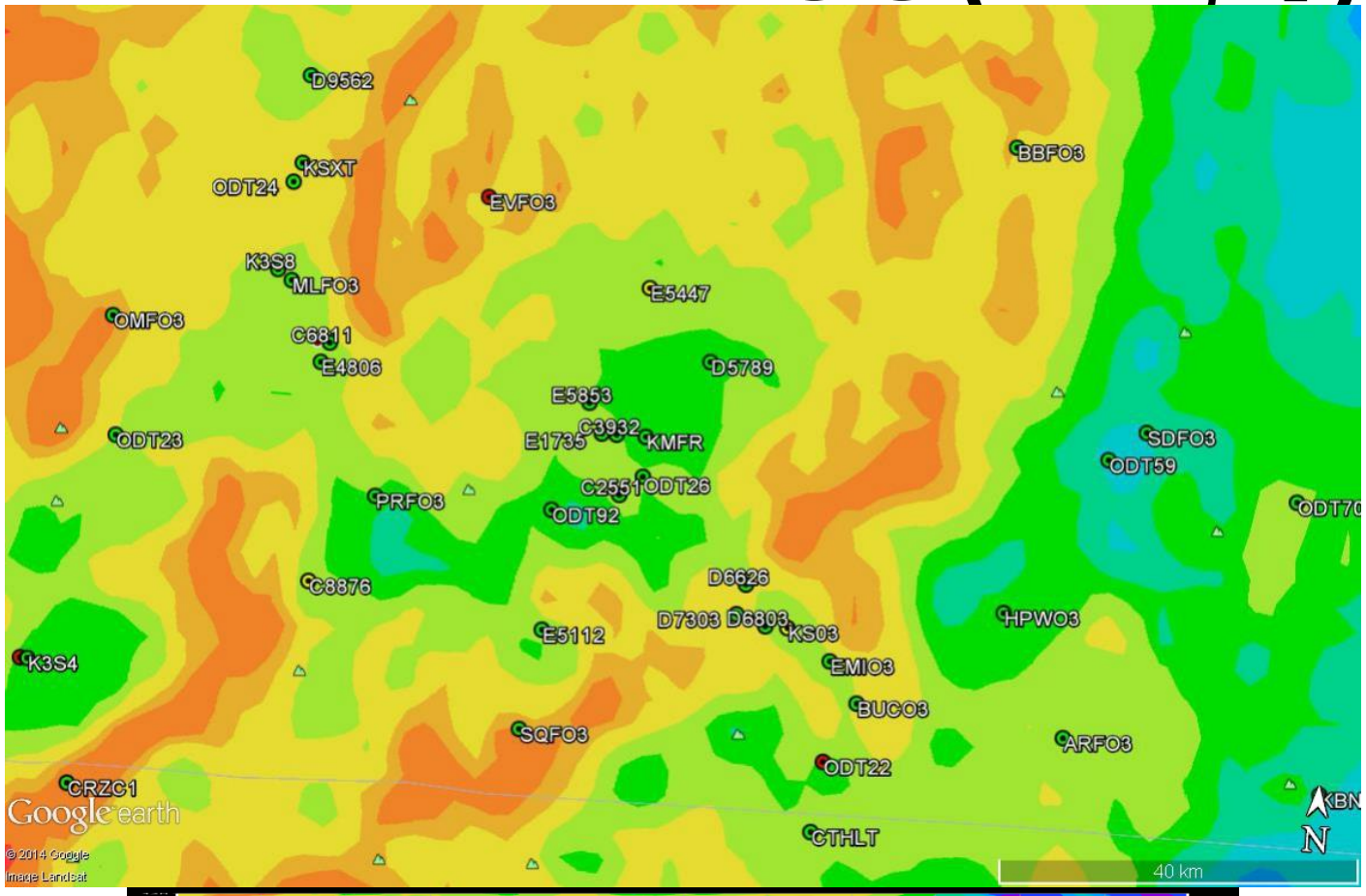
Accepted

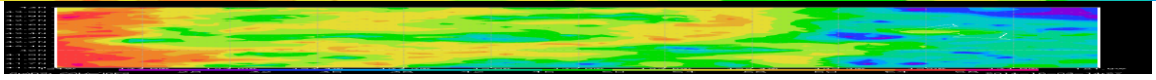
Rejected

Partial (Crossval)

NEW RTMA ANALYSIS (2m T, °F)

10/3/14
10Z





Ob Key:

Accepted

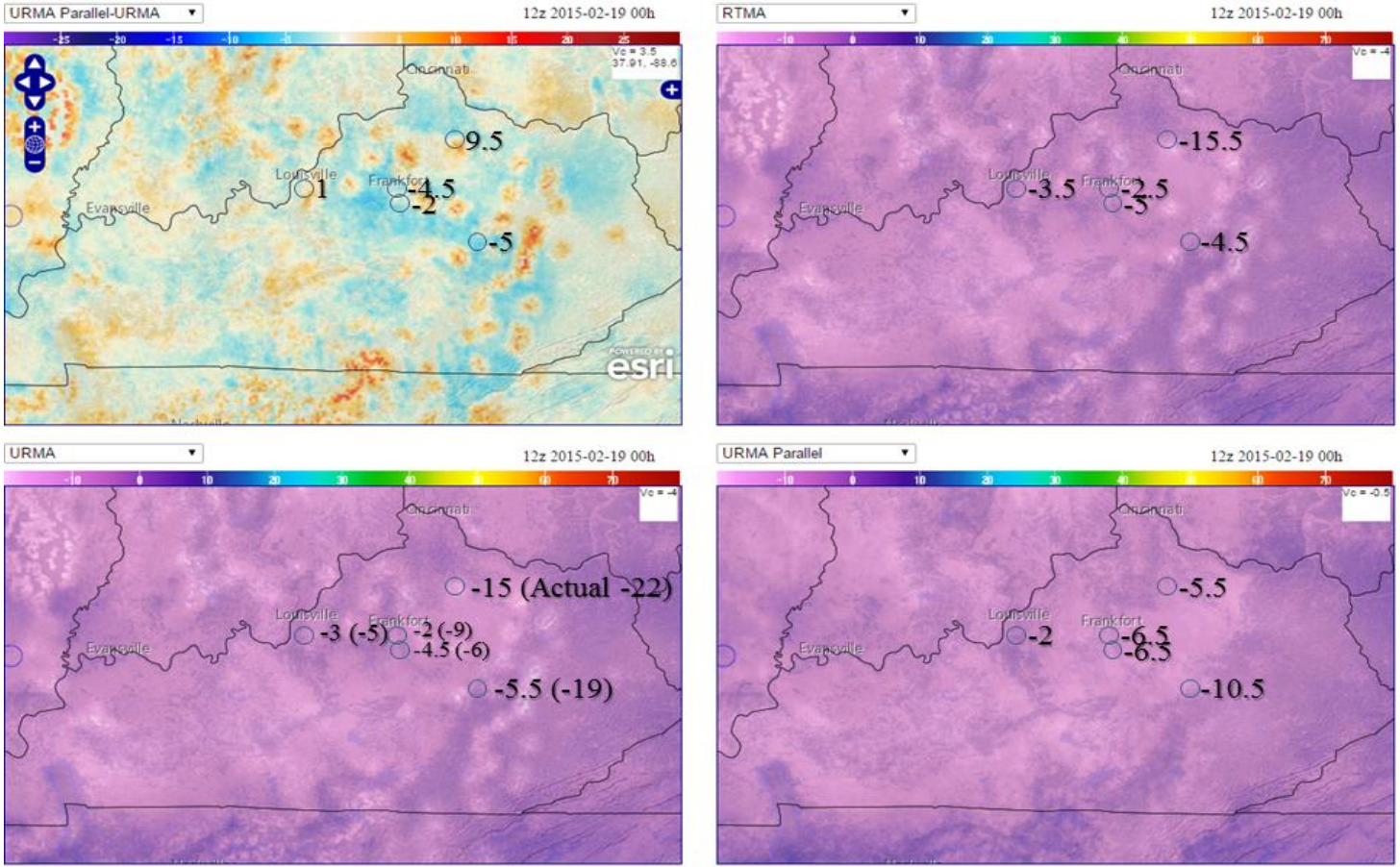
Rejected

Partial (Crossval)

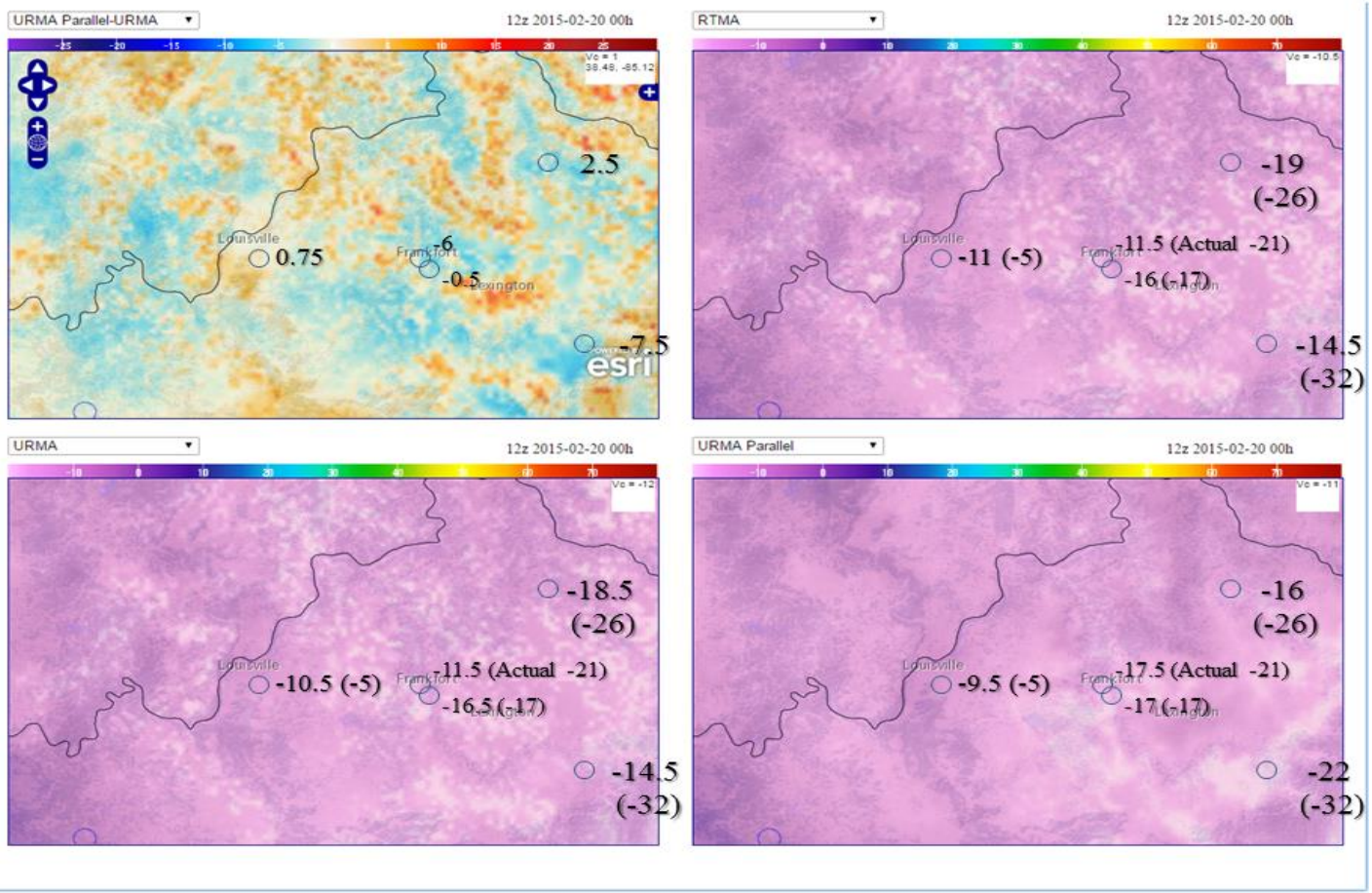
Differences at key obs (2m T, °F)

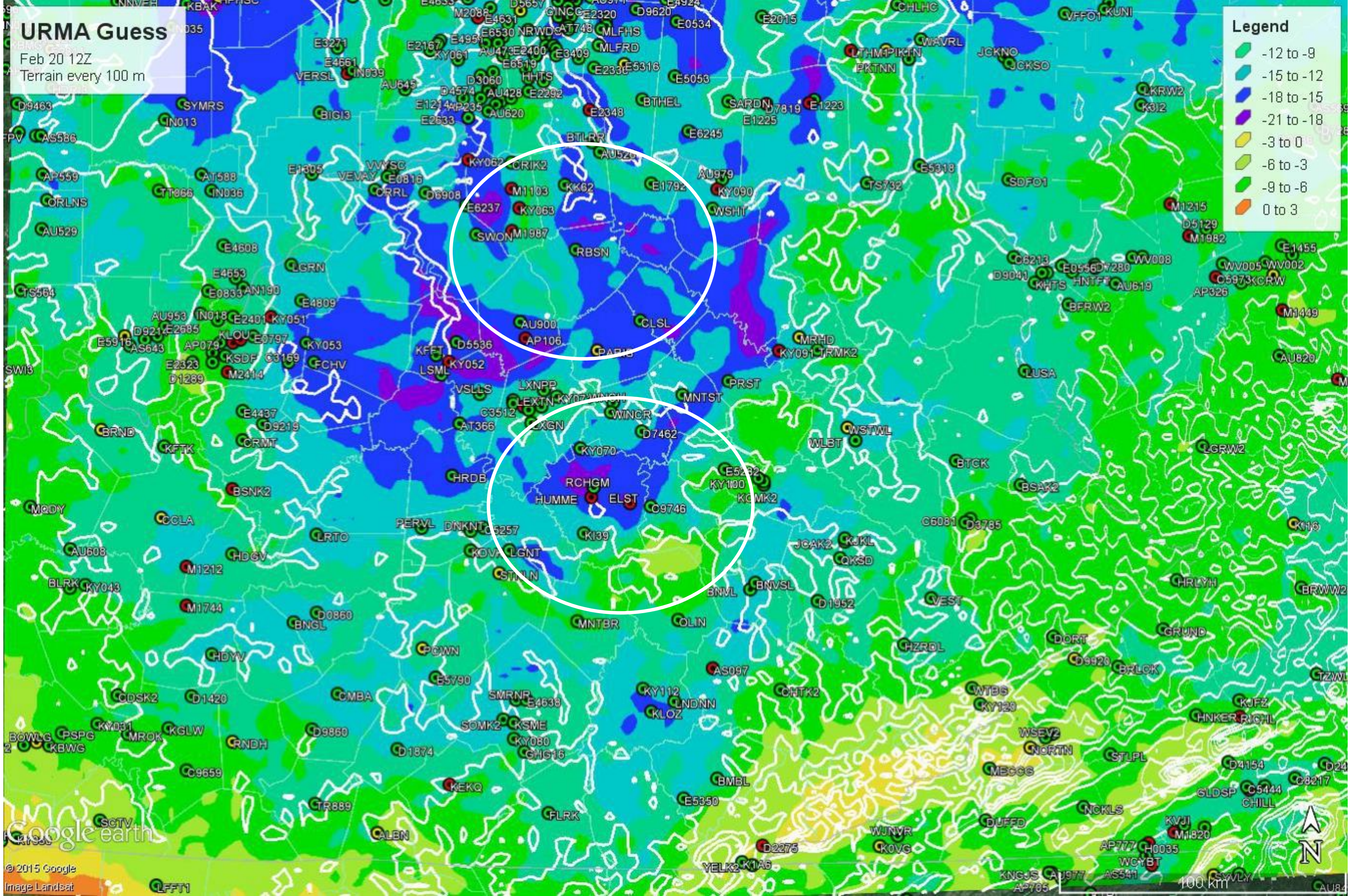
Site	Ob Val	Old BG	Old Anl	New BG	New Anl
KS 03	46. 31	57. 83	55. 13	57. 83	50. 99
OD T92	44. 69	44. 69	41. 45	54. 77	47. 75
BU CO 3	56. 93	48. 83	48. 29	55. 13	54. 95
EMI O3	55. 49	53. 87	52. 61	55. 67	53. 69
OD T59	37. 85	43. 25	41. 81	44. 15	39. 65
CT	50.	45.	47.	54.	51.

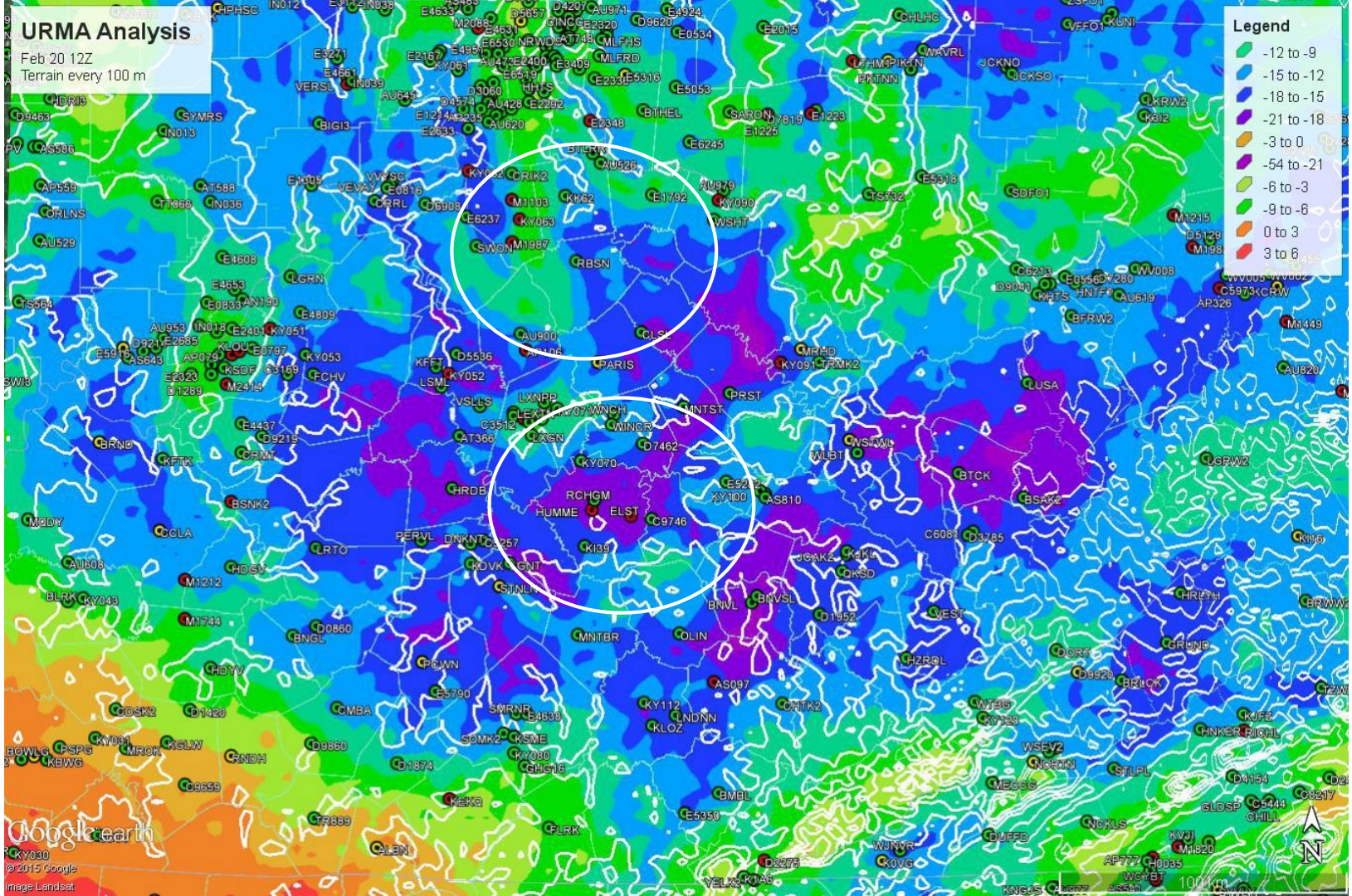
Example Cycle: Central KY

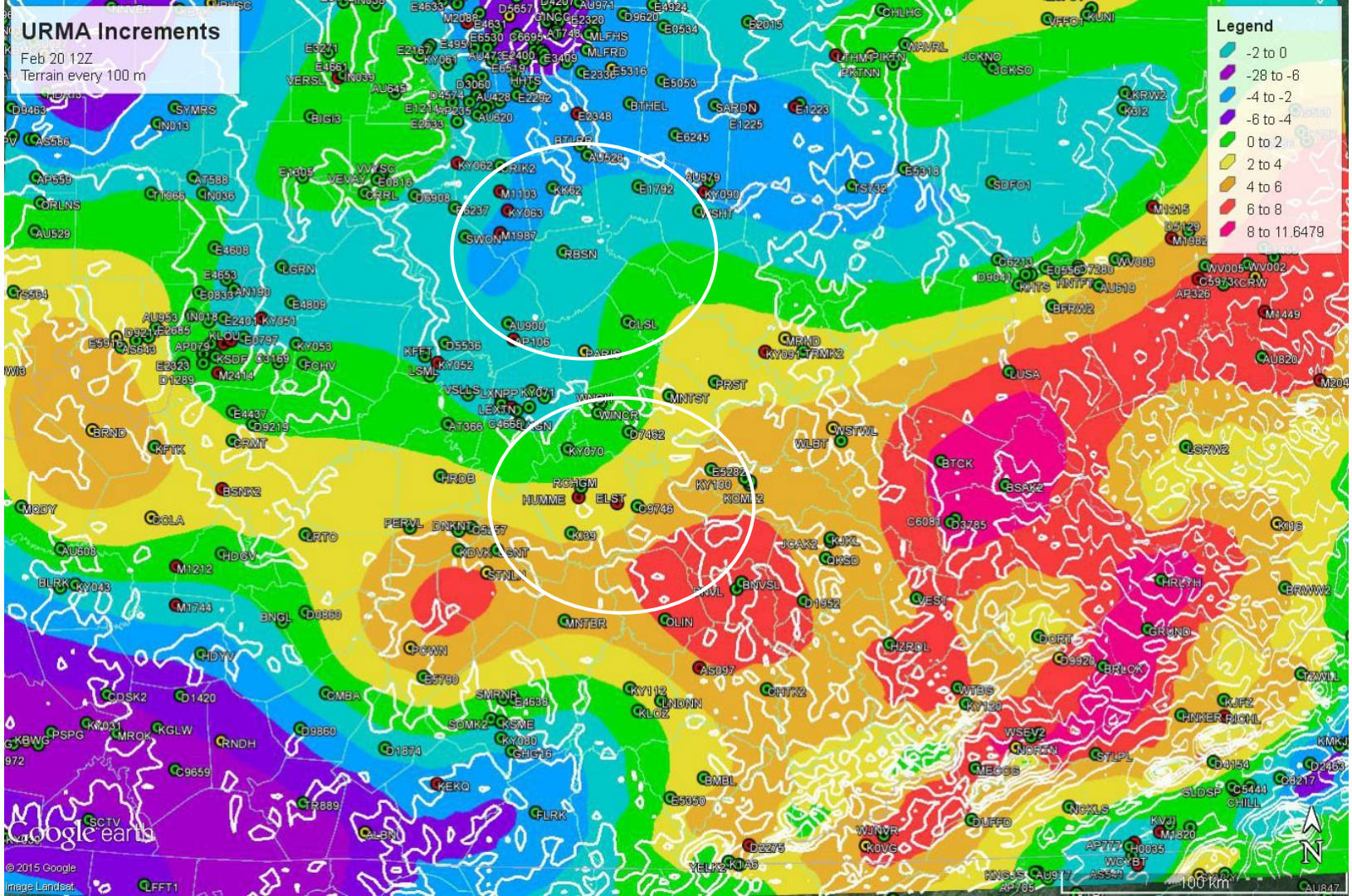


The next morning...




URMA Guess
Feb 20 12Z
Terrain every 100 m
Legend
-12 to -9
-15 to -12
-18 to -15
-21 to -18
-3 to 0
-6 to -3
-9 to -6
0 to 3
100 km
© 2015 Google
Image Landsat
Google earth

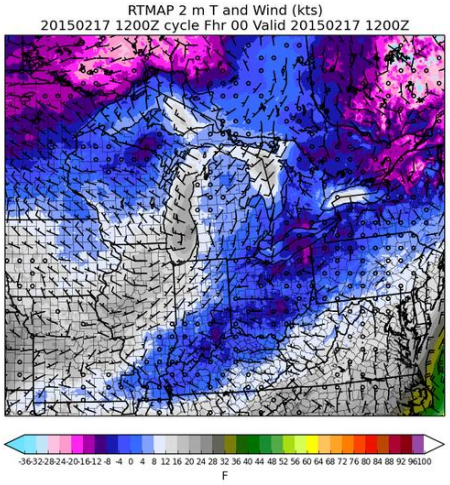

URMA Analysis
Feb 20 12Z
Terrain every 100 m
Legend
-12 to -9
-15 to -12
-18 to -15
-21 to -18
-3 to 0
-54 to -21
-6 to -3
-9 to -6
0 to 3
3 to 6
PARIS
HUMME
ELST
RCHGM
Google earth
© 2015 Google
Image Landsat
100 km
N

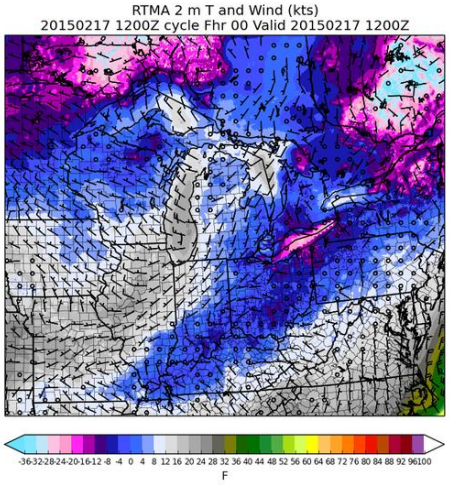

URMA Increments
Feb 20 12Z
Terrain every 100 m
Legend
-2 to 0
-28 to -6
-4 to -2
-6 to -4
0 to 2
2 to 4
4 to 6
6 to 8
8 to 11.6479
Google earth
© 2015 Google
Image Landsat
100 km
N

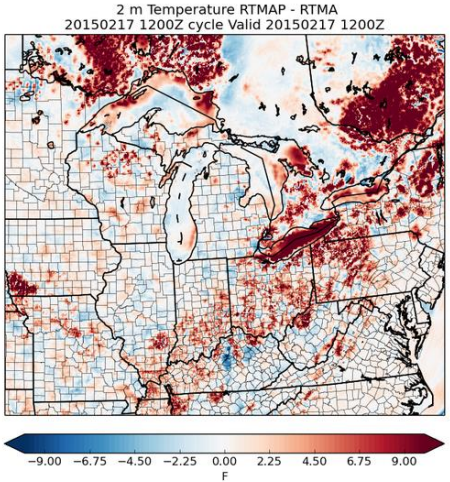
Ob and Analysis Values

Station	Ob	Background	Analysis
RBSN	-25.7	-16.5	-15.1
E1792	-9.9	-11.1	-9.5
KK62	-0.5	-14.4	-12.2
CLSL	-23.0	-16.9	-17.6
ELST	-31.7	-18.3	-21.6
KI39	-14.9	-12.2	-15.8
C9746	-16.2	-14.4	-18.1
KY070	-19.8	-16.3	-17.2
RCHGM	-17.1	-17.8	-19.9

Another Example: Lakes Erie/Ontario

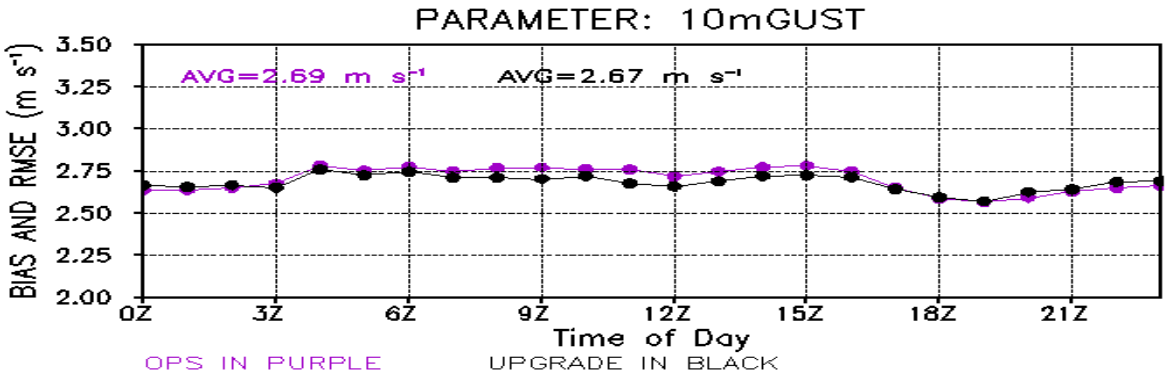






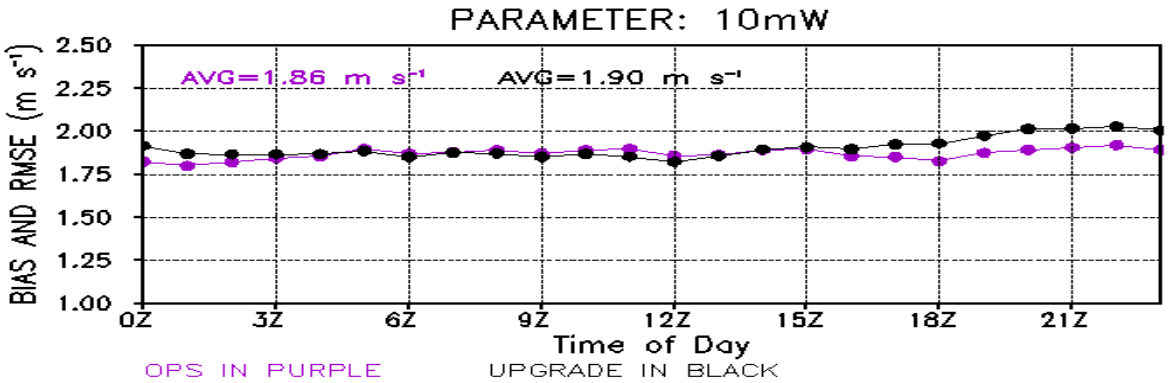
Warmer temps over Lake Erie better match reality, including local SSTs
Case pointed out by WFO Cleveland

Cross-Validation Stats: Gust



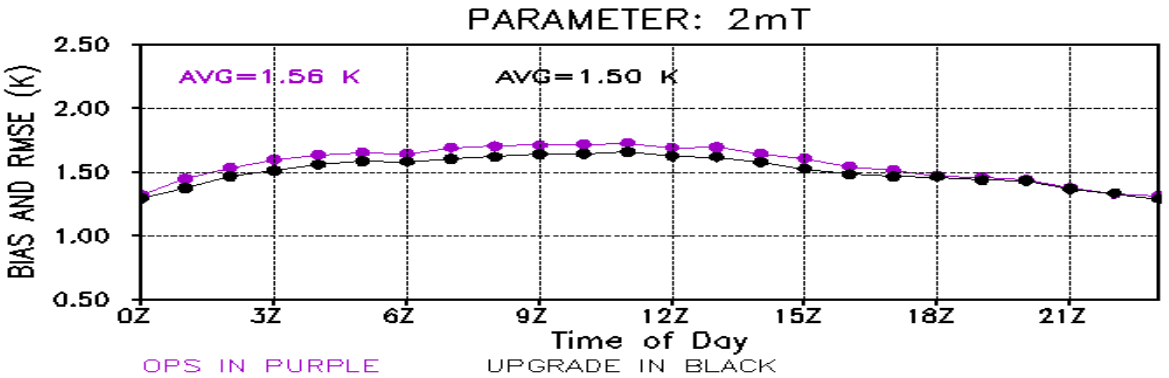
Stats valid 20 Feb 2015 - 2 Apr 2015

Cross-Validation Stats: Wind Speed



Stats valid 20 Feb 2015 - 2 Apr 2015

Cross Validation Stats: Temperature



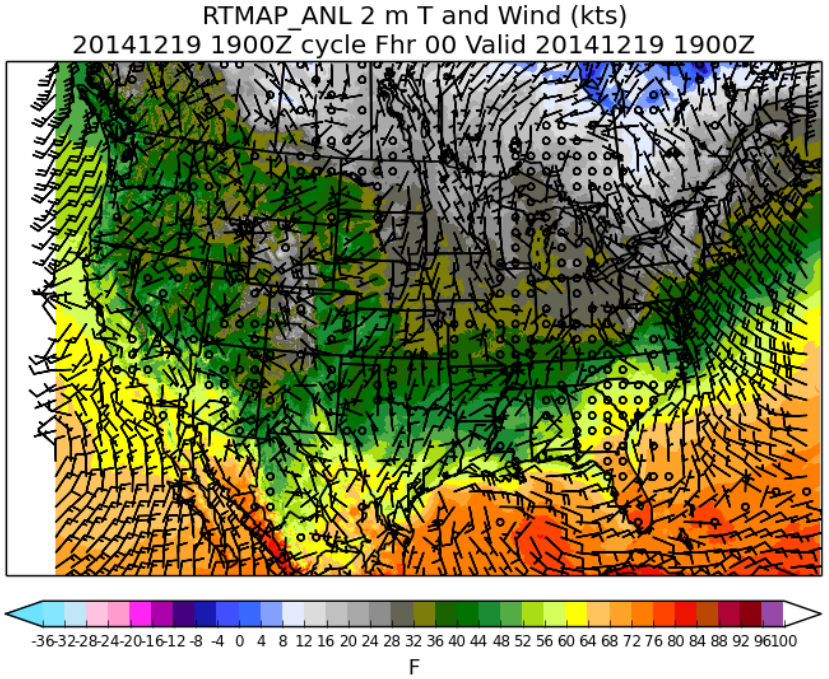
Stats valid 20 Feb 2015 - 2 Apr 2015

Ongoing Concerns

- Ob/mesonet quality control (coordinate with field, Clarus QC tests)
- Importance of background, limitations of resolution (field education)
- Limitations of matching analysis with observations (being compared to MoA)
- Data field is getting that we are not

Closing

- Some highlights of the Q3 FY15 bundle
  - Sky cover analysis
  - Improved Obs QC (buddy check and terrain adjustment)
  - Higher resolution background
  - Improved field coordination
- Some highlights of the Q1 FY16 bundle
  - Nonlinear Quality control
  - Additional analysis variables
    - Significant wave height
    - Ceiling
    - MSLP
  - Analysis of maximum and minimum temperature (URMA only)
    - MaxT: 7AM-7PM local time
    - MinT: 7PM-8AM local time
  - NBM implementation depends on this bundle



Thanks! Questions?

Thank you to the NWS Regions and WFOs who have provided thorough, continuous feedback on the RTMA/URMA!