

# Ensemble Testing at the Developmental Testbed Center (DTC)

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# 2013 Activities Summary

- SREF configuration experiments (ARW and NMMB subsets)
  - horizontal grid spacing (16 vs. 9km)
  - changes in microphysics (Ferrier, WSM6 and Thompson)
- Field Alignment Technique
  - DTC Visitor Program, Dr. Sai Ravela, MIT

# SREF Experiments



# SREF Testing

- NCEP SREF code used – system replicated on NOAA supercomputer Zeus
- 7 ARW Members first (7 NMMB Members added later)
- Control, 3 positive perturbations, 3 negative perturbations

Runs		
1. SREF 16km Standard Physics	2. SREF 16km Microphysics Perturbations	3. SREF 9km Standard Physics

- May 1-31, 2013
- Evaluation Variables: Temperature, Height, Relative Humidity, Wind and 3-hr accumulated precipitation
- Observation sources: PrepBufr (surface and upper air), Stage IV precipitation

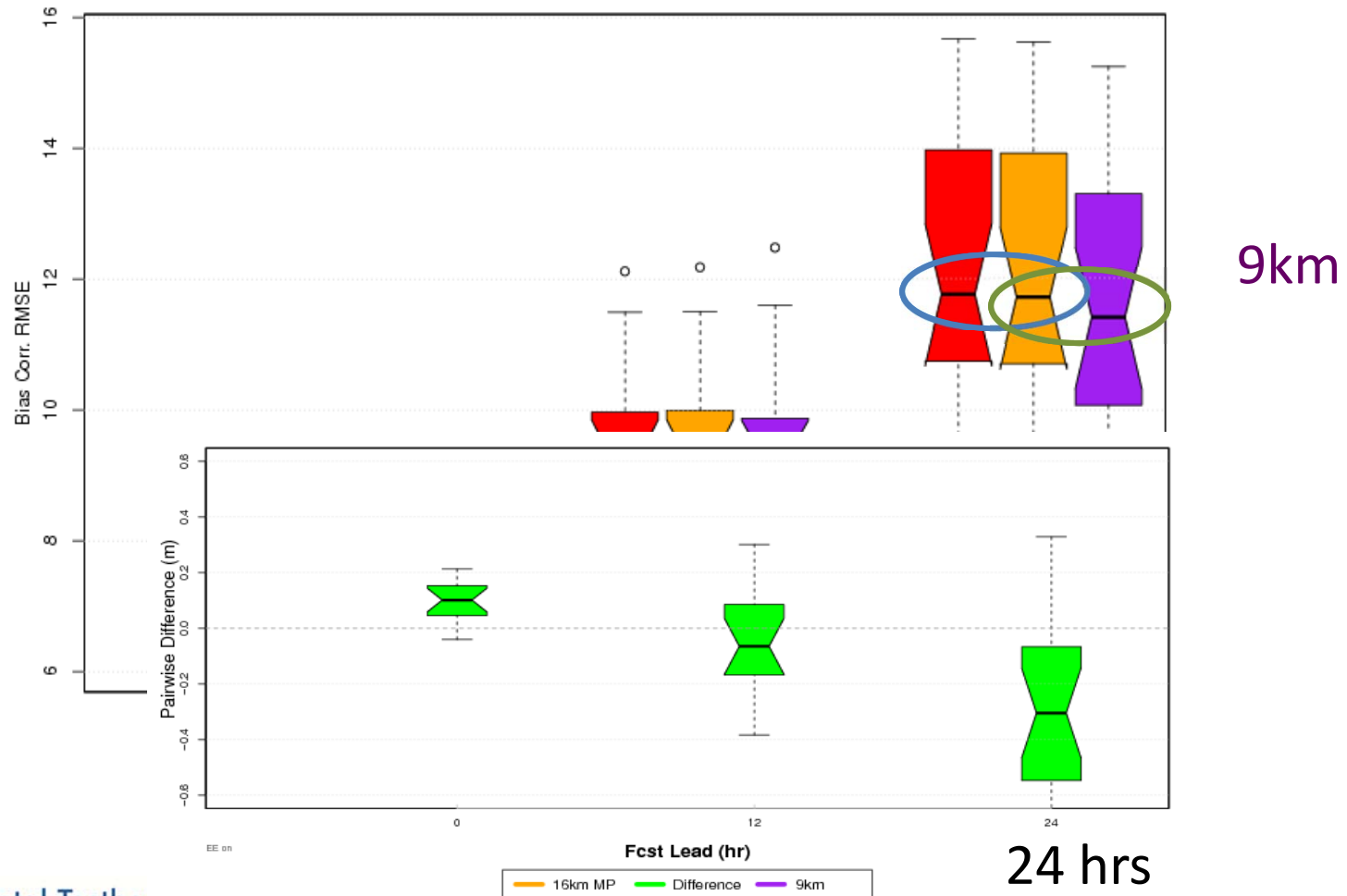
# RMSE after time mean error removed

500mb Height

24hr forecasts from 00UTC

SREF Ensemble Mean, Sept. 01-31, 2013, against PREPBUFR data

500 mb HGT - BCRMSE



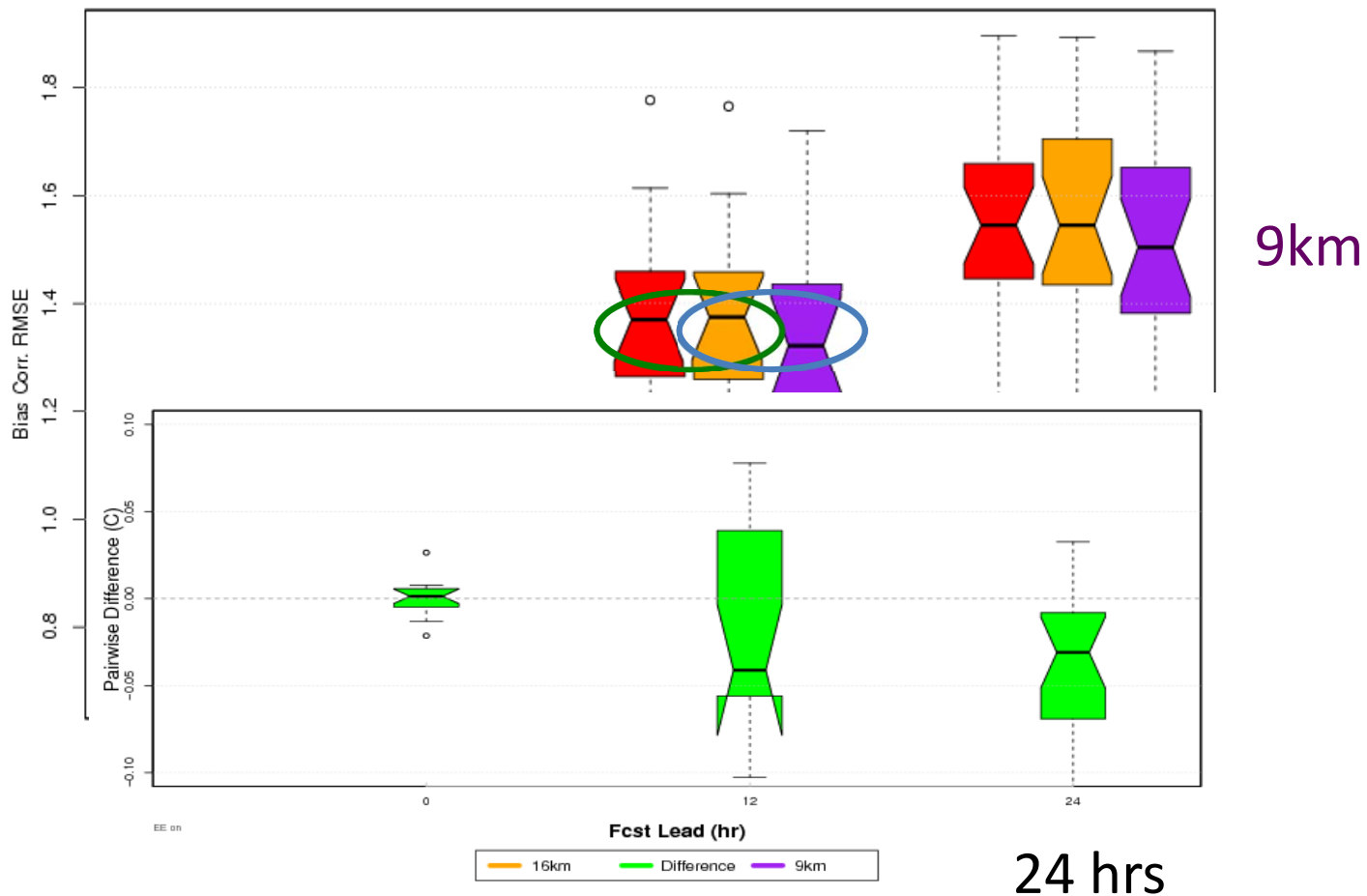
# RMSE after time mean error removed

## 850 mb Temp

24hr forecasts from 00UTC

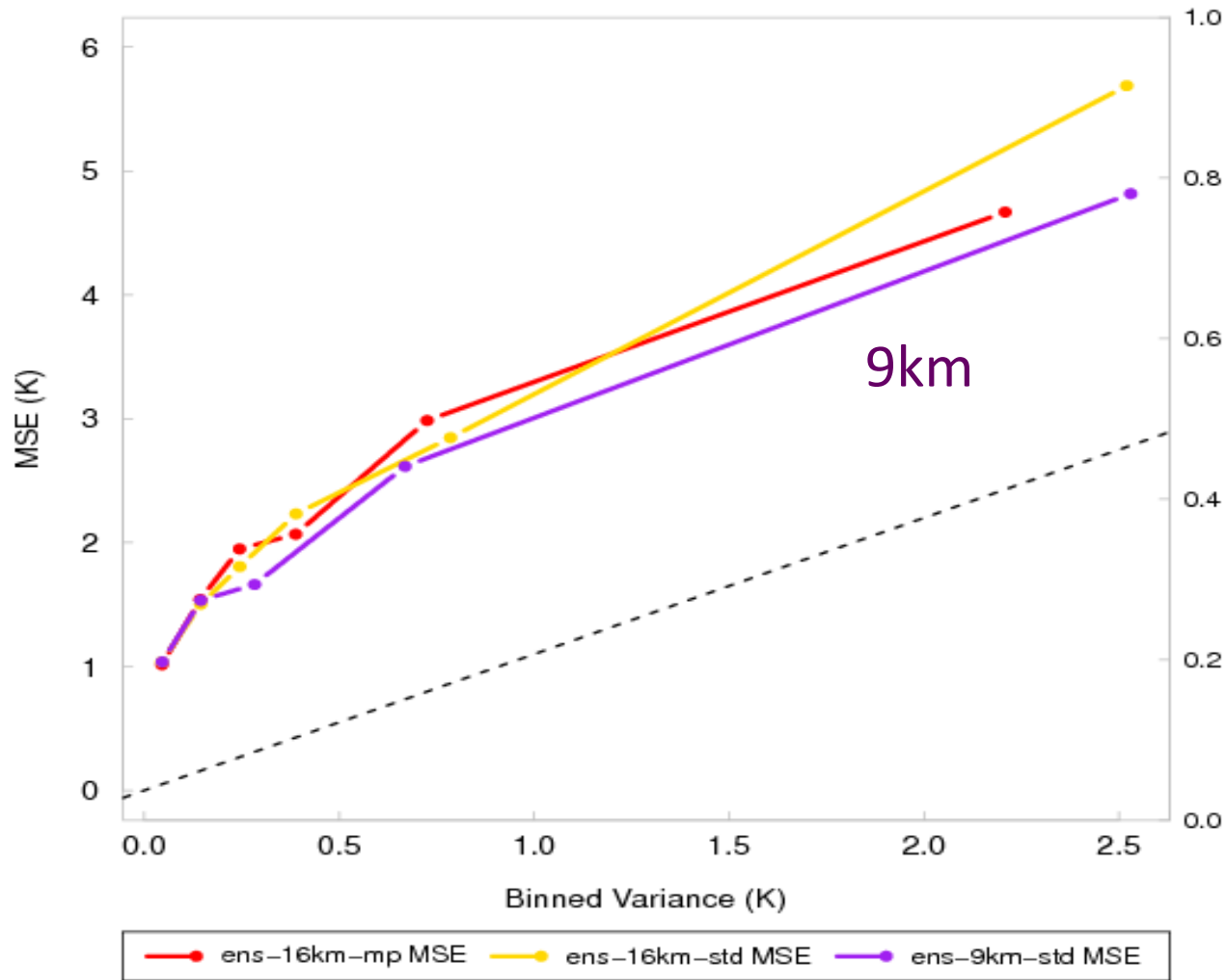
SREF Ensemble Mean, Sept. 01-31, 2013, against PREPBUFR data

850 mb TMP - BCRMSE



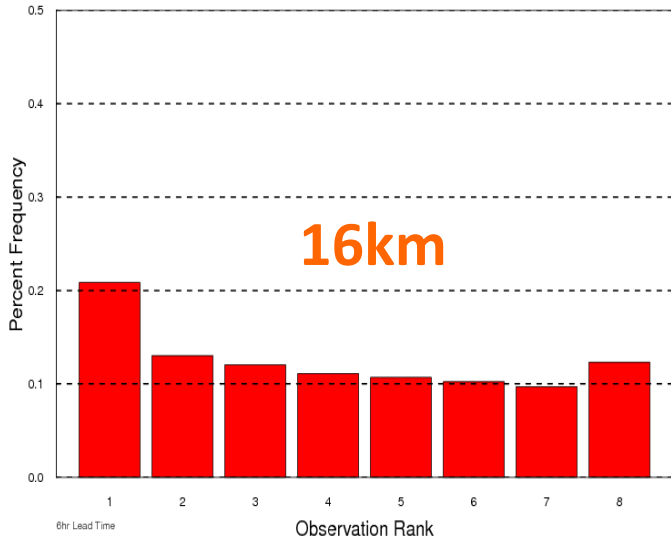
# 850mb Spread/Skill

Spread Skill for SREF ARW Members – 850mb TMP



# Accum Precip Results

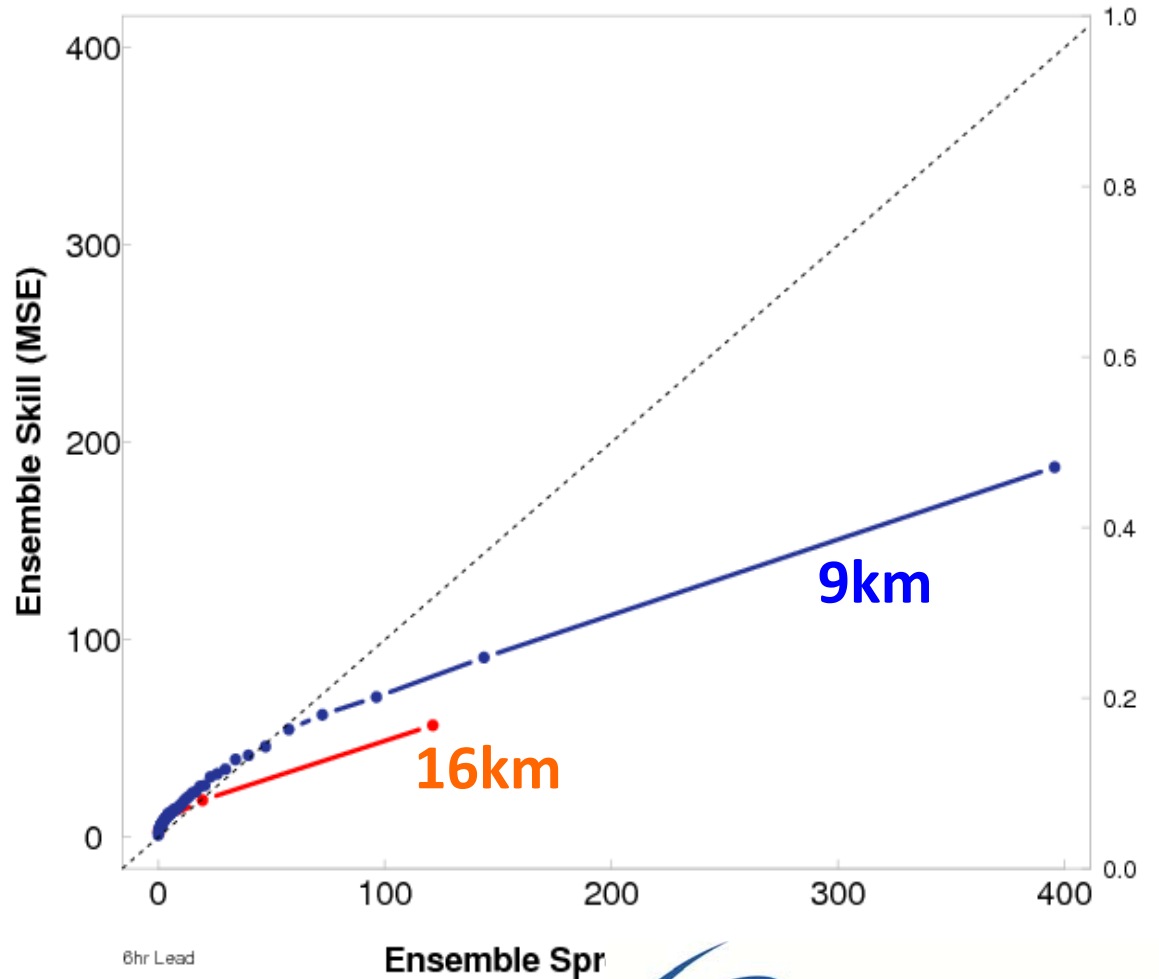
Rank Histogram for 16km-Std - APCP 3hr Accumulation - F06



Rank Histogram for 9km-Std - APCP 3hr Accumulation - F06



Spread-Skill - APCP 3hr Accumulation - F06





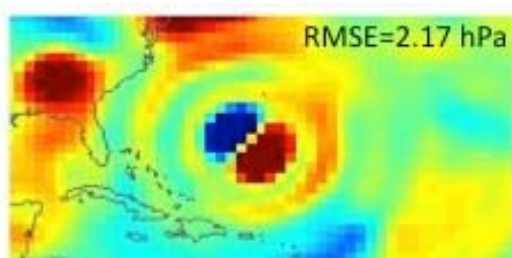
# Field Alignment

# DTC Visitor Support – Field Alignment Technique – Sai Ravela

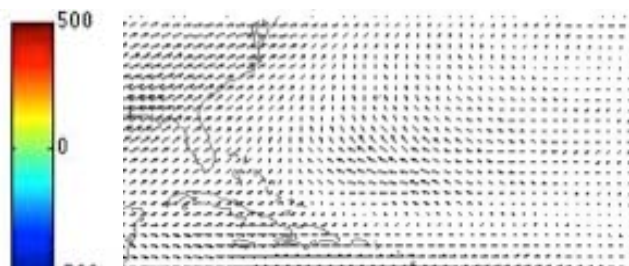
- Recommendation from 2<sup>nd</sup> Ensemble User Workshop
- Tested for separating amplitude & displacement components of forecast error
- Code has been made available to the community

# Field Alignment Technique Examples

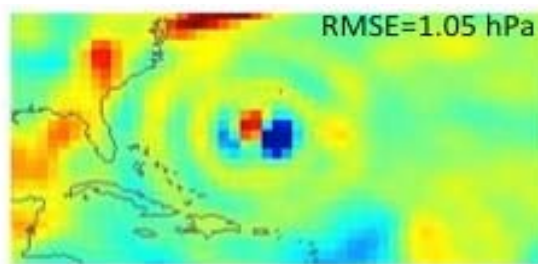
**Error decomposition, Hurricane Katia example, Sept. 6 2011, GEFS unperturbed member 12 hr Forecast, initialized at 00UTC**



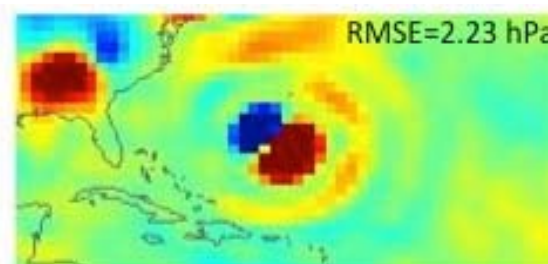
Total Error



Displacement Vector



Amplitude Error



Change between the original and the "aligned" forecasts

Total Error 2.17 mb

Amplitude Error 1.05 mb

Displacement Error 1.12 mb

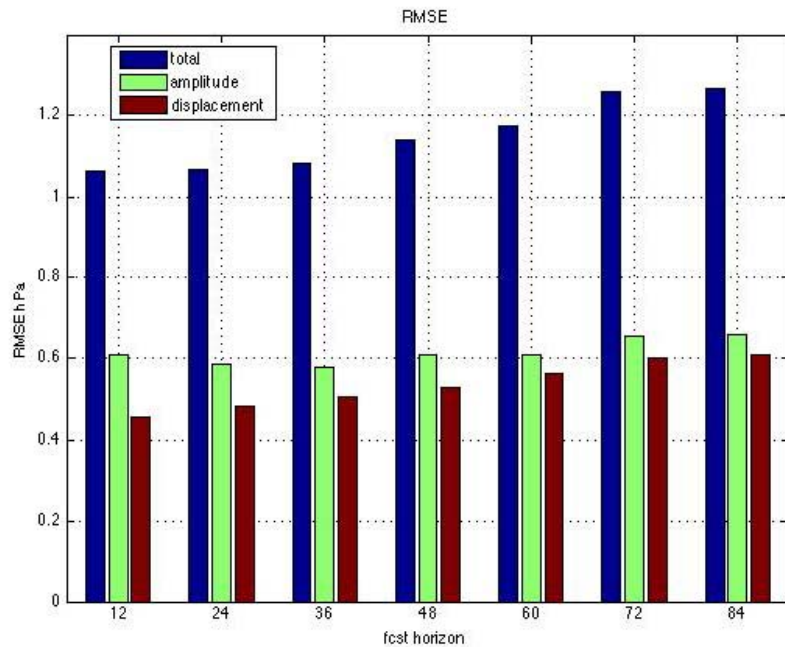


Developmental Testbed Center

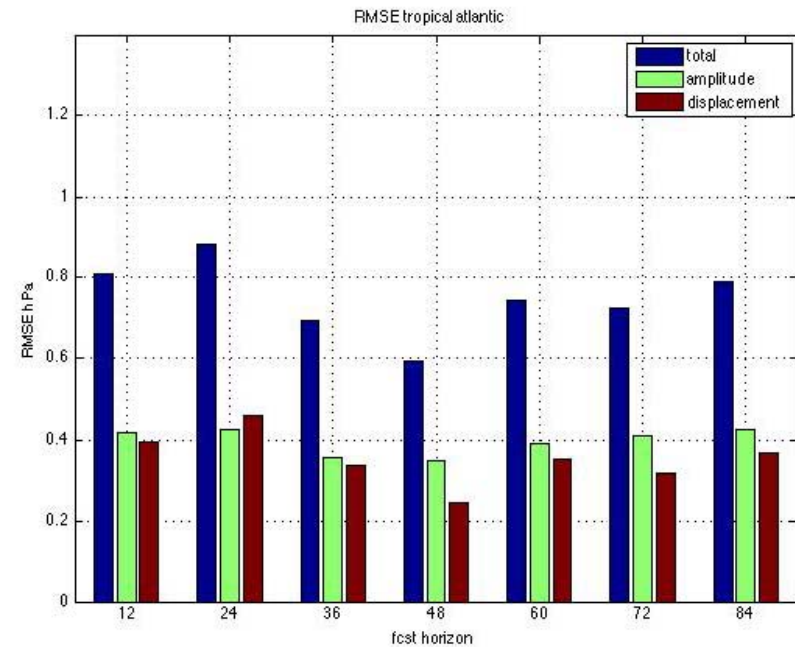
*Courtesy of Scott Gregory*

# Field Alignment Technique Examples

## Error decomposition with lead times for Sept 2011 GEFS unperturbed member forecasts



global domain



regional domain

# ENSEMBLE FUNCTIONALITIES

List of centrally/locally/interactively generated products required by NCEP Service Centers for each functionality are provided in attached tables (eg., *MSLP, Z,T,U,V,RH, etc, at 925,850,700,500, 400, 300, 250, 100, etc hPa*)

	FUNCTIONALITY	CENTRALLY GENERATED	LOCALLY GENERATED	INTERACTIVE ACCESS
1	Mean of selected members <i>Done</i>			
2	Spread of selected members <i>Done</i>			
3	Median of selected values <i>Done Sept. 2005</i>			
4	Lowest value in selected members <i>Done Sept. 2005</i>			
5	Highest value in selected members <i>Done Sept. 2005</i>			
6	Range between lowest and highest values <i>Done Sept. 2005</i>			
7	Univariate exceedance probabilities for a selectable threshold value <i>Done, Dec 05</i>			
8	Multivariate (up to 5) exceedance probabilities for a selectable threshold value <i>Done, Dec 05</i>			
9	Forecast value associated with selected univariate percentile value <i>Done Sept. 2005</i>			
10	Tracking center of maxima or minima in a gridded field (eg – low pressure centers) <i>Done Sept. 2005</i>			
11	Objective grouping of members <i>TBS for AWIPS2</i>			
12	Plot Frequency / Fitted probability density function at selected location/time (lower priority) <i>Basic function done; Interactive version to be scheduled for AWIPS2 (TBS)</i>			
13	Plot Frequency / Fitted probability density as a function of forecast lead time, at selected location (lower priority) <i>Basic function done; Interactive version TBS</i>			
14	Spaghetti (ability to interactively change contour/domain etc) <i>Basic function done; Interactive version TBS</i>			

2ND ENSEMBLE USER WORKSHOP RECOMMENDATIONS - May 18-20 2004

### **Additional basic GUI functionalities:**

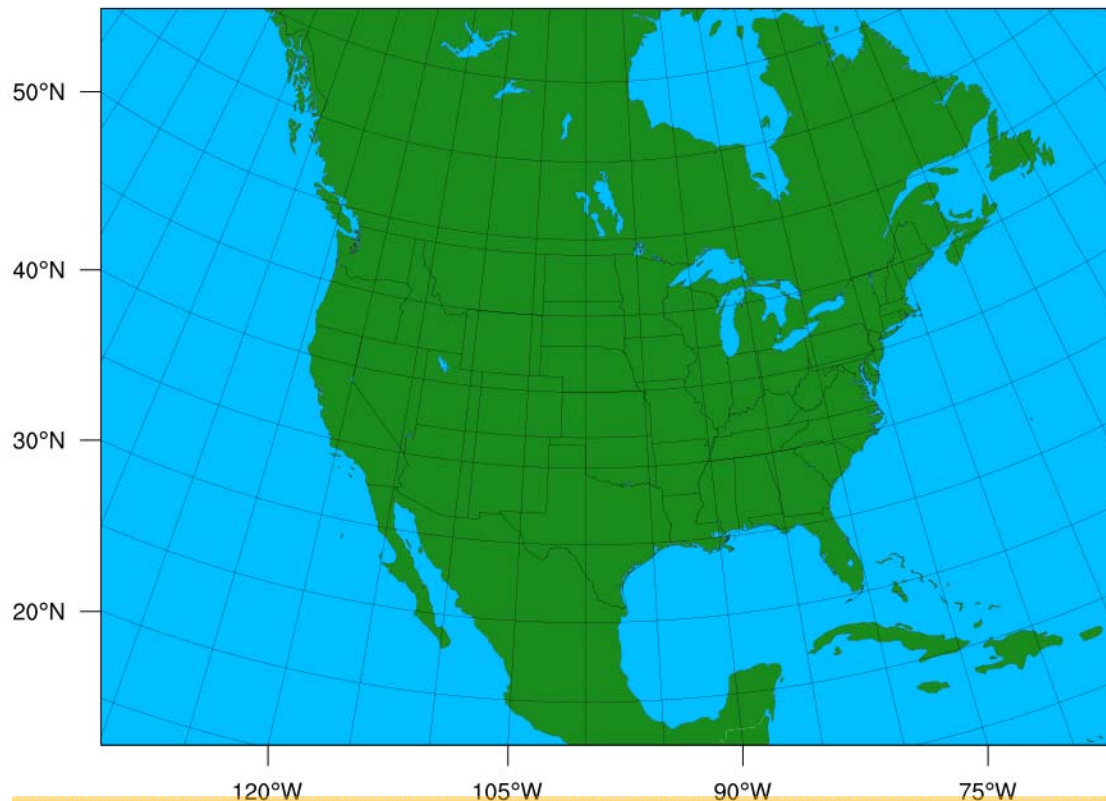
- Ability to manually select/identify members *Done*
- Ability to weight selected members *Done, Sept. 05*

### **Potentially useful functionalities that need further development:**

- Mean/Spread/Median/Ranges for amplitude of specific features *(TBS)*
- Mean/Spread/Median/Ranges for phase of specific features *(TBS)*

# Experimental Regional Ensemble Forecast (ExREF)

- NOAA ESRL/GSD has run an ensemble for HMT-W for various years
- Since the 2012-2013 winter, the domain became North American



- Community resource for **development & testing** of new ensemble techniques
- **9km res.**, configuration can change in response to partners needs
- On NOAA R&D machines - **non-operational**

*Distribution: STO WFO and RFC, WPC, Unidata THREDDS, and new...  
FirstEnergy Weather (private)*

- New position at CIRA / GSD
  - Ensemble forecasting research, development, testing
- CIRA position number 14-105
- <http://www.cira.colostate.edu/cira-employment>

**THANKS!!!**