DECISION BRIEF: Q4 FY2010 and Q1 FY2011

GUAM-RTMA Implementation
CONUS RTMA-2.5km Implementation
HAWAII-RTMA Domain Realignment

Mesoscale Modeling Branch

20 September 2010

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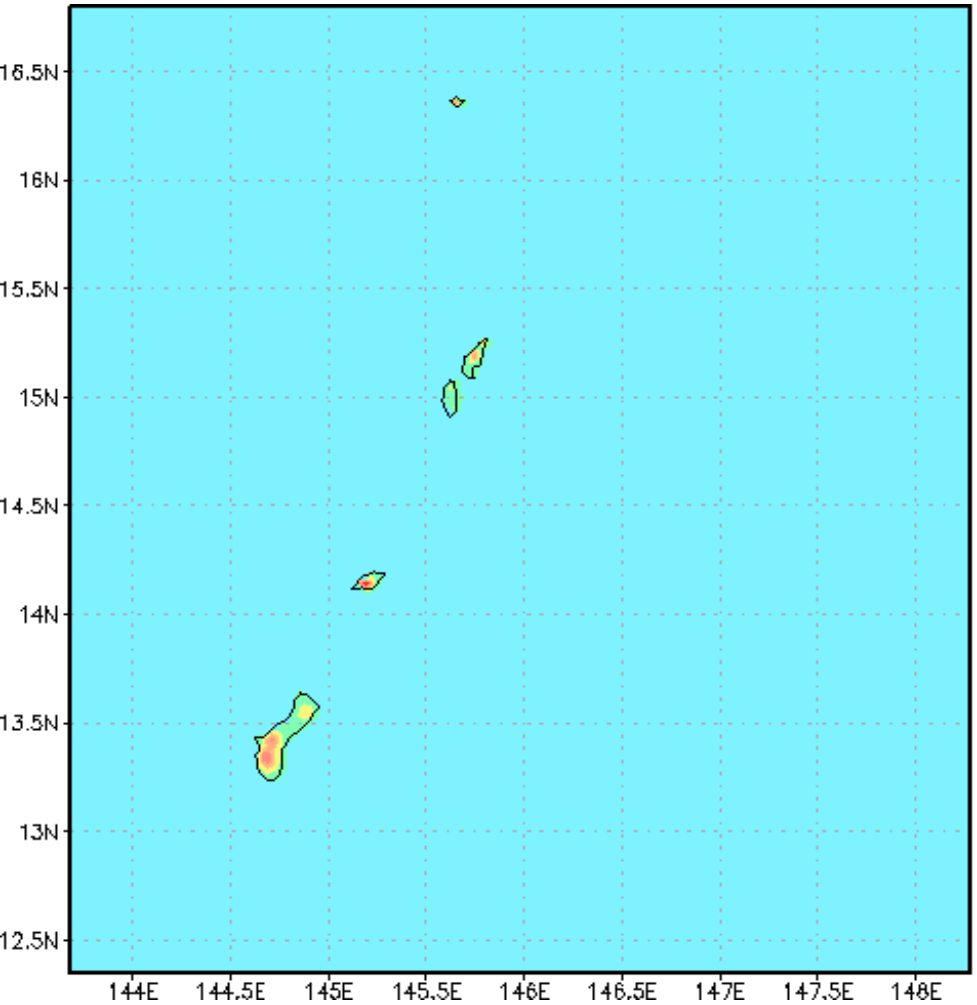
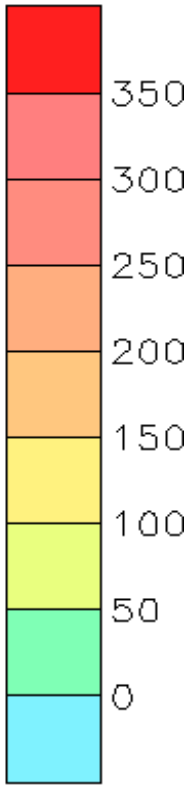
GUAM RTMA

GUAM-RTMA





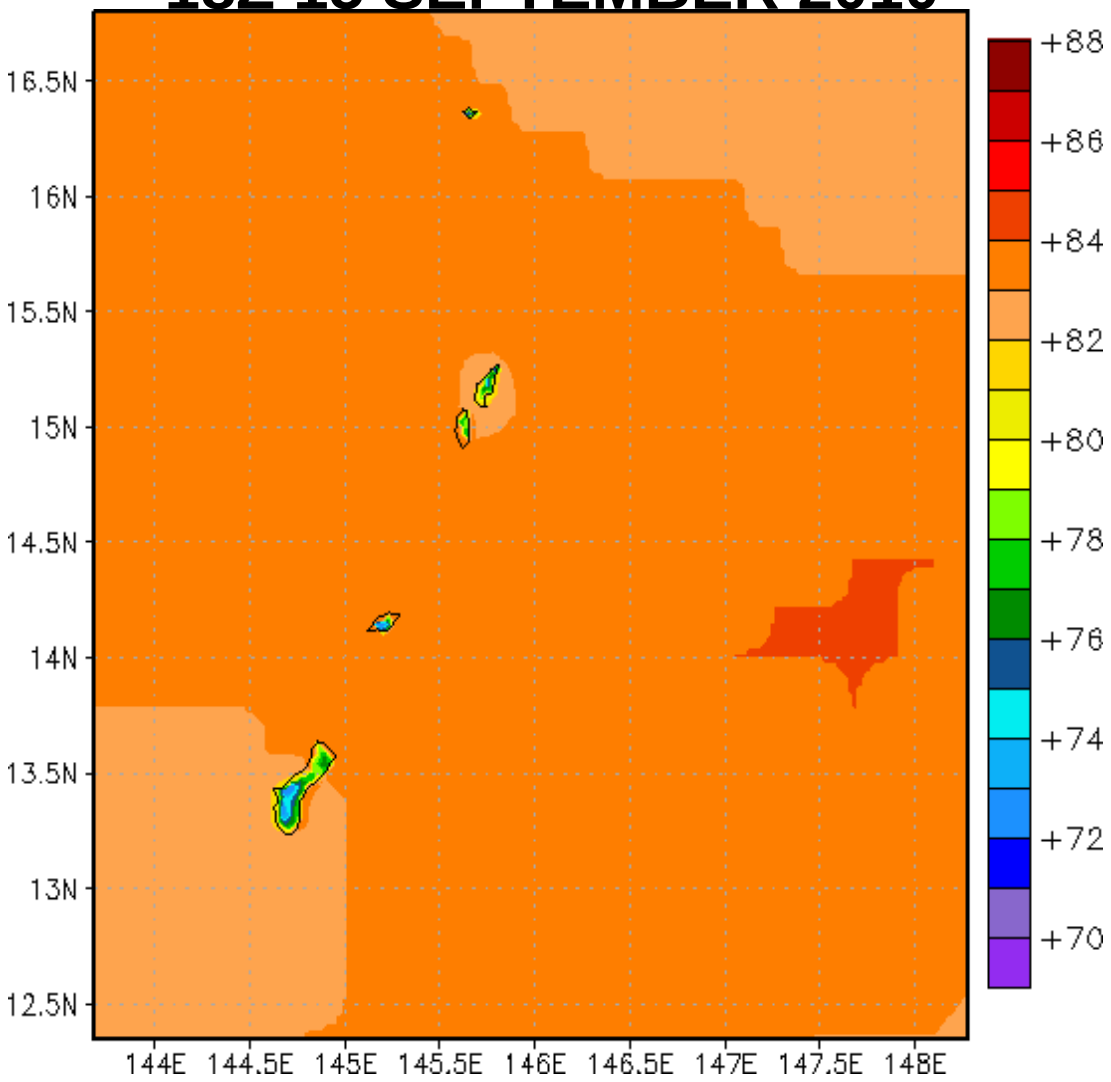
Domain of the Guam NDFD-grid and terrain height in meters

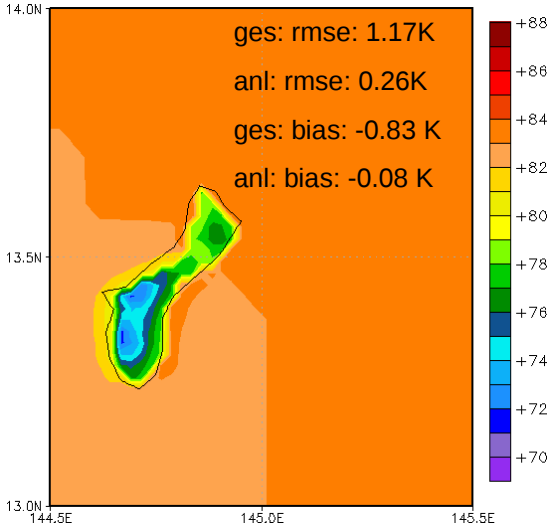
Description

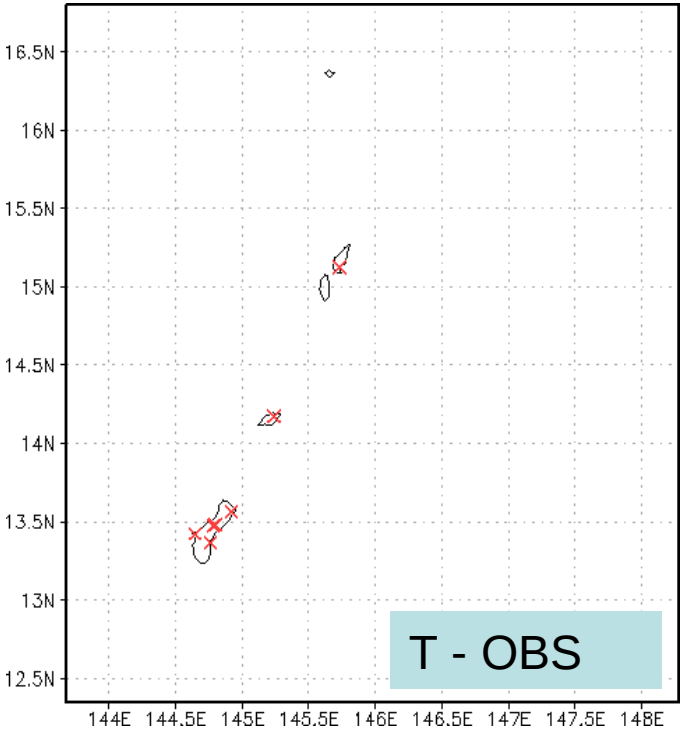
- Mercator grid
- 2.5 km resolution
- 193 x 193 grid points
- Use Unified RTMA code
- Use GFS forecasts downscaled to 2.5km as First Guess
- Use Terrain following background-error covariances
- Analyze 2m-T, 2m- q , 10m- u,10m - v, and psfc
- Compute analysis uncertainty

T-ANALYSIS (F)

18Z 15 SEPTEMBER 2010

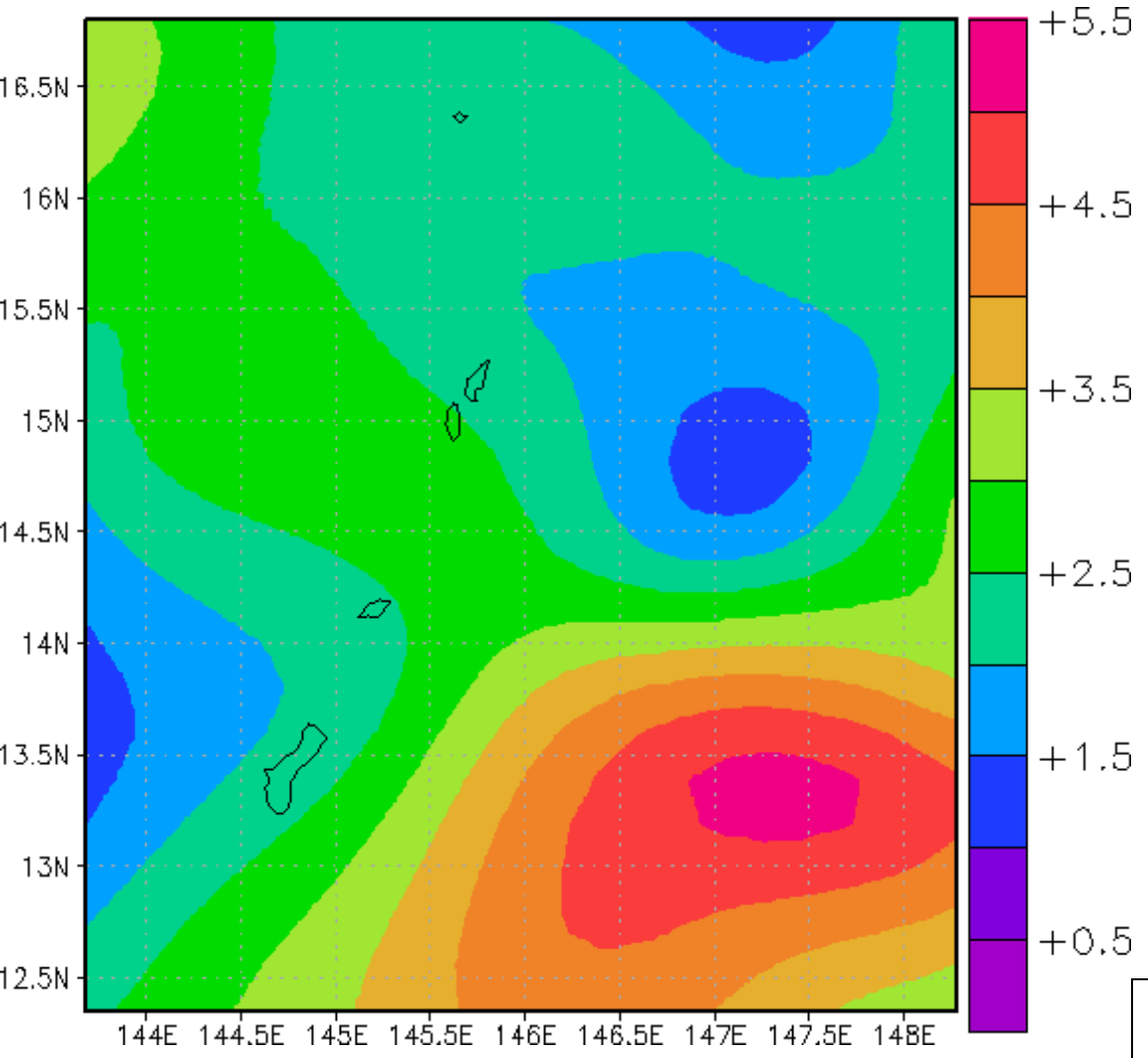






Ob-map illustrates the typical T-ob scenario. Obs are mostly METARS and Mesonets. From time to time, assimilate additional 1 to 3 marine obs.

WSPED FIRST GUESS (m/s)
18Z 15 SEPTEMBER 2010



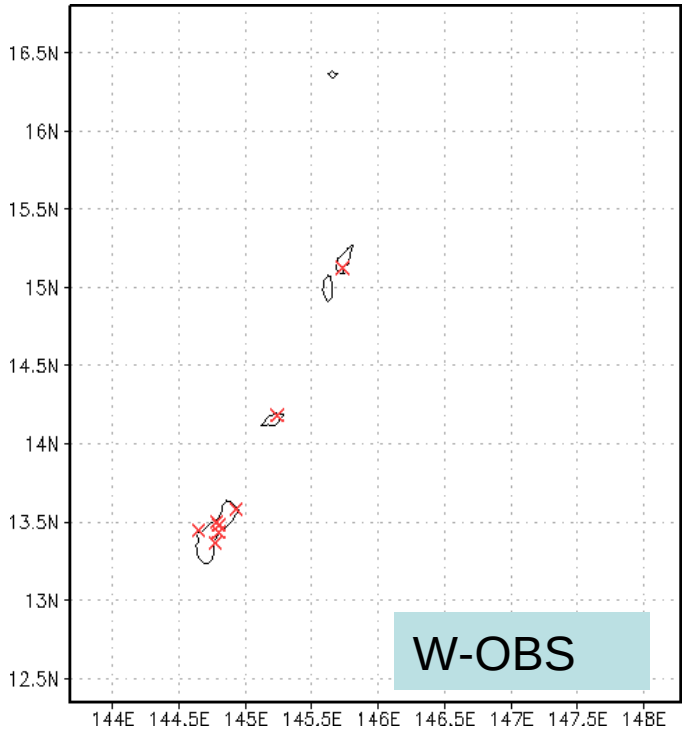
GFS, from which the First Guess is derived, is too coarse to resolve the islands

ges: rmse: 2.66 m/s

anl: rmse: 1.47 m/s

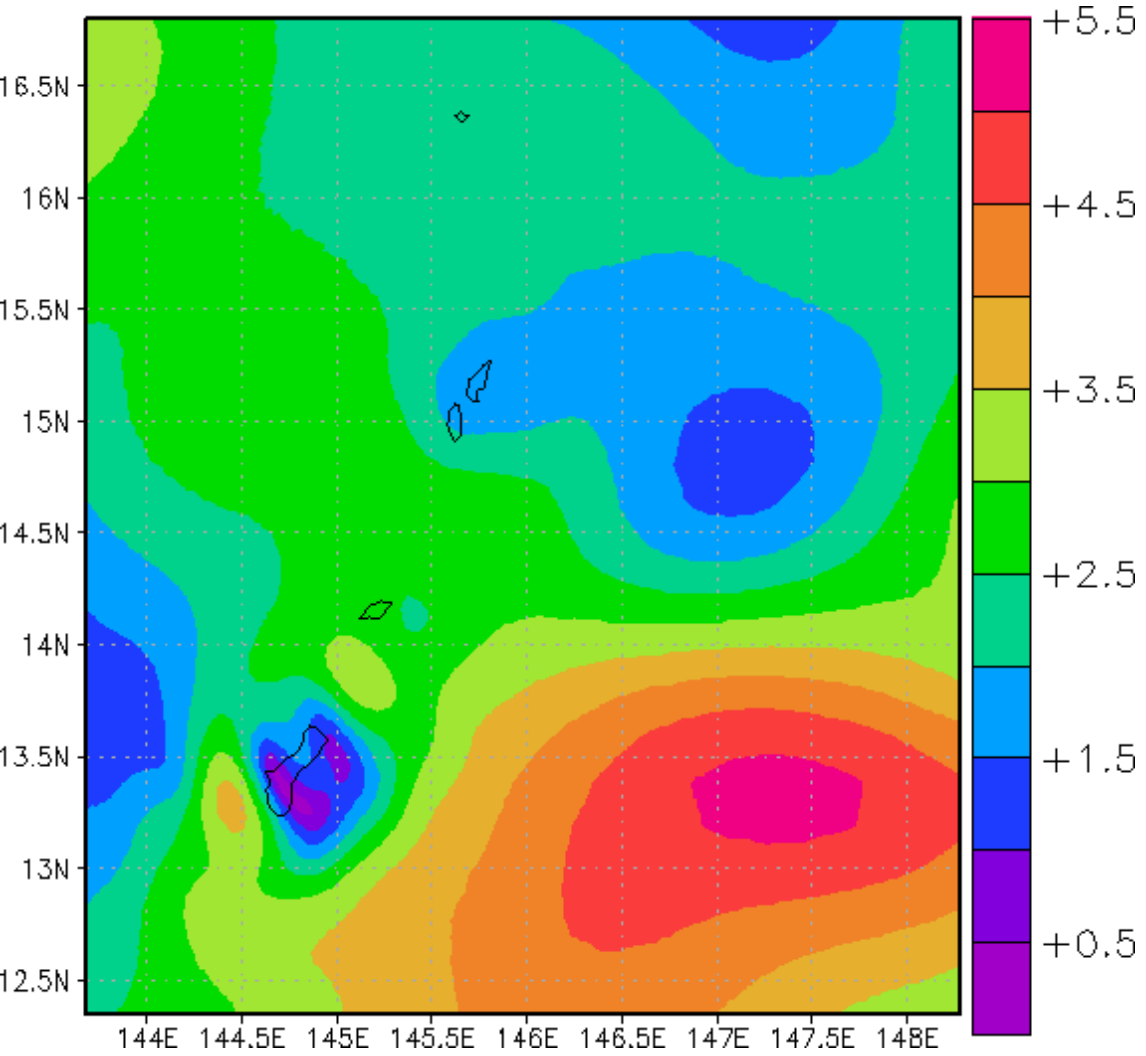
ges: bias: -0.76 m/s

anl: bias: 0.36 m.s



Typical w-ob scenario! From time to time, ASCAT and WindSat winds also available

WSPED ANALYSIS (m/s)
18Z 15 SEPTEMBER 2010



NOTES:

- Very few obs over water

  system already uses a large assimilation time window of -/+ 6h centered around the anl time.

  It also uses the approach of the “First Guess at the Appropriate Time (FGAT)”

- In the future will use forecast from 4km-WRF to build the first guess

FINAL REMARKS

- GUAM-RTMA PARALLEL RUNNING CONSISTENTLY SINCE NOV 2009

- RUNS OFF OF THE UNIFIED RTMA SYSTEM. NO SEPARATE CODE NEEDED

- ANALYSIS RUN FOR 00, 03, 06, 09, 12, 15, 18, and 21Z

- EMC/website DEVELOPED IN MARCH 2010

CONUS 2.5km RTMA

CONUS 2.5km RTMA

FEATURES THAT ARE COMMON TO BOTH THE 2.5 and 5-km RTMA

- FIRST GUESS FIELDS DOWNSCALED FROM 13-km RUC

- BACKGROUND ERROR COVARIANCES ARE MAPPED TO THE (2.5 and 5 km) TERRAIN FIELD

- ANALYZE 2m-T, 2m-SPFH, 10m U and V-wind, pfsc

- COMPUTE AN ESTIMATE OF THE ANALYSIS UNCERTAINTY FOR EACH ANALYZED FIELD

CONUS 2.5km RTMA / NEW FEATURES

1 . Increased Horizontal resolution

2. Extended Assimilation Time window for the obs:
   -/+30 min around the anl time. 5km RTMA uses -/+12 min

3. Use First Guess at the Appropriate Time (FGAT)

4. Apply sequential bias-correction algorithm for the background temperature (Dee and Da Silva, 1998, QJRMS, and Dee and Todling, 2000, MWR). Use decaying average to update bias

$$bias(n+1) = (1-a)\, bias(n-1) + a*bias(n) ;\ 0 < a < 1 \text{ ; chosen parameter}$$

5. Improved Quality Control for the OBS / Gross-error check

6. Add ocean surface WindSat and ASCAT winds and low-level satellite drift winds. Time window is -/+3h for these ob types!

2.5km terrain fits ob elevations significantly better than current 5km terrain does:

ROOT- MEAN SQUARE DIFFERENCE BETWEEN THE TERRAIN HEIGHT AND THE OBSERVATION ELEVATION

	CONUS	Western Region
5km -Terrain	83.5m	137.0m
2.5km -Terrain	65.9m	104.4m

Note: Statistics were computed using temperature station data for 12Z 11 March 2009.

There were:

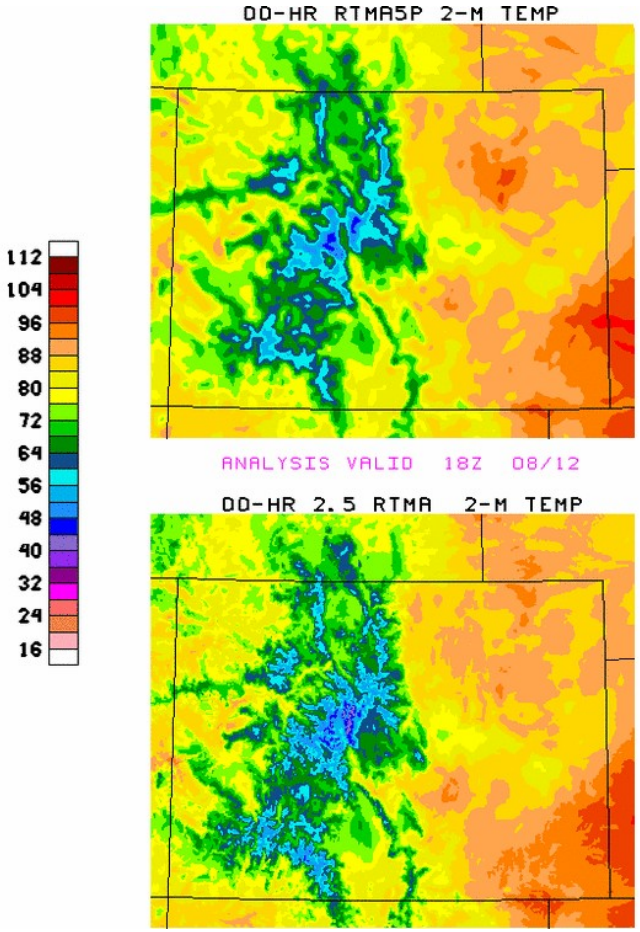
- 11952 Stations over the entire CONUS

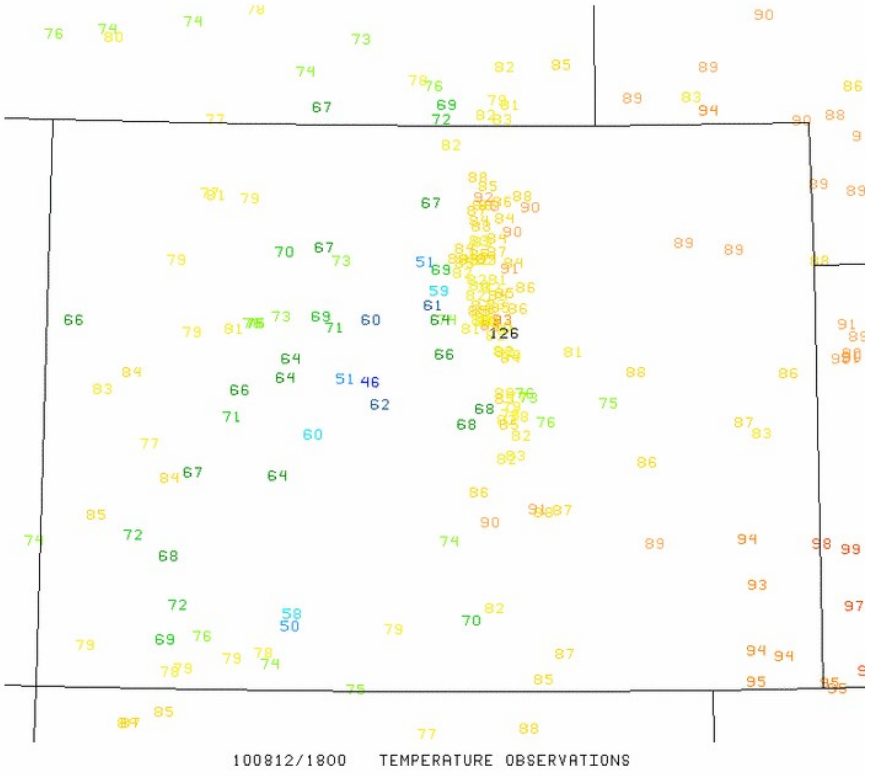
- 3633 Stations over Western Region, defined here as being the region to the west of 100W

- FORECASTERS HAPPIER WITH 2.5km ANALYSIS, SINCE FIELDS BEAR MORE RESEMBLANCE TO THE 2.5km MatchObsAll FIELDS THAT THEY ARE USED TO LOOKING AT. EXAMPLES FOLLOW:

2-m T ANALYSIS VALID 18 Z 12 AUG 2010 over Colorado

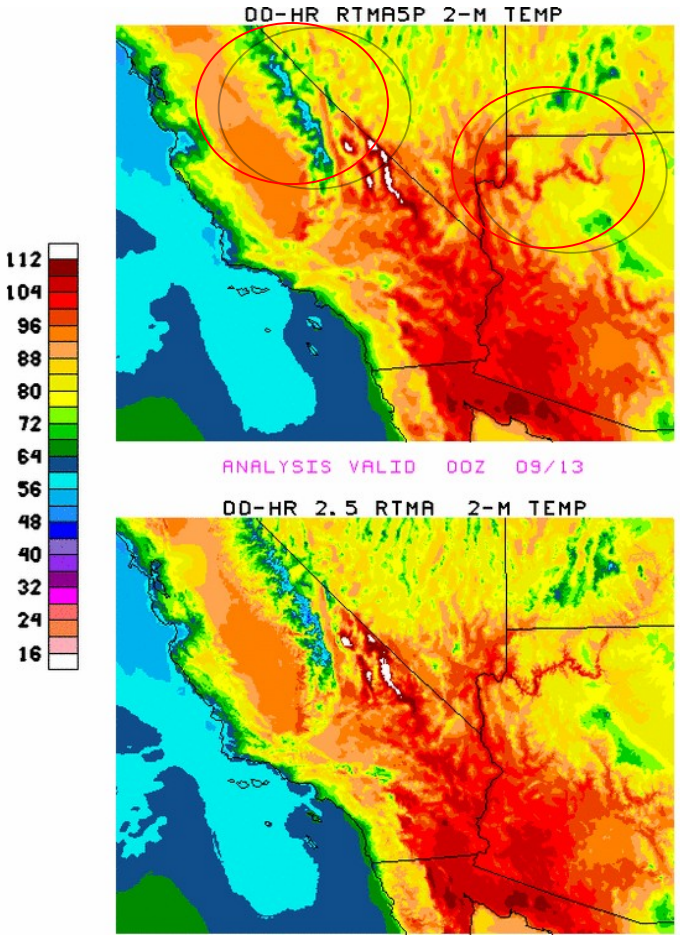
Comparison between the 2.5km and 5km RTMA

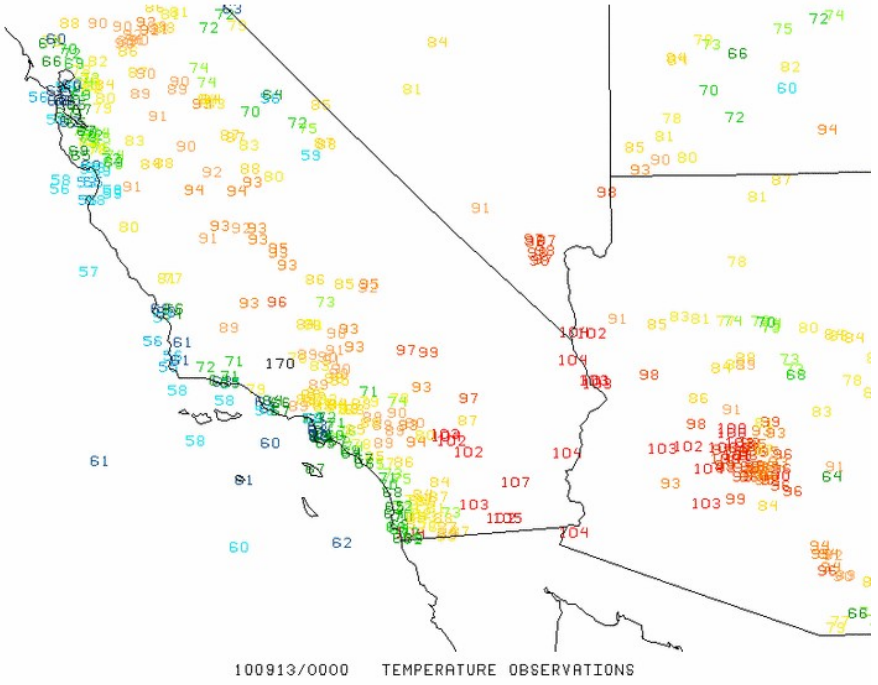




The various terrain features are much better resolved at 2.5km

2-m T ANALYSIS VALID 00 Z 9 SEPT 2010 over the far southwest
Comparison between the 2.5km and 5km RTMA

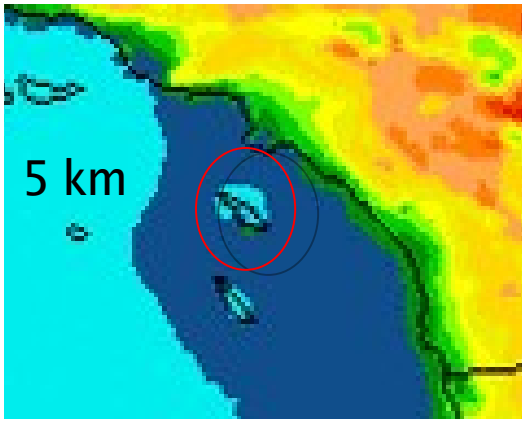


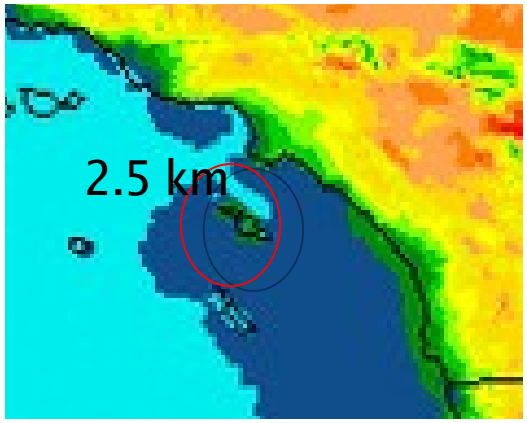


The various terrain and valley features show up better at 2.5 km

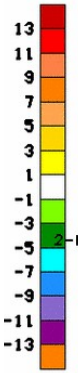
2-m T ANALYSIS VALID 00 Z 9 SEPT 2010 over the far southwest
Comparison between the 2.5km and 5km RTMA

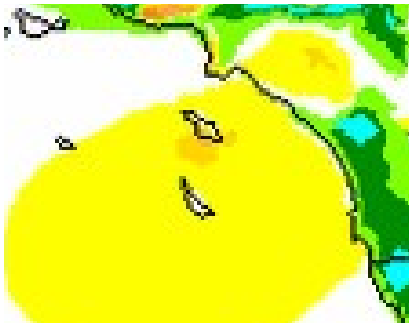
2-m temps

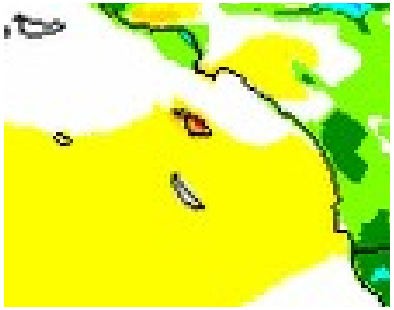




Example shows that Santa Catalina Island is resolved at 2.5 km but not at 5km



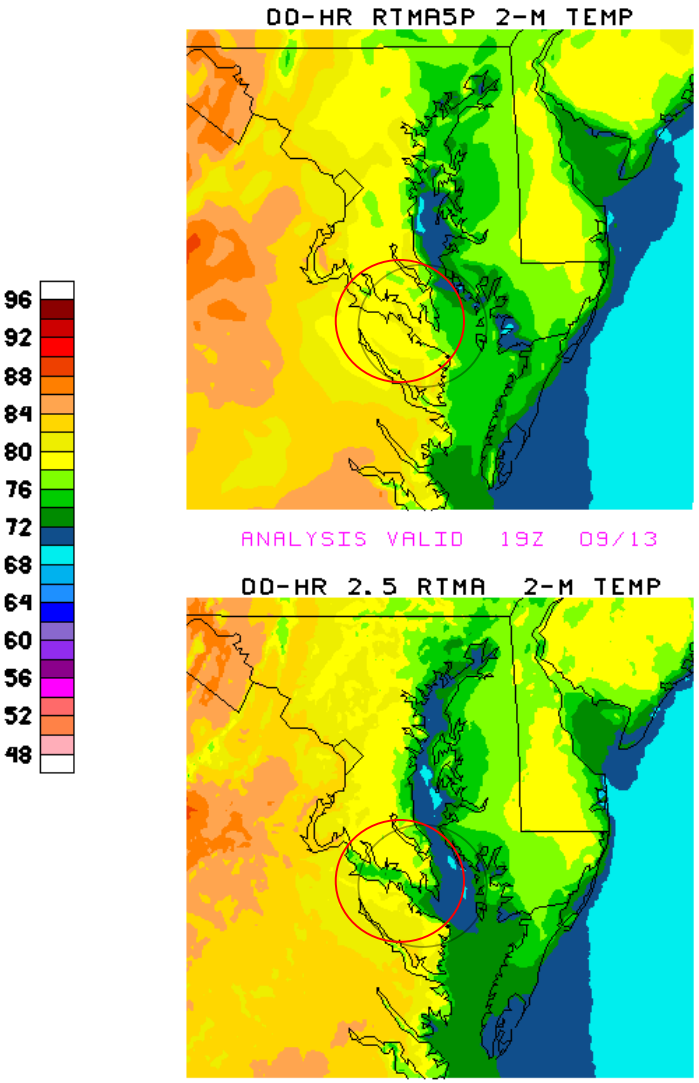




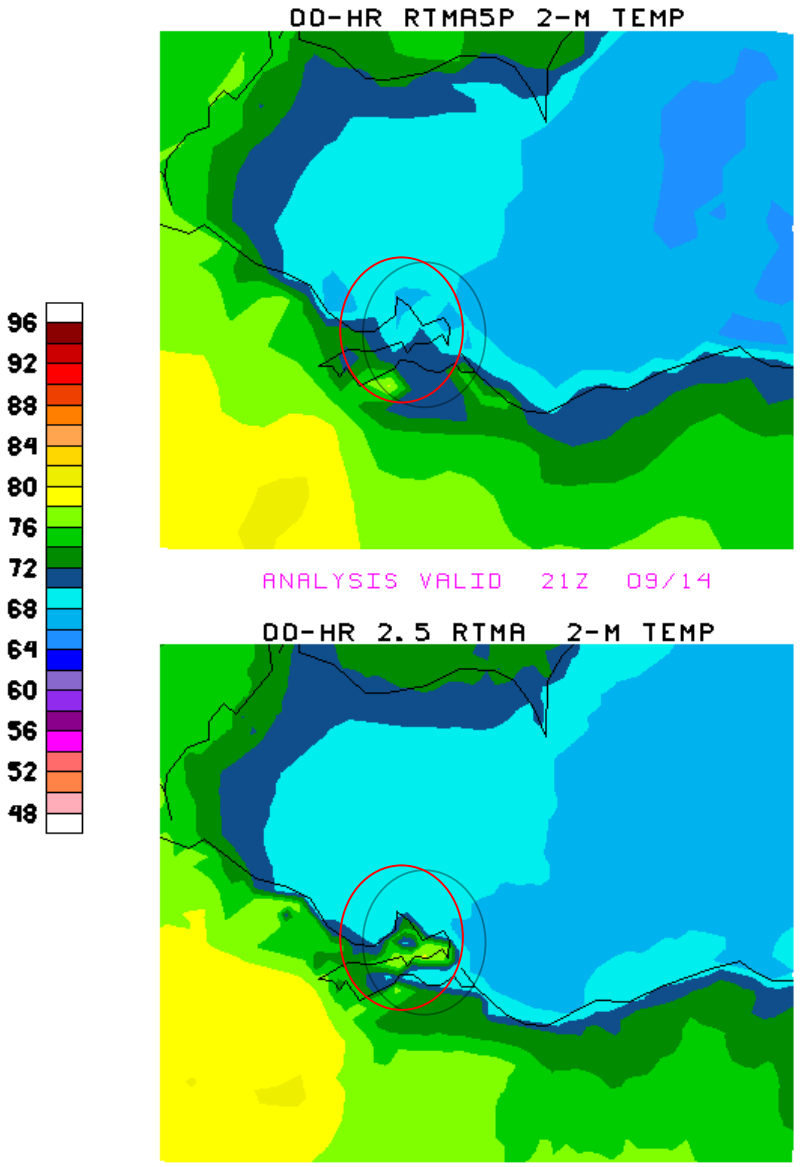
2-m temperature increments

Sample 2.5 km vs 5 km 2-m Temperature Analysis over the DC area

Valid 19z 13 Sept 2010

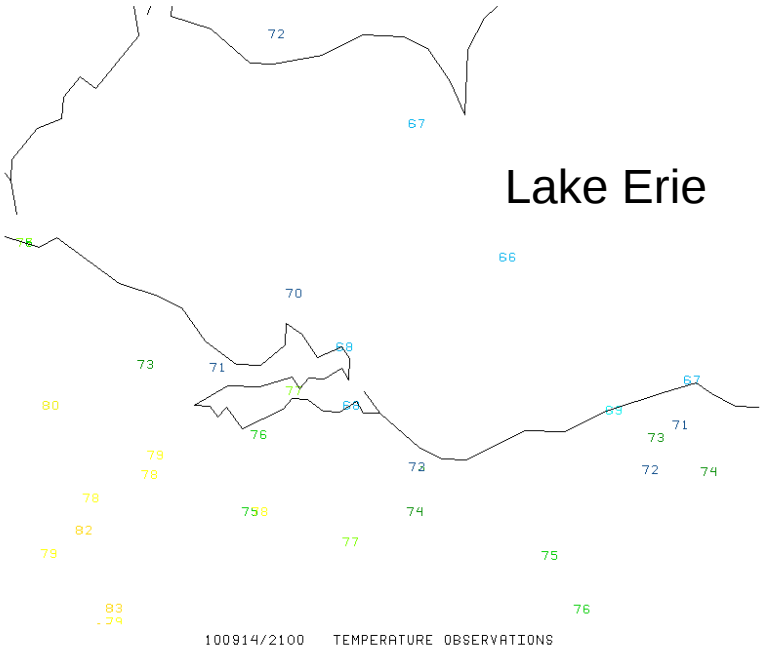


Overall, the cooler Bay is better resolved at 2.5 km



21 Z 14 September 2010

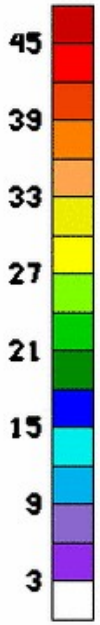
Ohioś no rth shore

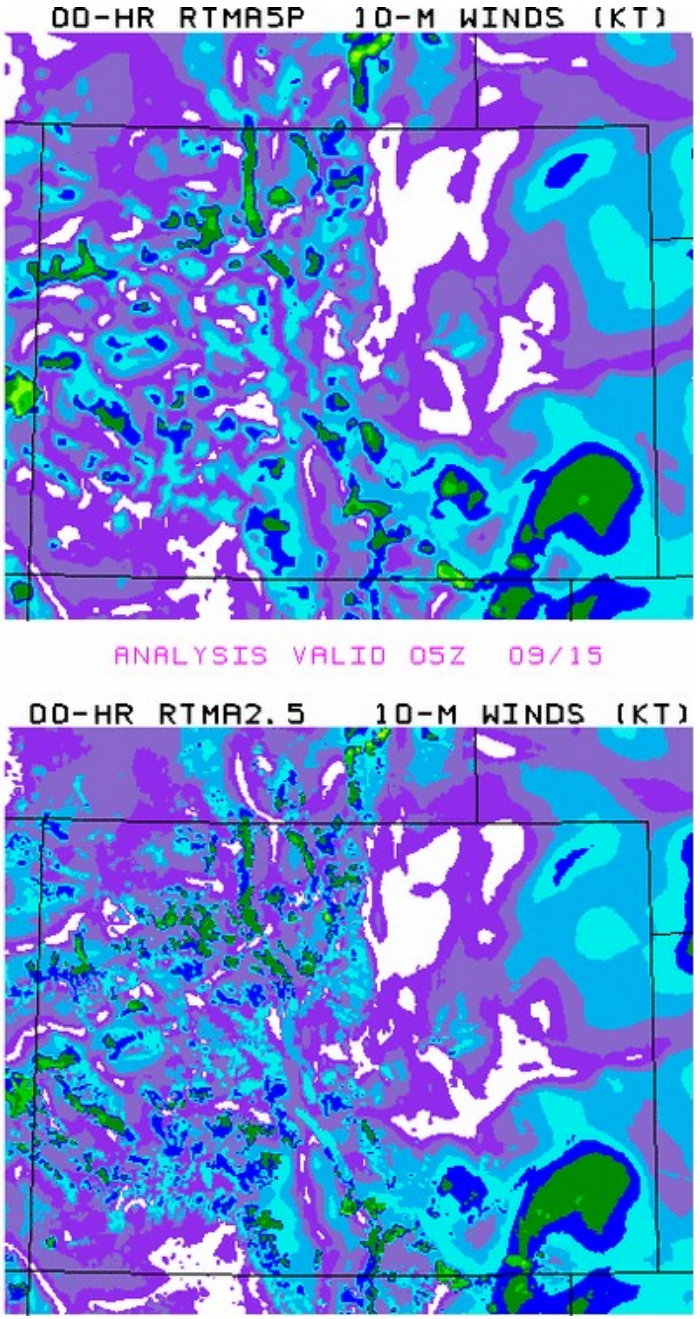


Sample 2.5 km vs 5 km temperature analysis valid 21z 14 Sept 2010 over northern Ohio. The peninsula near Sandusky, OH, is partially resolved at 2.5 km but not at 5km.

5Z 15 September 2010

Sample 10-m wind speed field over Colorado valid 05z 15 September 2010. The higher speeds over the higher terrain are better shown at 2.5 km





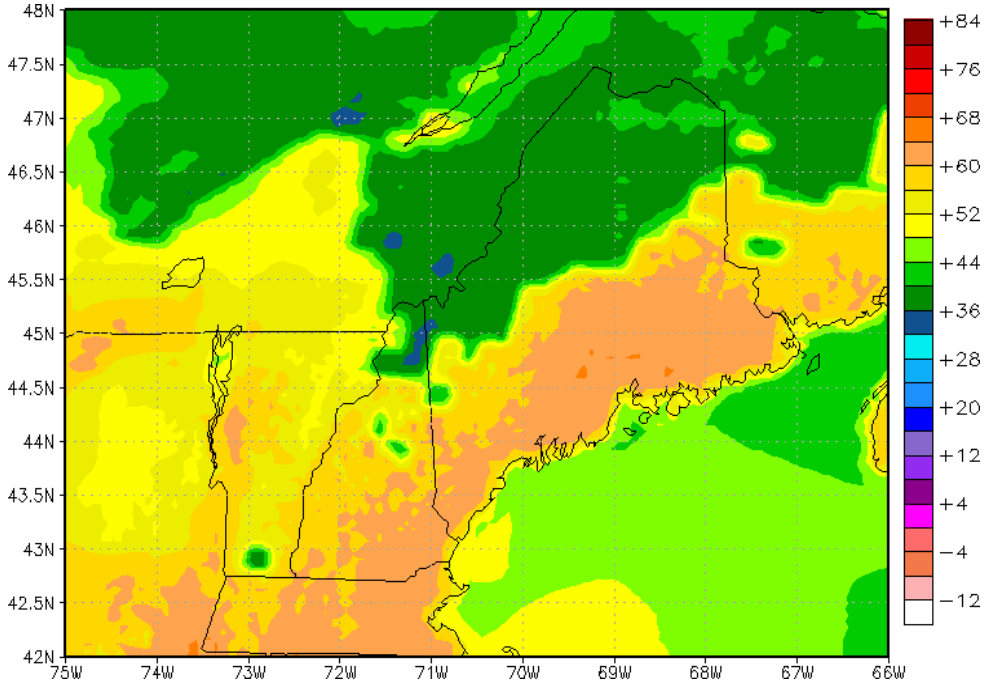
IMPACT FROM THE EXTENDED TIME WINDOW

STATION COUNT FOR T-OBS / VALID 12Z 15 Nov 2009

	T- window -/+ 0.2h	T- window -/+ 0.5h	Increase
Mesonets	8019	12081	50.6 %
Land Synotic+ METARS	1973	2049	3.8 %
Surface Marine	155	169	9.0 %
Total	10147	14299	40.9 %

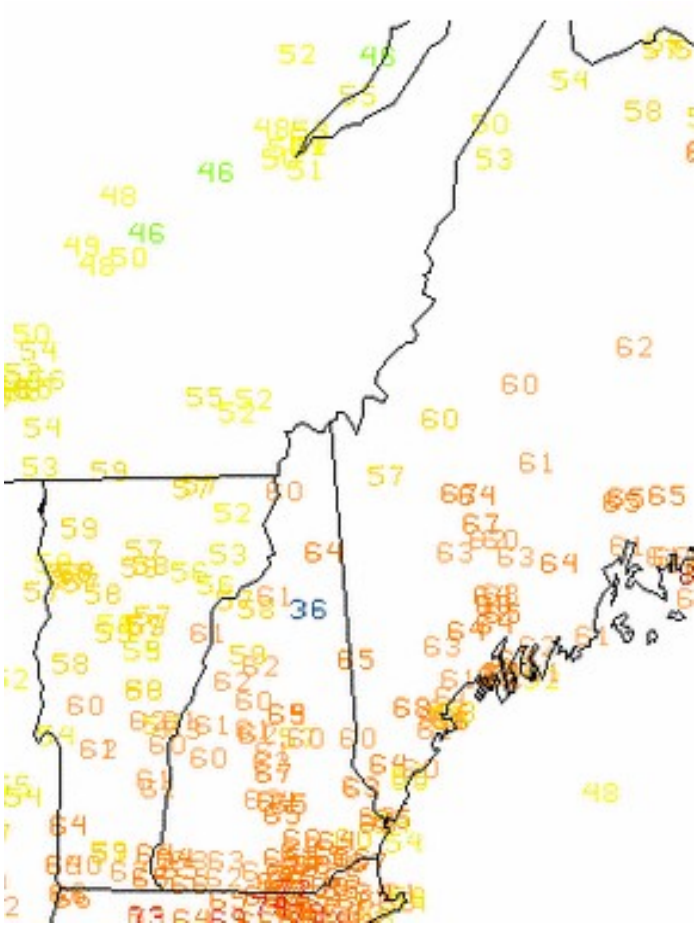
EXAMPLE OF THE IMPACT OF FGAT AND BIAS CORRECTION

2m-T FIRST GUESS / 15Z 5 April 2010



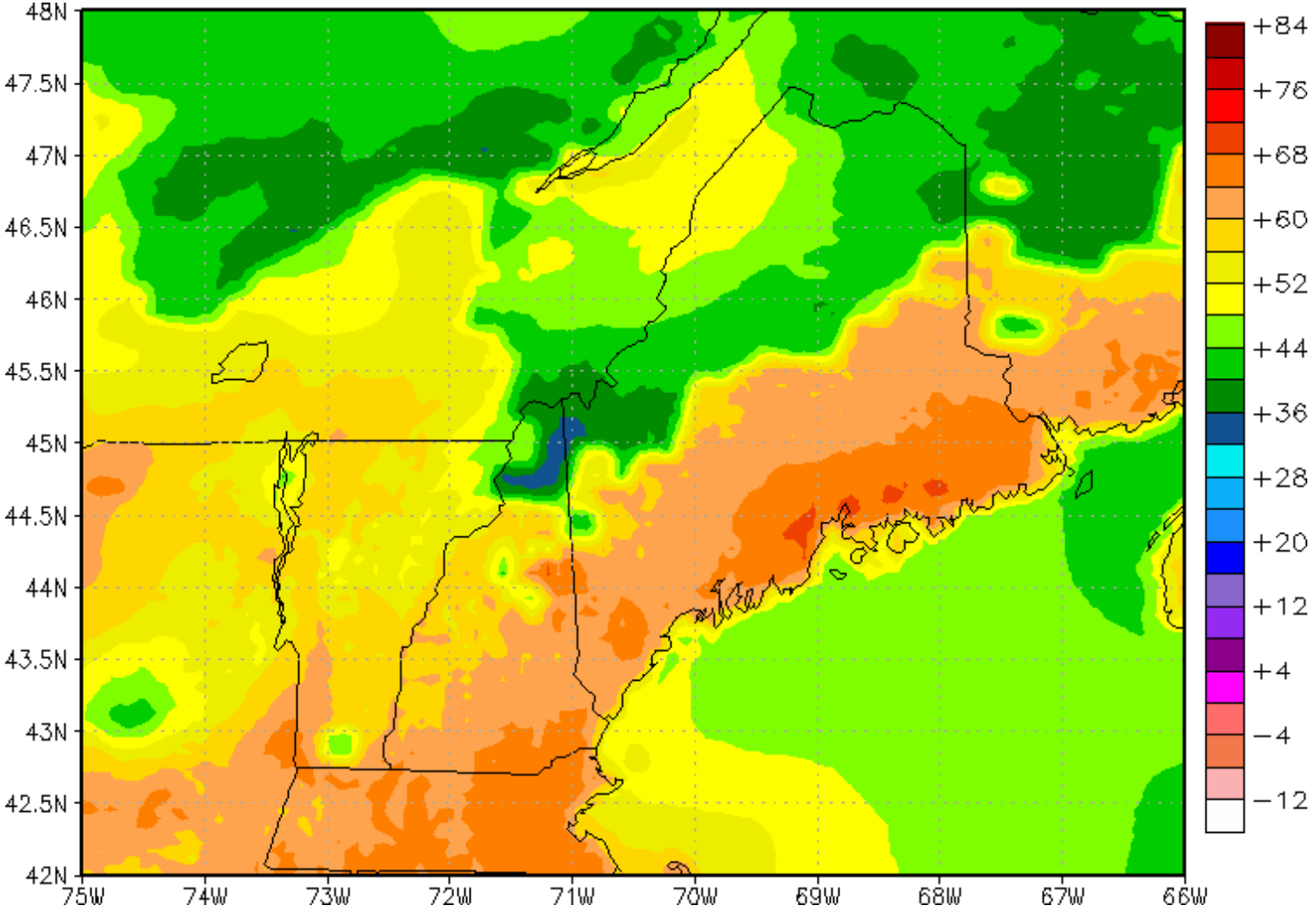
Over northwest Maine: FG temperatures are too low compared with the obs. This was in part due to a deficient snow clearing in the RUC.

T- OBS USED FOR THE ANL



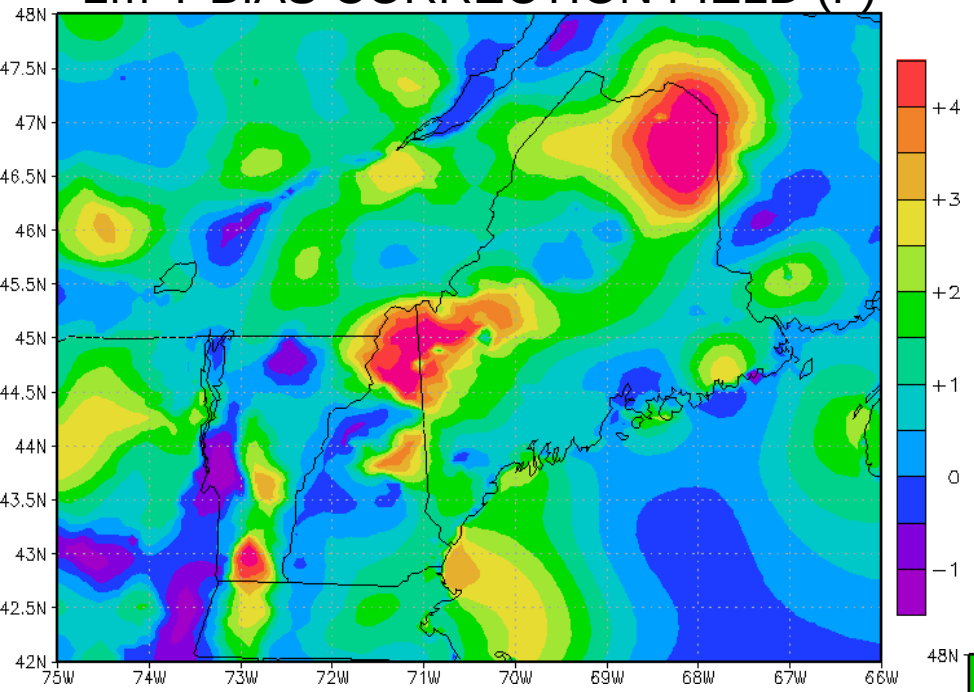
ANALYSIS / NO BIASCOR AND NO FGAT

15Z 5 April 2010



Although improvements are seen upon the First Guess, the temperatures are still too cold for most of west and northwest Maine

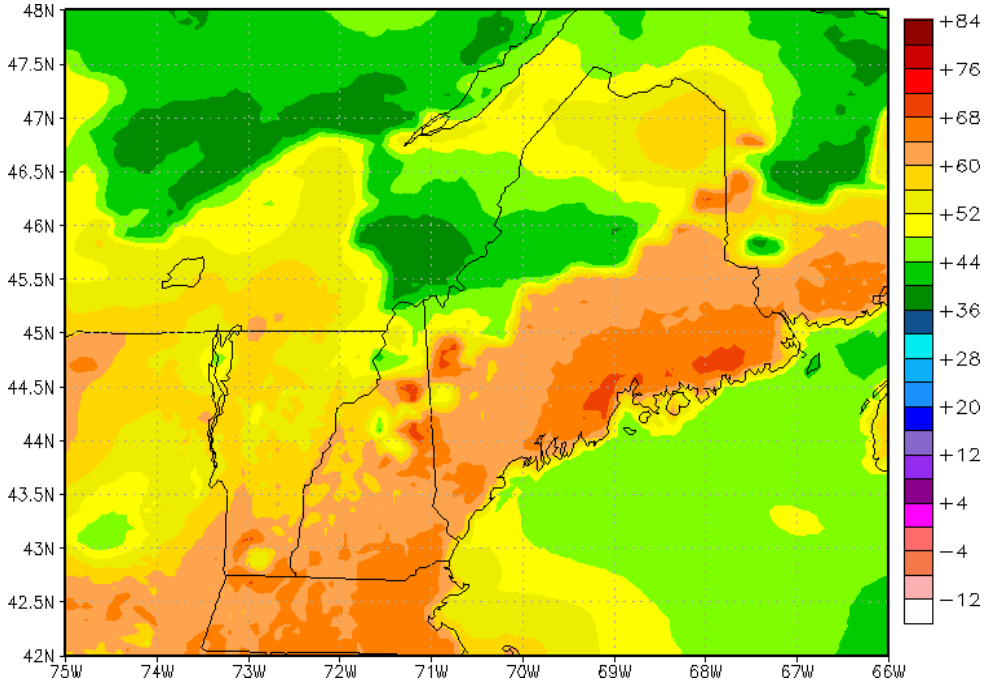
2m-T BIAS CORRECTION FIELD (F)



15Z 5 April 2010

Resulting analysis shows warmer temperatures, especially over northwest Maine where there are obs. This is the result of the combined effect of FGAT and Bias Correction.

2m-T ANL USING BIASCOR +FGAT

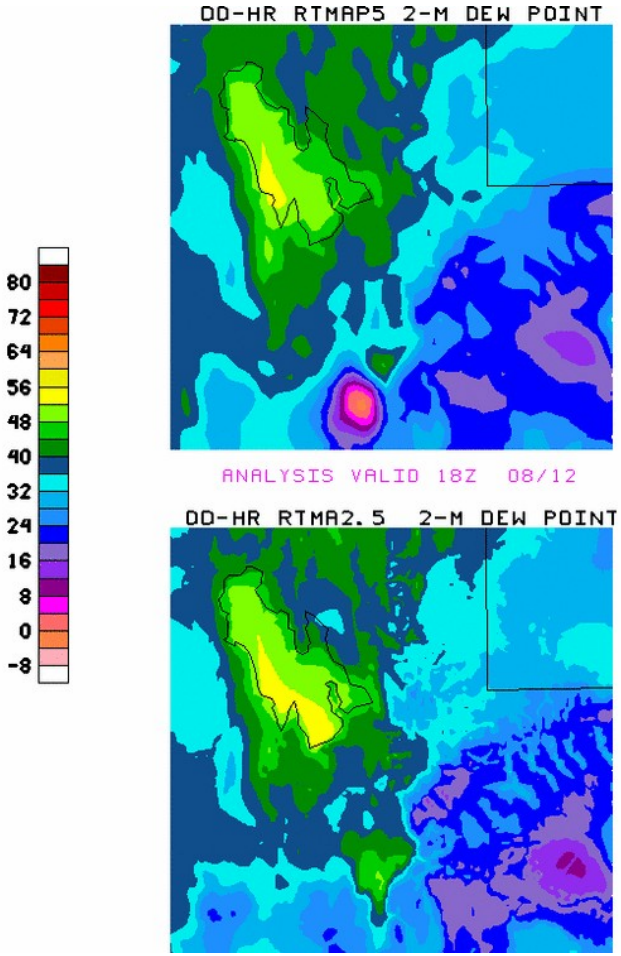


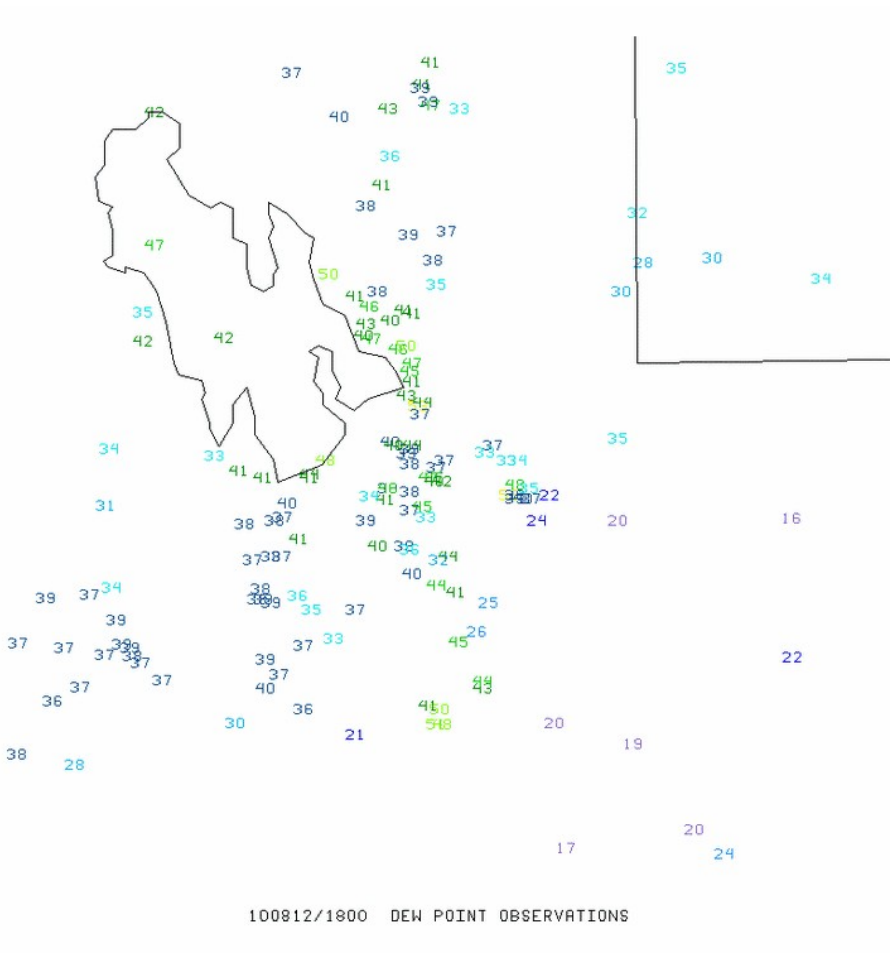
1. Bias correction warms the FG over most of Maine ➔ warmer analysis too

2. FGAT is however crucial

EXAMPLE OF THE IMPACT FROM THE IMPROVED QUALITY CONTROL FOR MOISTURE OBS OVER UTAH

DEW POINT VALID 18Z 12 August 2010





The dry bullseye in the 5 km version is eliminated in the 2.5 km RTMA

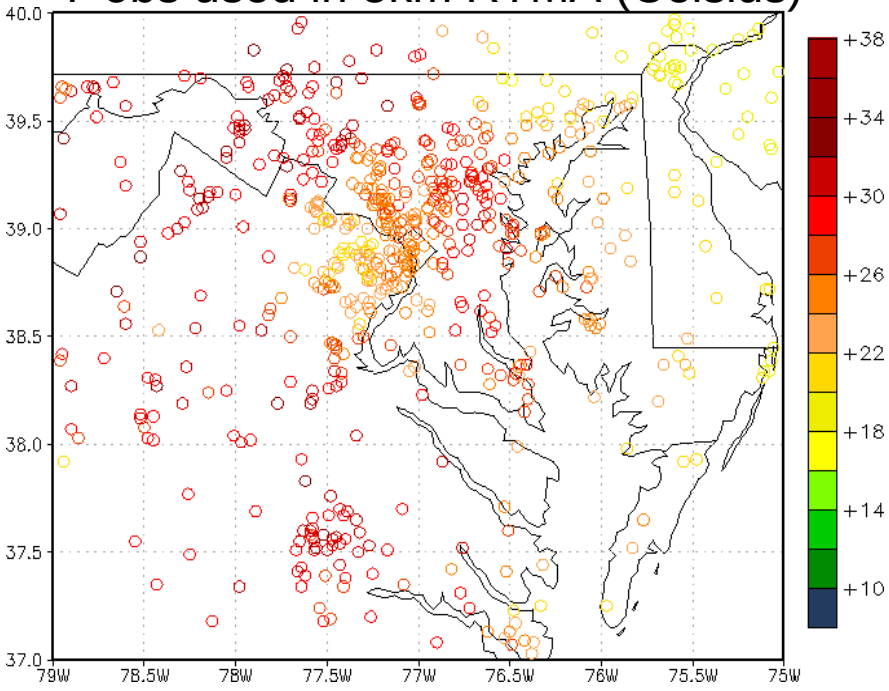
SAMPLE RETROSPECTIVE CASE WHERE THE “OLD” 5km RTMA DID WELL

Will show that the 2.5 km version would also handle it well

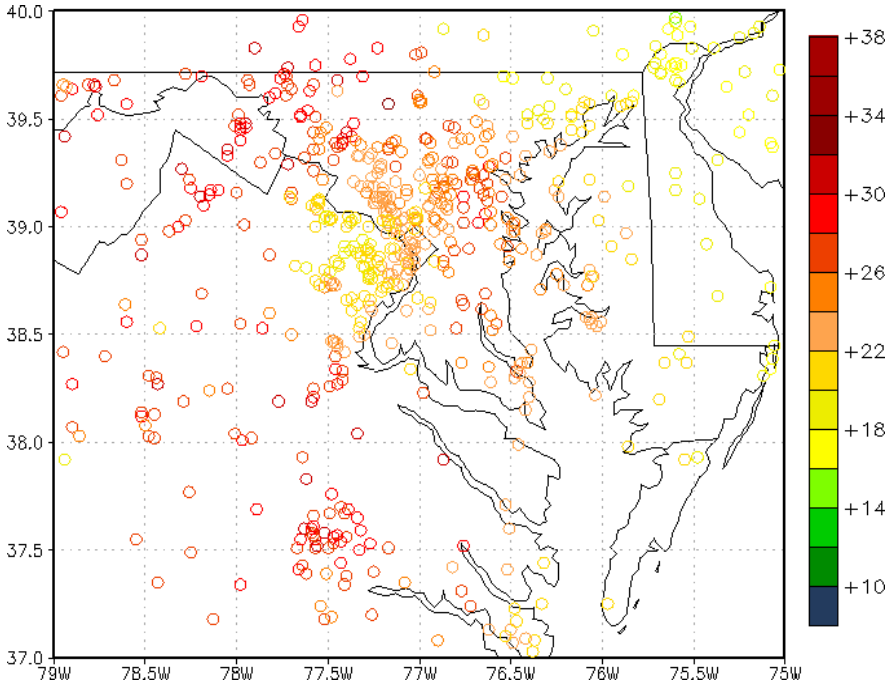
CONVECTIVELY-INDUCED COLD POOL IN GREATER WASHINGTON DC / OLD CASE

VALID 18 Z 13 June 2007

T-obs used in 5km RTMA (Celsius)

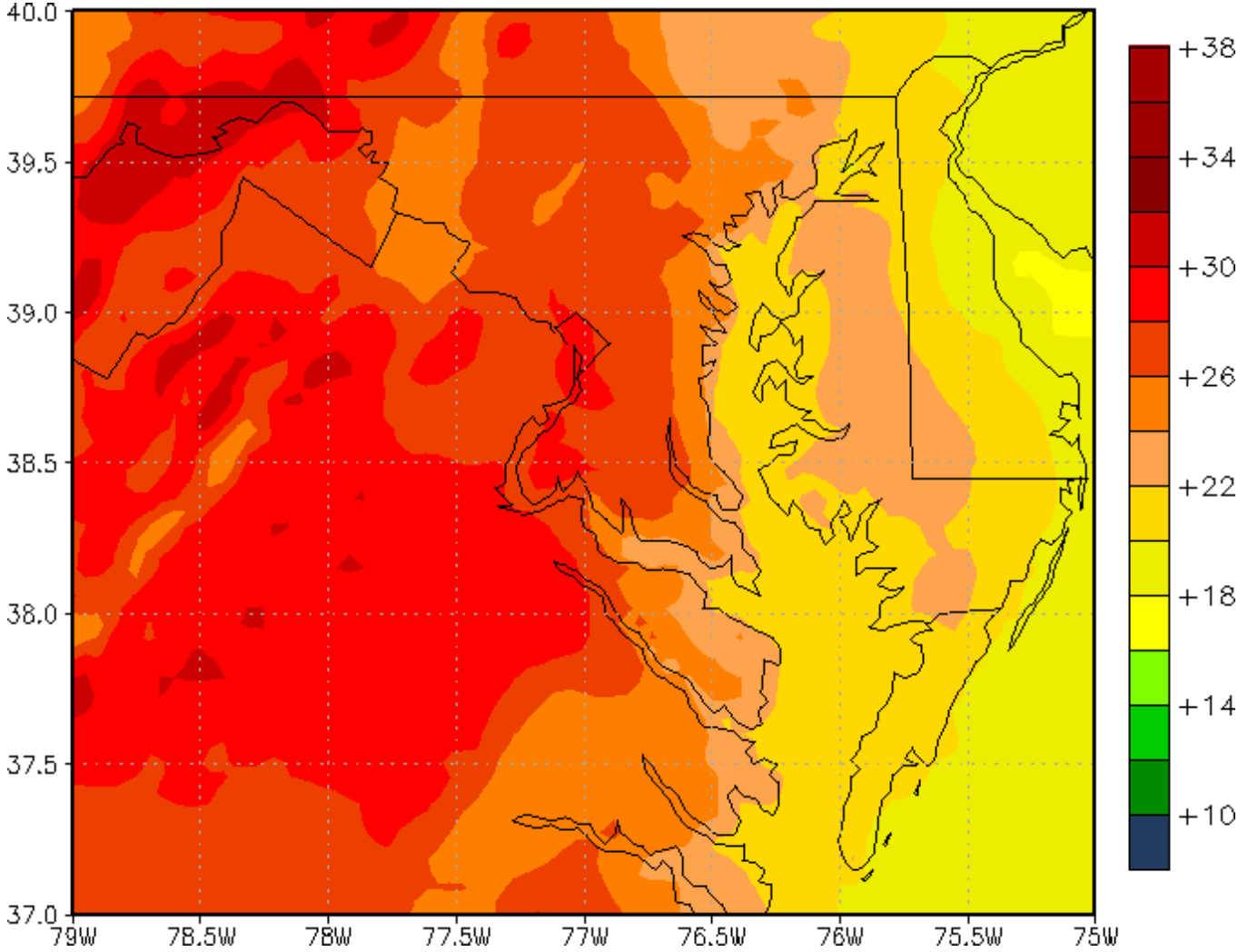


T-obs used in 2.5km RTMA (Celsius)



The RTMA generally analyzes convectively induced cold pools very well. The example shows a cold pool in northeastern Virginia and Washington DC.

OLD CASE OF TEMPERATURE ANALYSIS (Celcius) Valid 21Z 13 June 2007

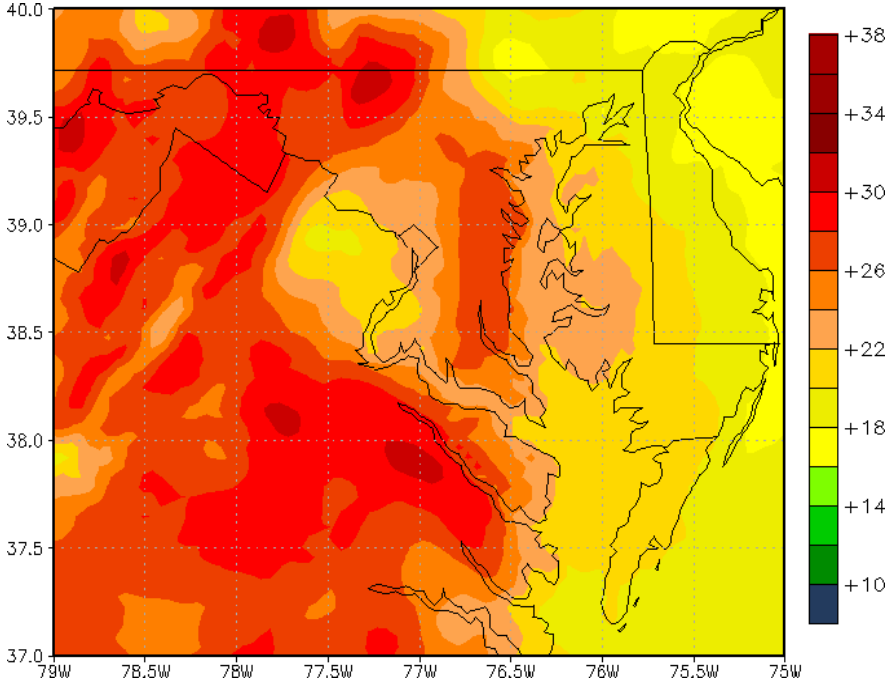


Cold Pool is not well defined in the First Guess!

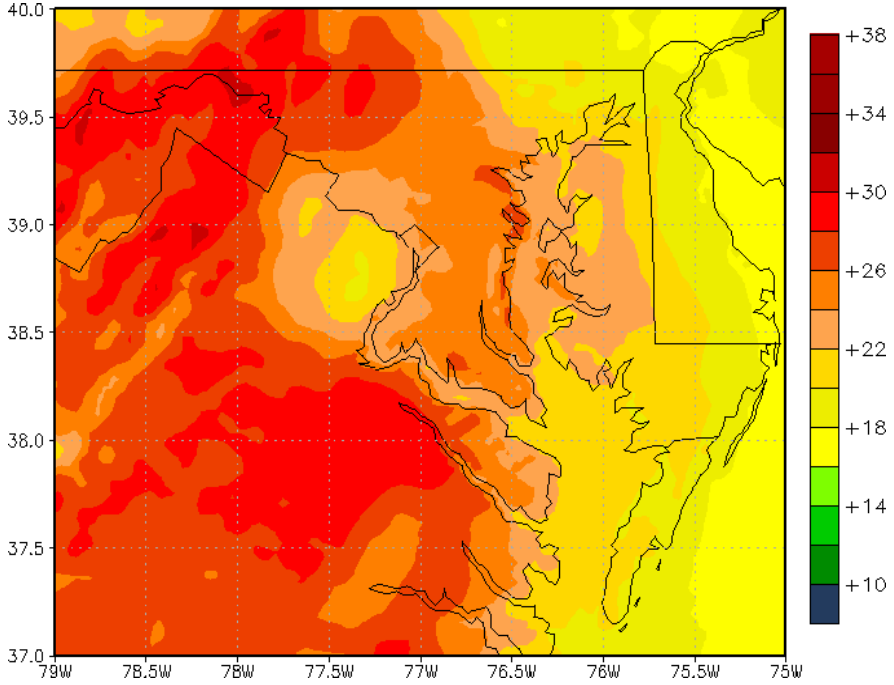
OLD CASE OF TEMPERATURE ANALYSIS (C)

Valid 21Z 13 June 2007

5km RTMA



2.5km RTMA



5km RTMA known to have analyzed the cold pool very well (see left panel)

Right panels shows that the 2.5 km RTMA also does well.

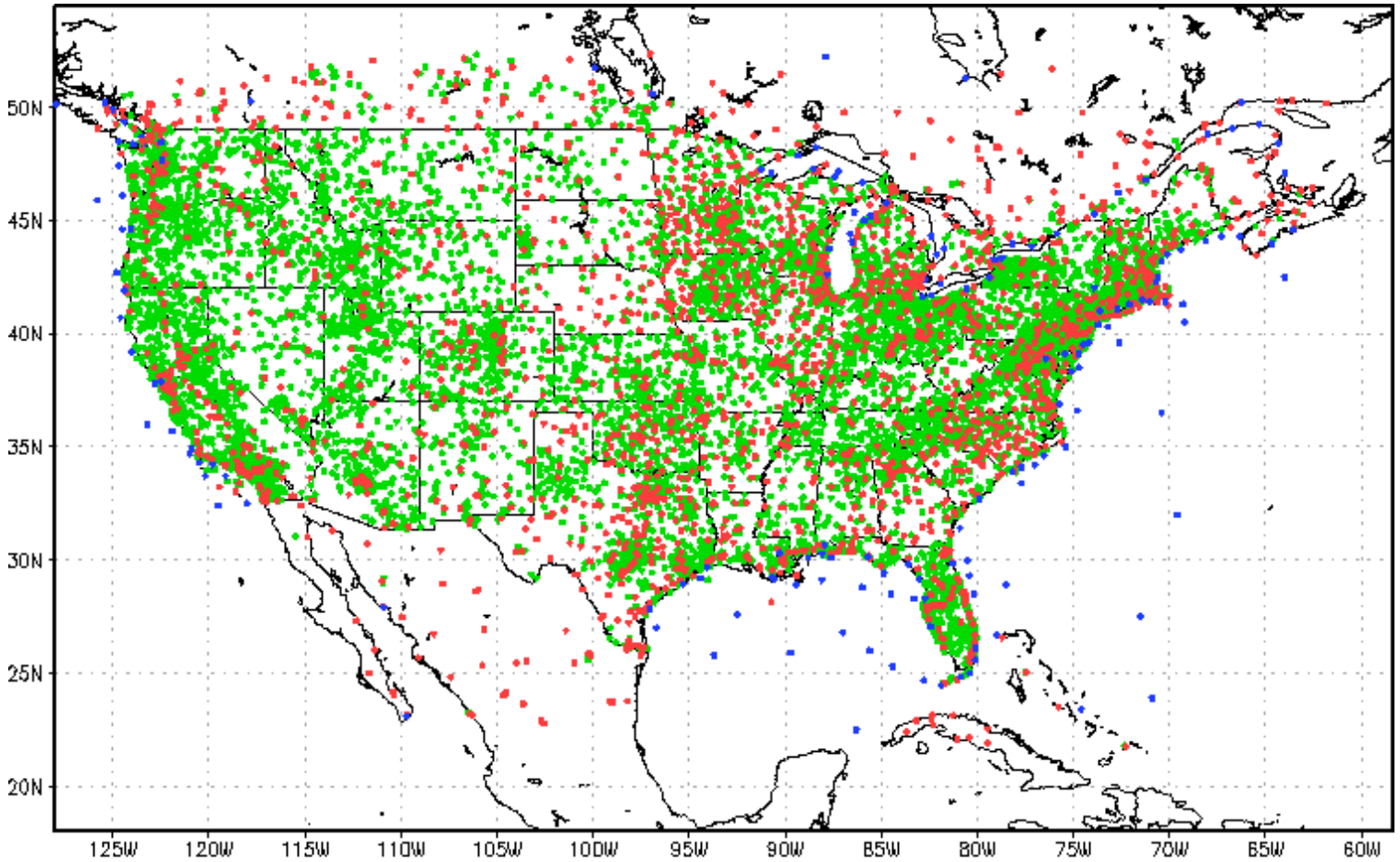
Note: 2.5km First guess was linearly interpolated from the 5km first guess.

CROSS-VALIDATION STATISTICS

Added cross-validation to the EMC 5km and 2.5km parallels

Results show that the global rms differences and biases are comparable for both systems.

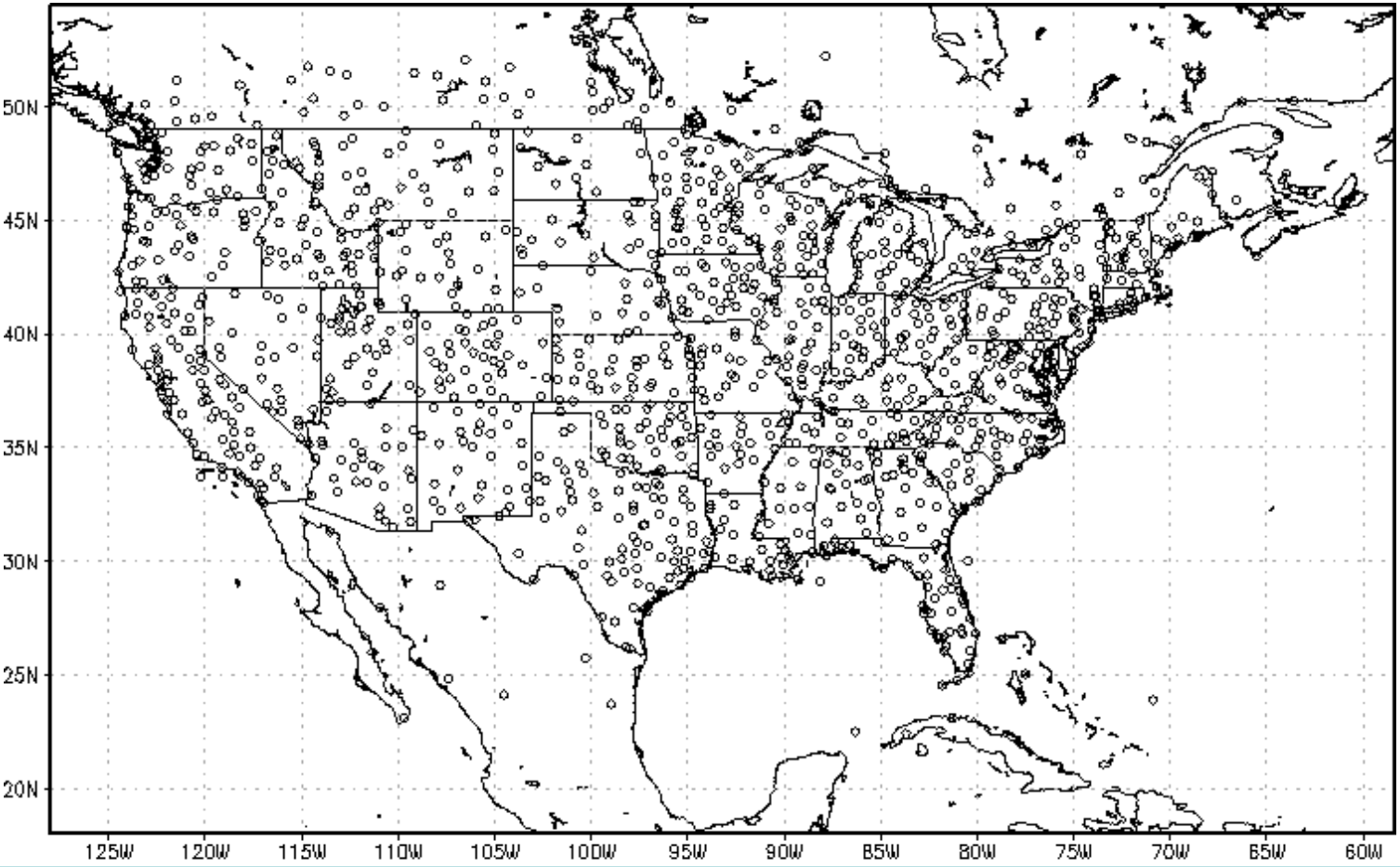
CONUS 2.5km RTMA / CROSS-VALIDATION



Map of all T-obs used for the 15Z 20 November 2009 Analysis

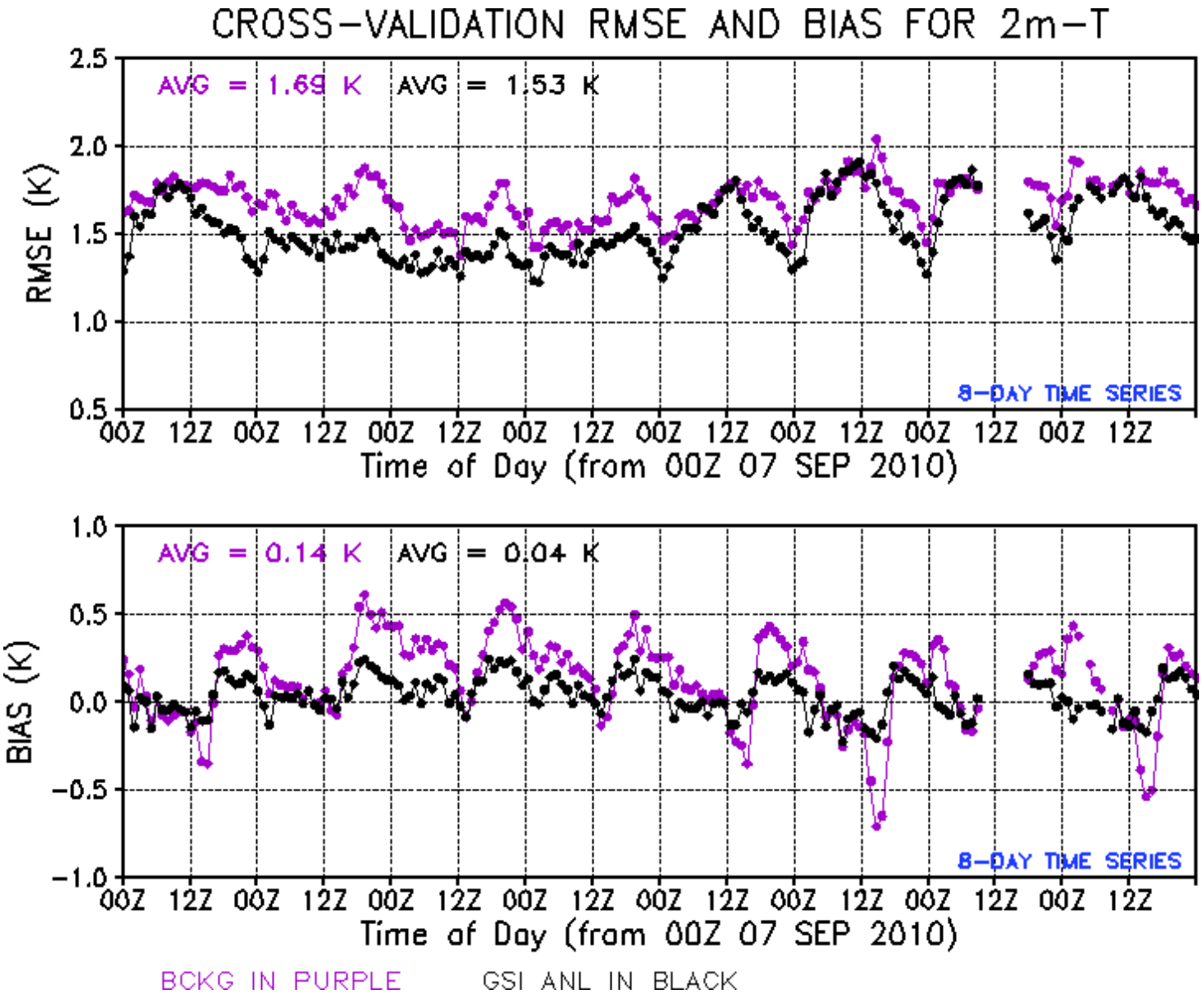
Out of this map, generate sets of disjoint validation datasets to use for cross-validation. Randomly select one set as the cross-validation set for each analysis hour. In constructing the validation datasets, try to avoid the redundancy implied by pairs of obs lying too close to each other. This is done for each ob type (T, Q, W, Ps).

CONUS 2.5km RTMA / CROSS-VALIDATION SET #5

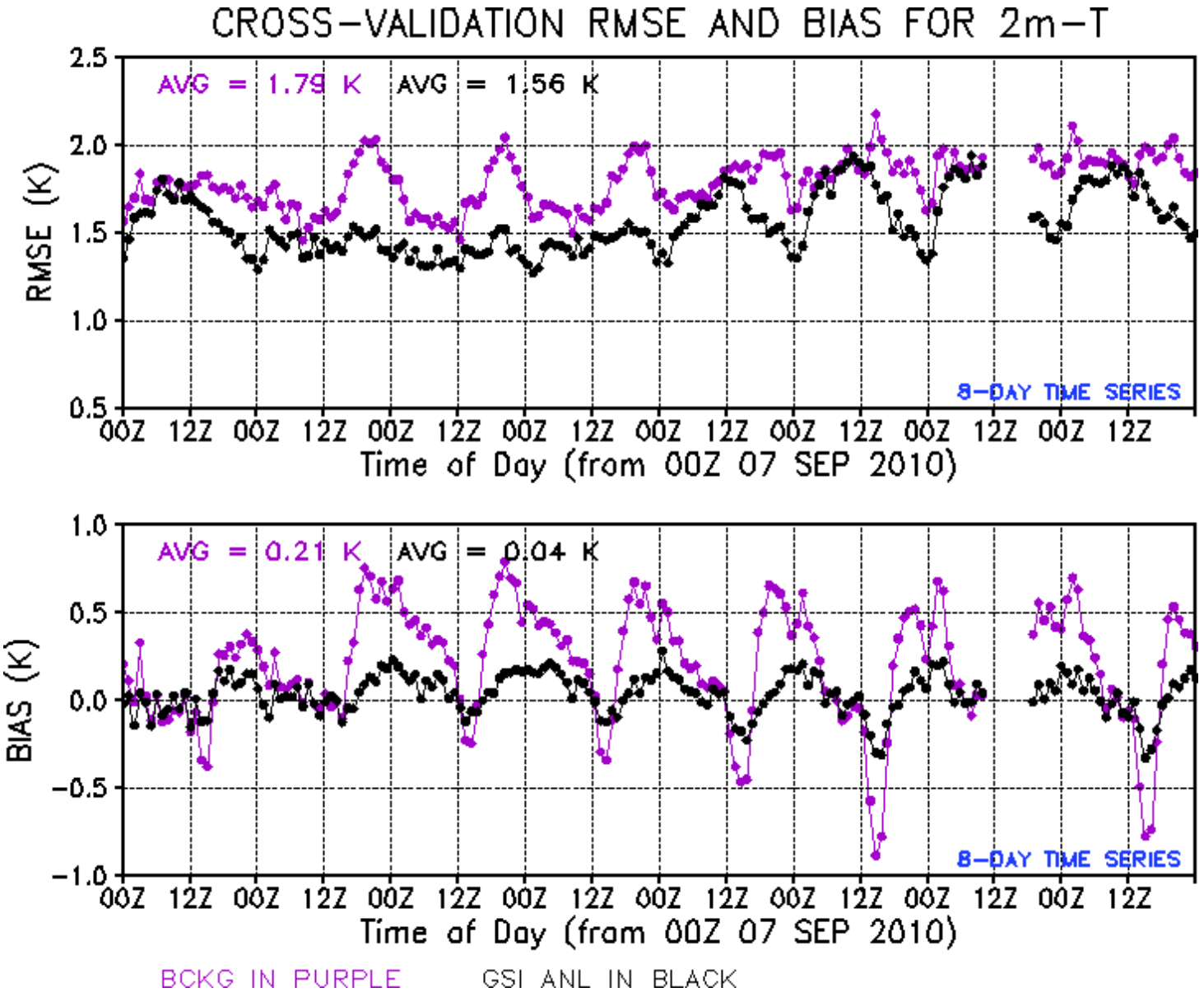


Example of a cross-validation dataset. This is set number 5 of a total of 5 sets , each containing approximately 10% of the data. Note that, in order to avoid pairs of obs that are too close together, some of the obs must be left out from the construction of the disjoint datasets. This explains why each of the 5 (and not 10) datasets contains approximately 10% of the data

CONUS 2.5km RTMA / CROSS-VALIDATION

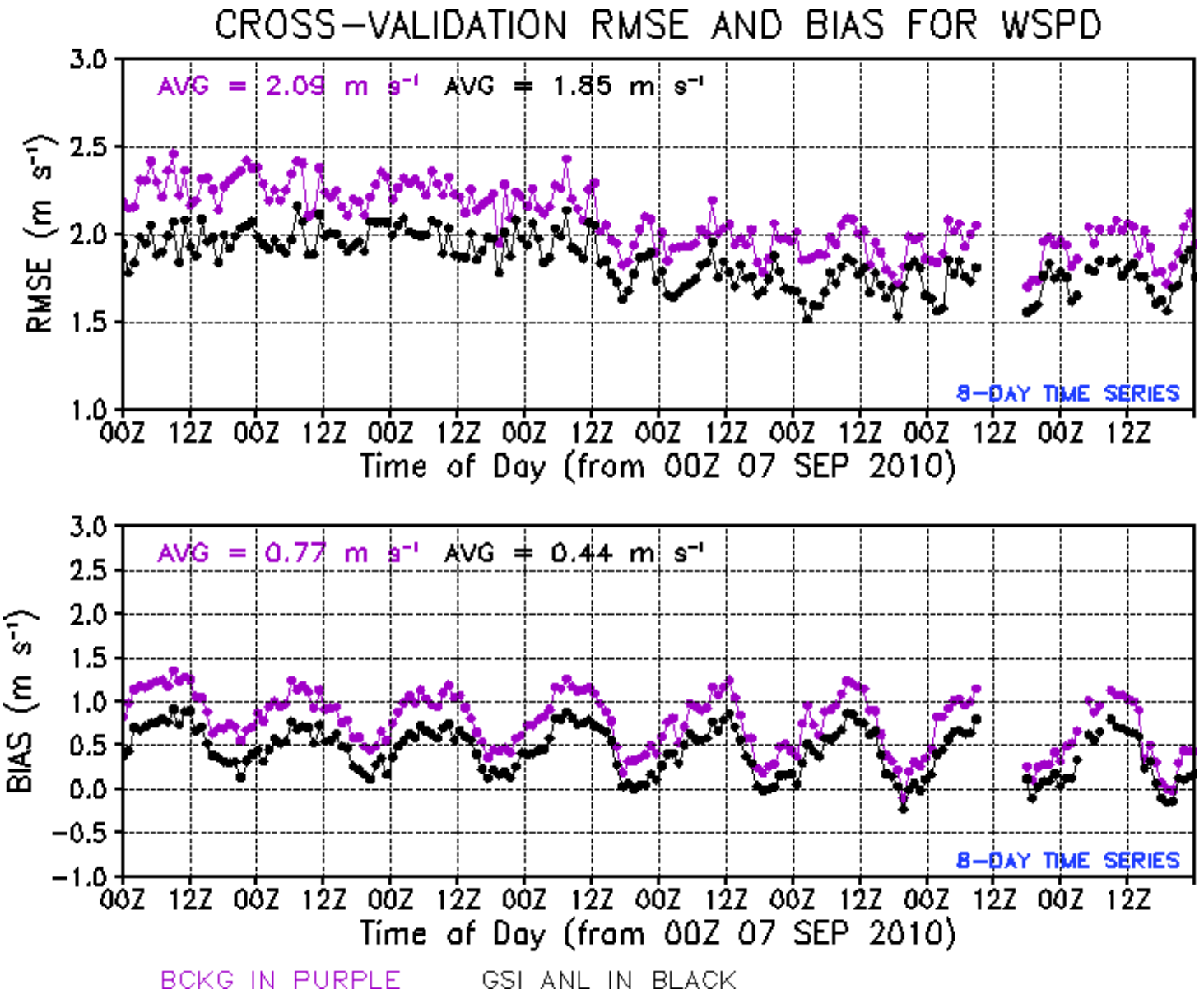


CONUS 5km RTMA / CROSS-VALIDATION

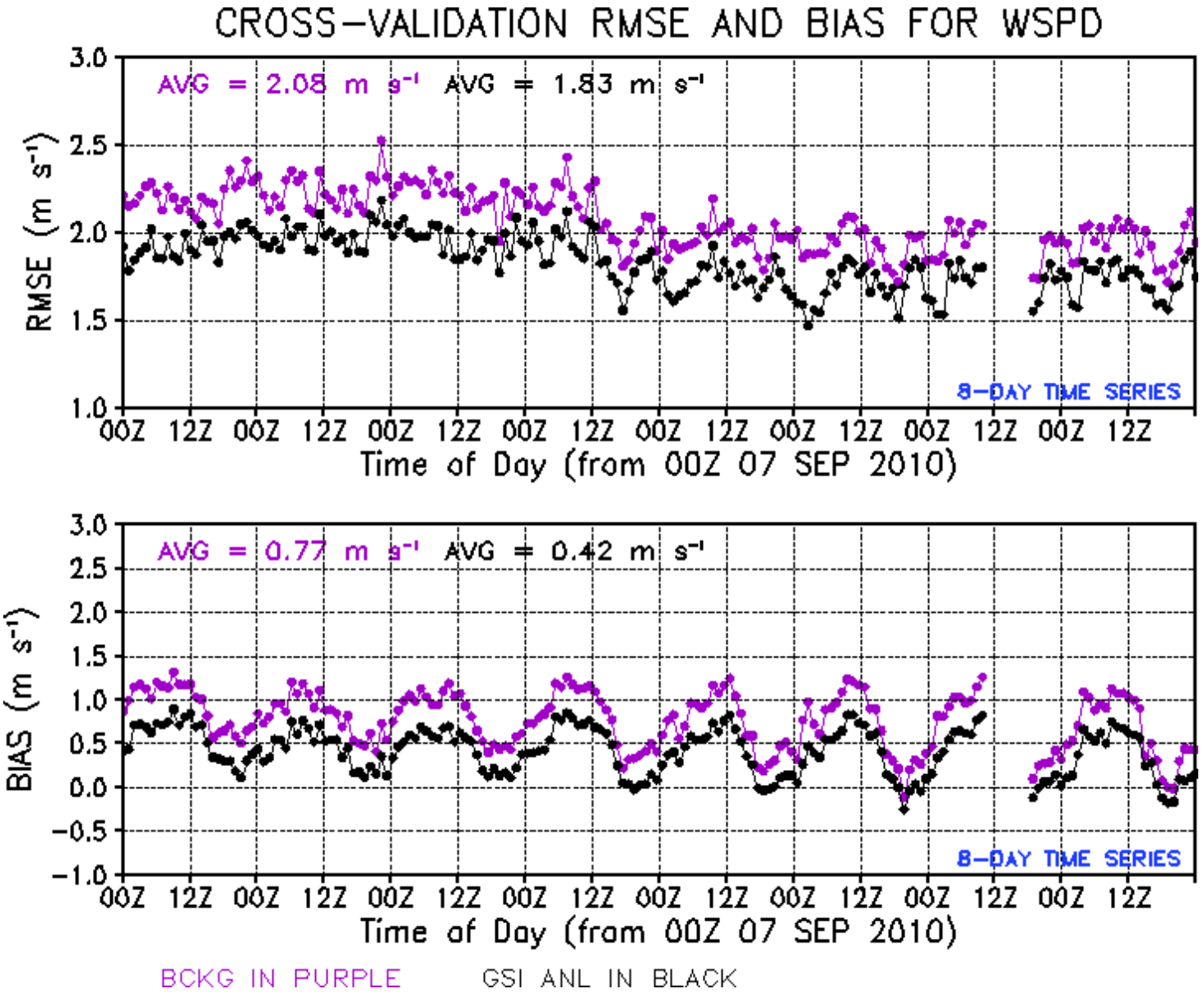


Global cross-validation stats for 2.5km and 5 km analyses are similar

CONUS 2.5km RTMA / CROSS-VALIDATION



CONUS 5km RTMA / CROSS-VALIDATION



Global cross-validation stats for 2.5km and 5 km analyses are similar

FINAL REMARKS

- CONUS 2.5 km-RTMA PARALLEL RUNNING CONSISTENTLY SINCE SEPTEMBER 2009

- RECEIVING CONTINUED FEEDBACK FROM FORECASTERS. THEY DOWNLOAD THE RTMA DATA FROM THE EMC PARALLEL AND ALSO LOOK AT THE EMC RTMA WEBSITE.

- MOST SYSTEM IMPROVEMENTS HAVE BEEN IN RESPONSE TO FEEDBACK FROM THE PARTIES WHO ACTUALLY USE THE RTMA PRODUCTS. CHANGES ARE DISCUSSED DURING THE Bi-WEEKLY RTMA TELECONFERENCES.

- WORK ON ADDING THE 2.5km CONUS RTMA FIELDS TO OPERATIONAL NOMADS ALSO CONCLUDED.

DOMAIN REALIGNMENT FOR HAWAII RTMA

HAWAII RTMA DOMAIN REALIGMENT

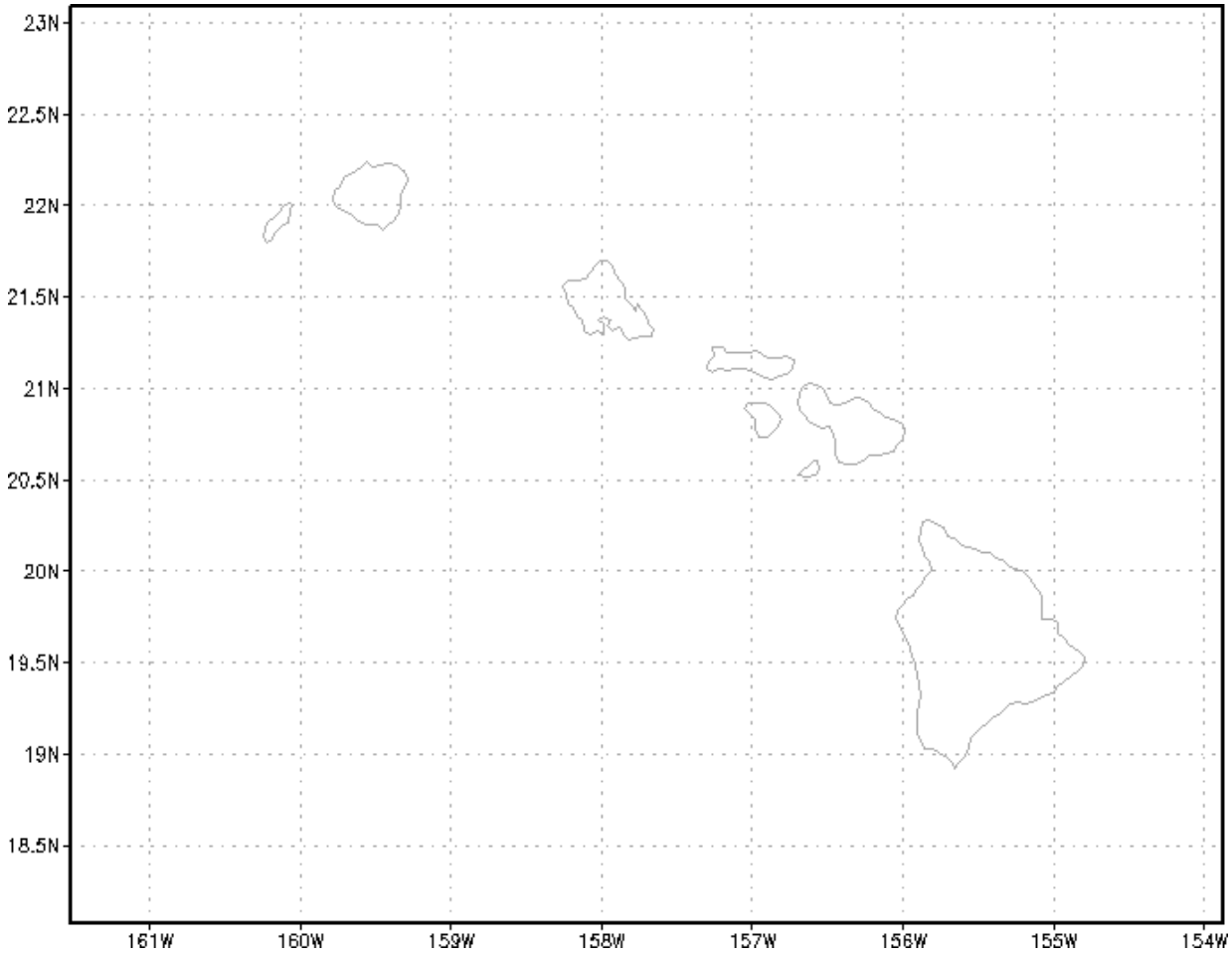
NWS/PACIFIC REGION REQUESTED CHANGES TO THE DOMAIN SPECIFICATION FOR HAWAII-RTMA AND THE NDFD.

CHANGES NEEDED IN ORDER TO ALIGN THE HAWAII GRID DOMAIN WITH THE NORTH PACIFIC NDFD GRID

THE CHANGES REPRESENT A VERY SMALL DOMAIN SHIFT:

	OLD DOMAIN	**NEW DOMAIN**
LOWER LEFT CORNER	LAT=18.06678 N	LAT=18.072699 N
	LON=198.374755 E	LON=198.474999 E
UPPER RIGHT CORNER	LAT=23.082000 N	LAT=23.087799N
	LON=206.031000 E	LON=206.130999 E

THE NEW HAWAII-RTMA DOMAIN

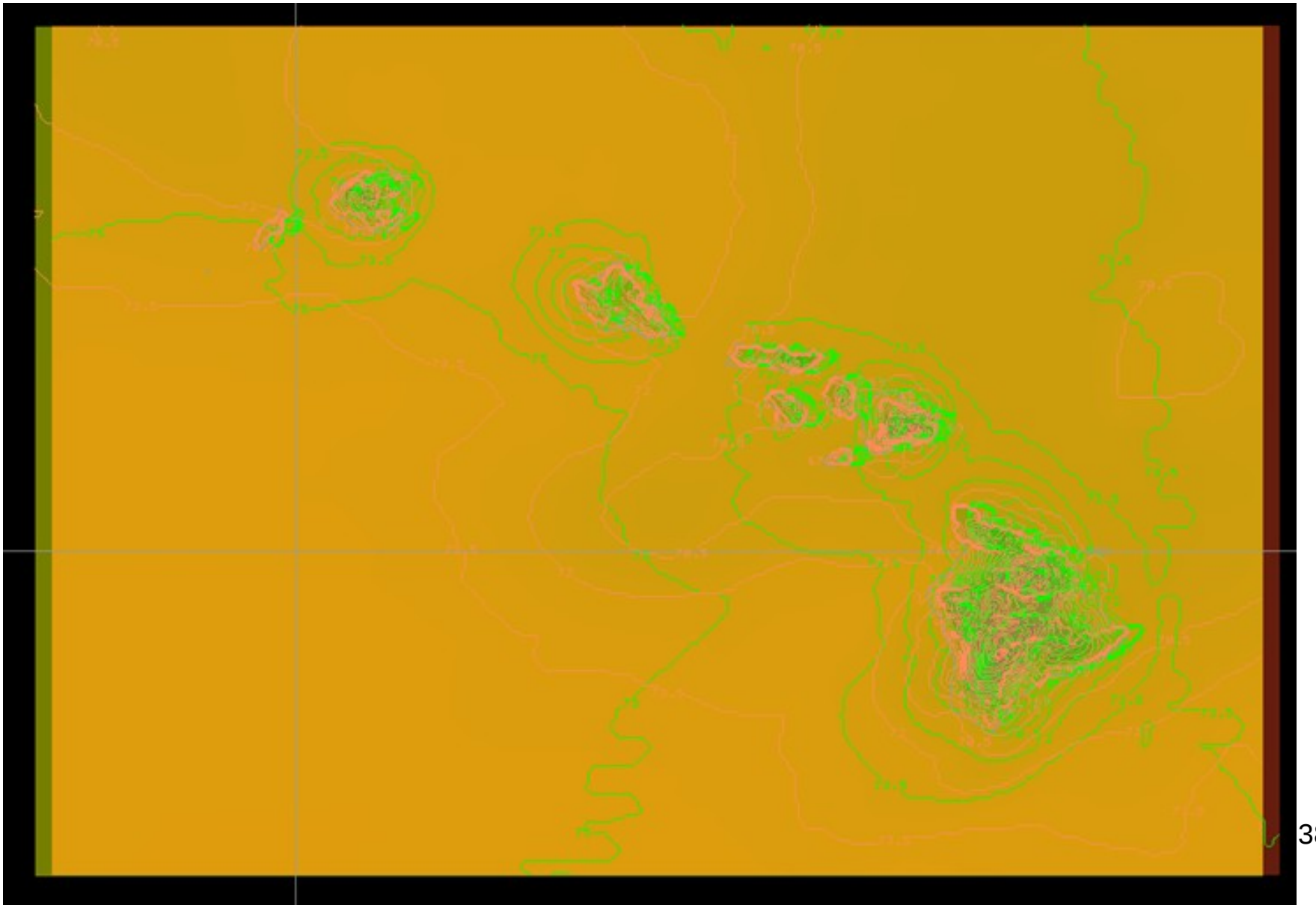


Lower left corner: DLAT=0.005919 deg DLON=0.100244 deg

Uppper right corner DLAT=0.00579 deg DLON=0.099999 deg

Hawaii Grid Shift

Ignoring the contours, the green part is in the old HI-NDFD domain, the red part is in the new and the orange part is the intersection of the two.



IMPLIED CHANGES:

- RTMA FIXED FILES
- RTMA POST
- LIBRARIES: CNVGRIB

FINAL REMARKS:

- THIS IS A VERY MINOR RTMA SYSTEM CHANGE.
- A SAMPLE ANALYSIS FILE WAS SUCCESSFULLY TESTED ON AWIPS