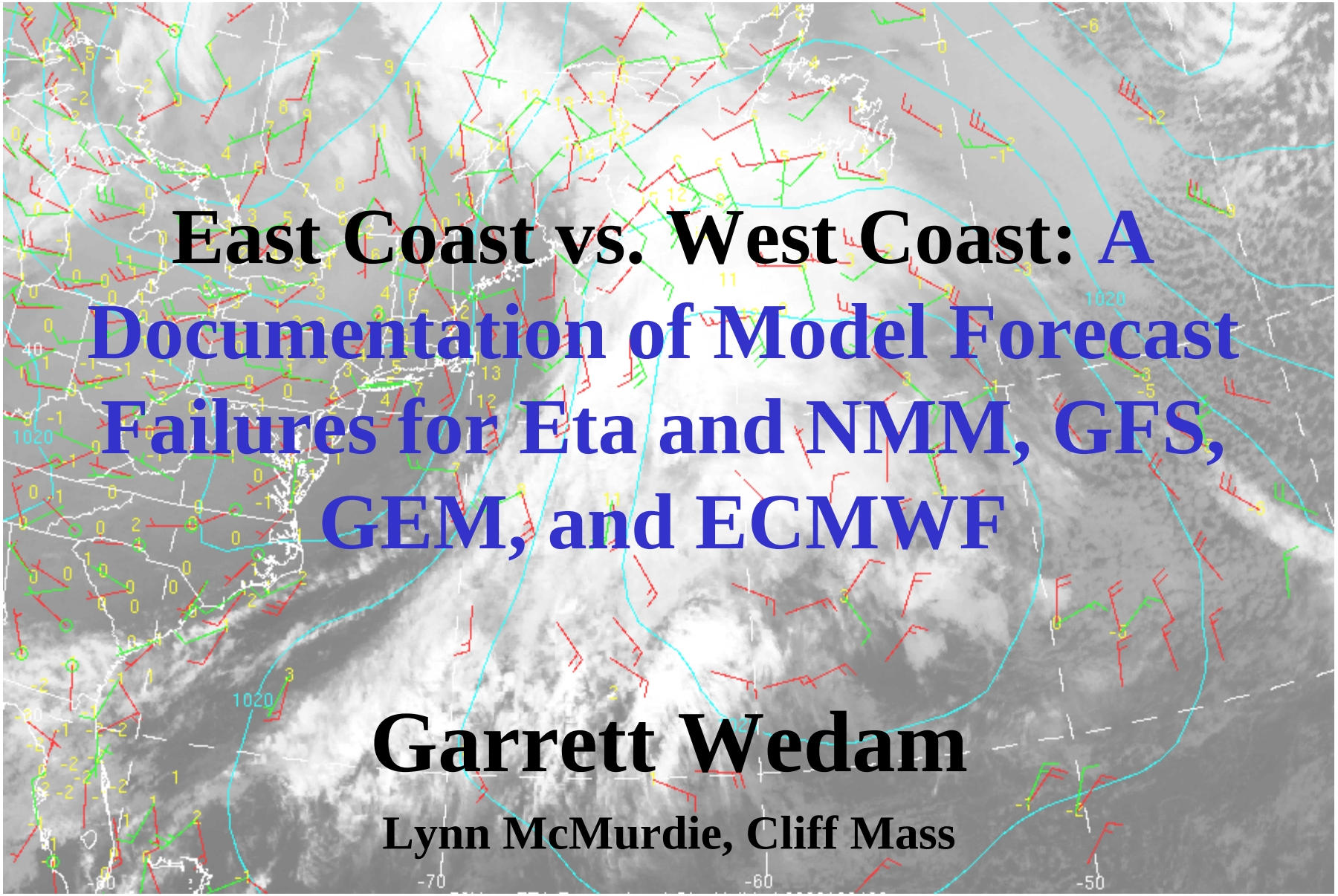
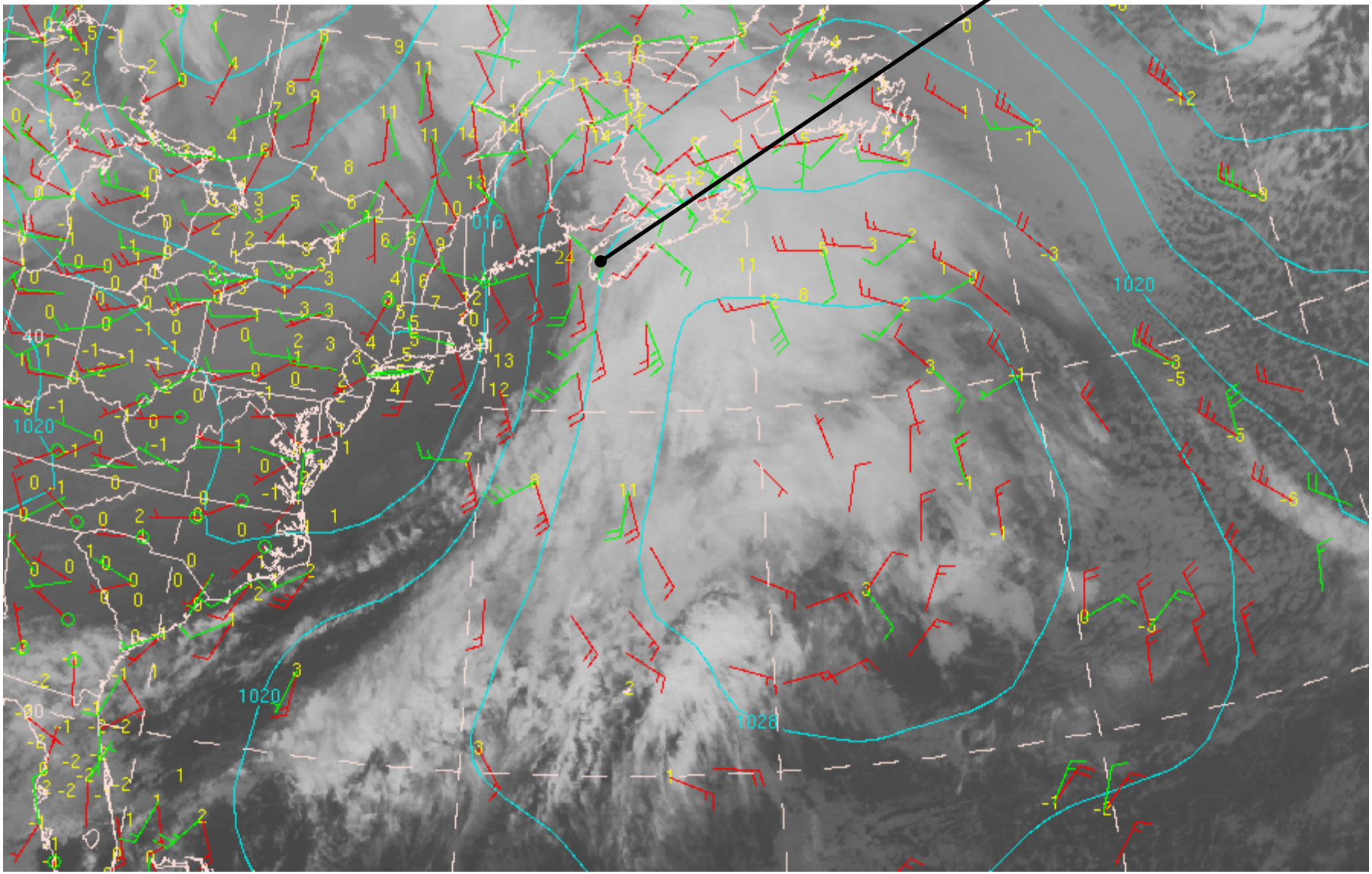


East Coast vs. West Coast: A Documentation of Model Forecast Failures for Eta and NMM, GFS, GEM, and ECMWF

Garrett Wedam

Lynn McMurdie, Cliff Mass

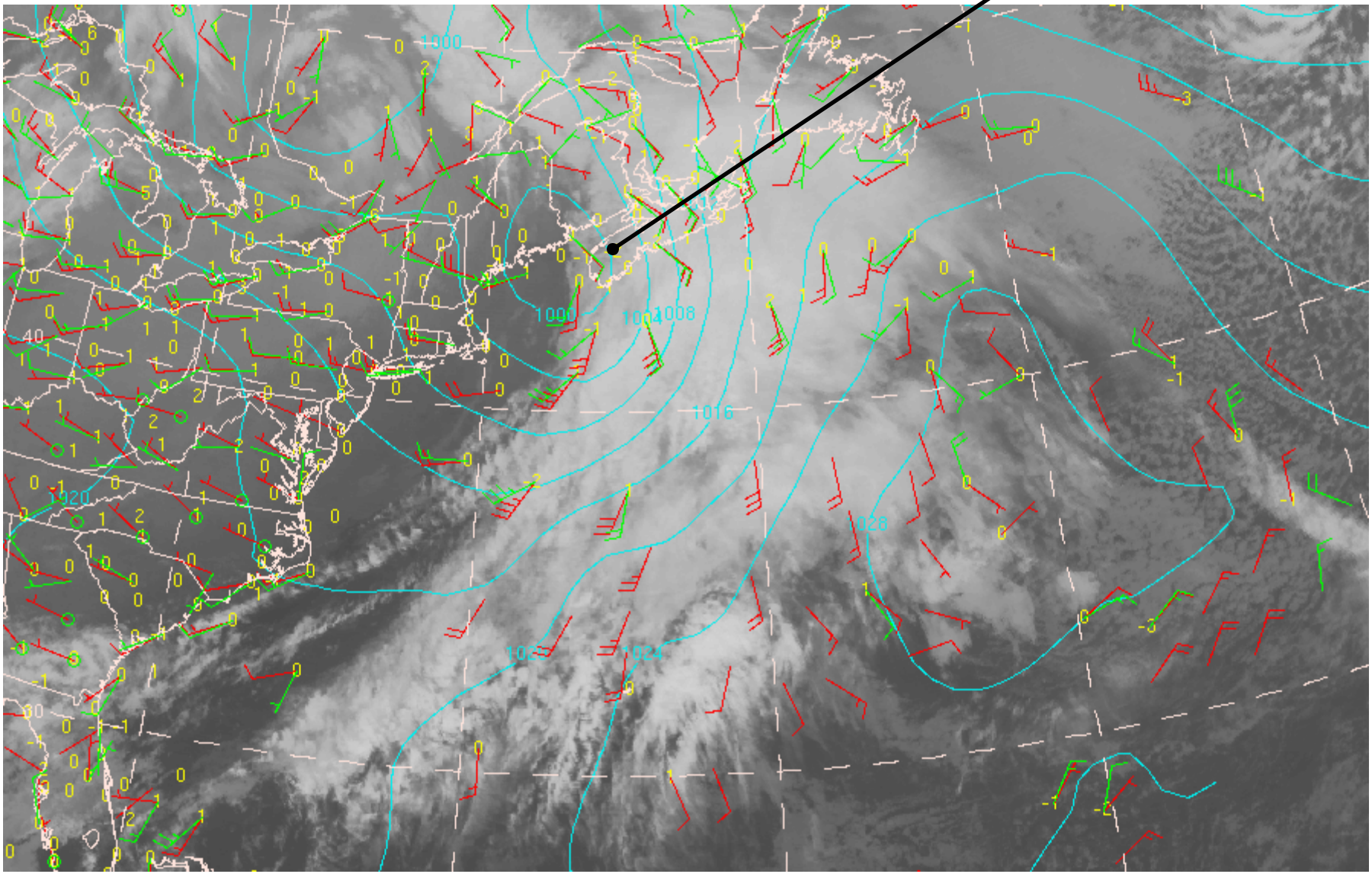
72-hour NAM Forecast: Ridging



72-hr NAM forecast with Obs verification

Valid Dec 24, 2006

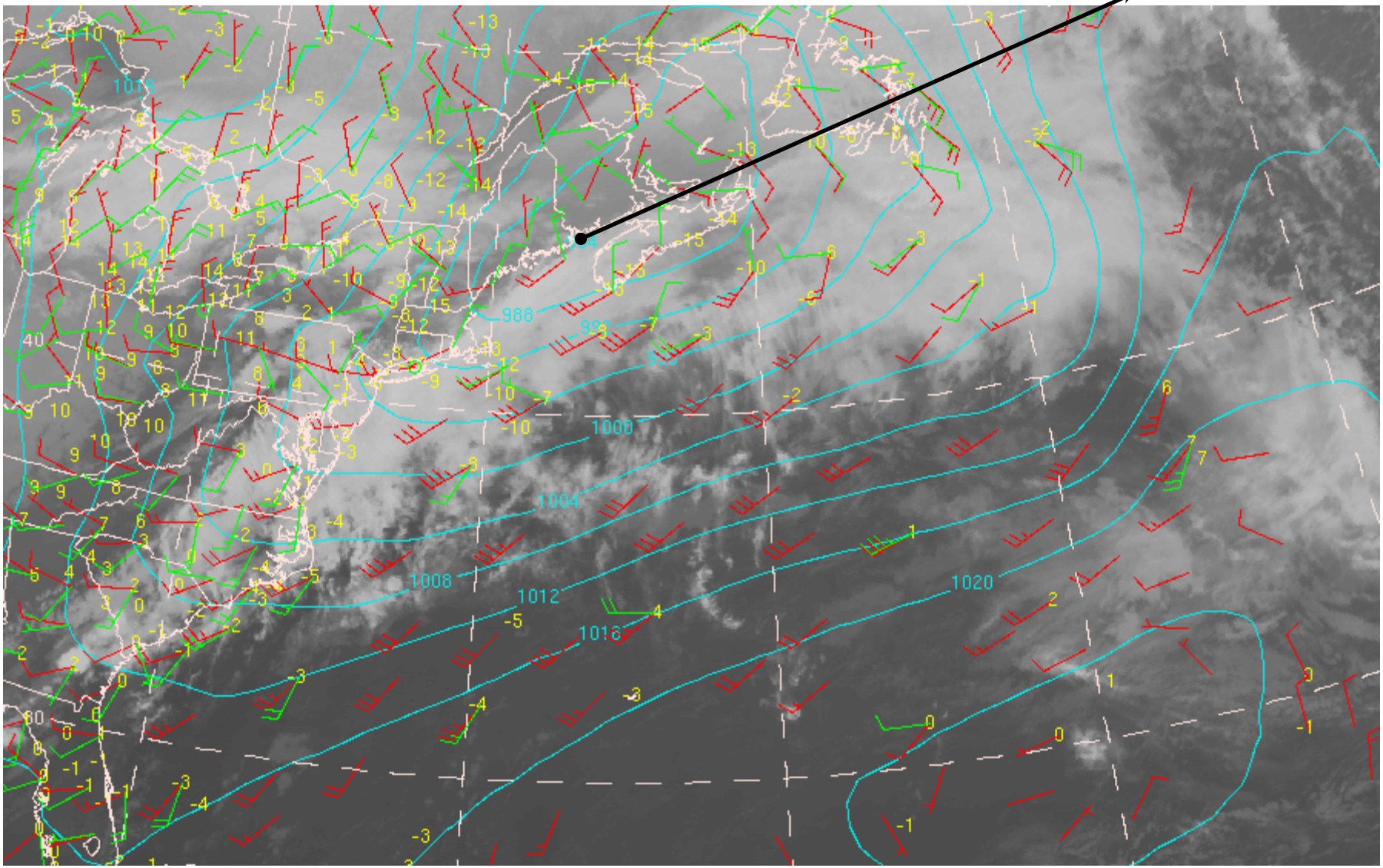
72-hour Reality: Low Center



00-hr NAM analysis and obs verification

Dec 24, 2006

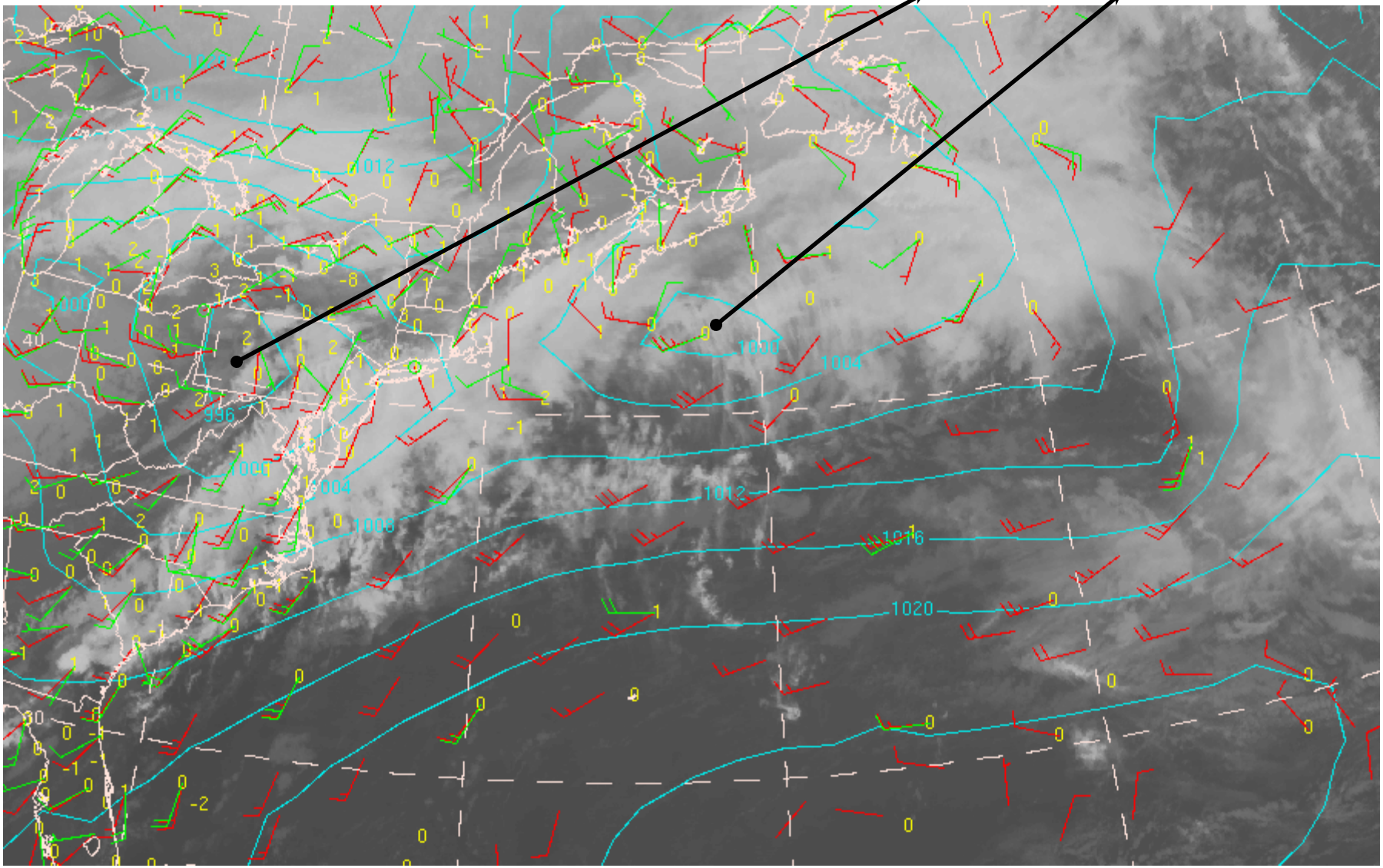
72-hour Forecast: One Deeper Low Center



72-hr CMC-GEM forecast with Obs verification

Valid Feb 07 00Z

72-hour Reality: Two Low Centers 995 and 999 mb Lows

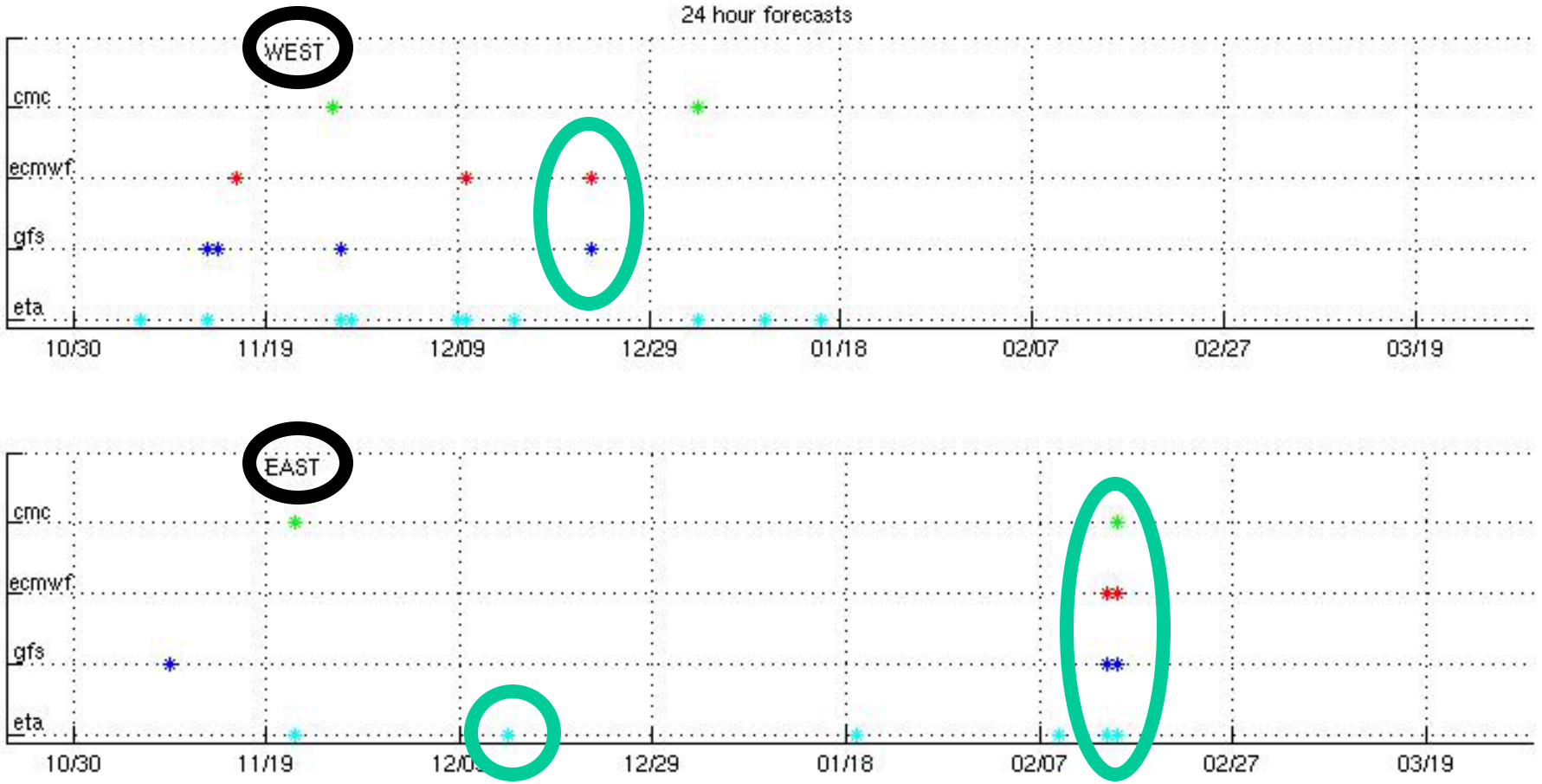


Analysis and Obs verification Feb 07 00Z

On the Horizon

Dates of Large Forecast Errors (by model)

Errors greater than 5 mb



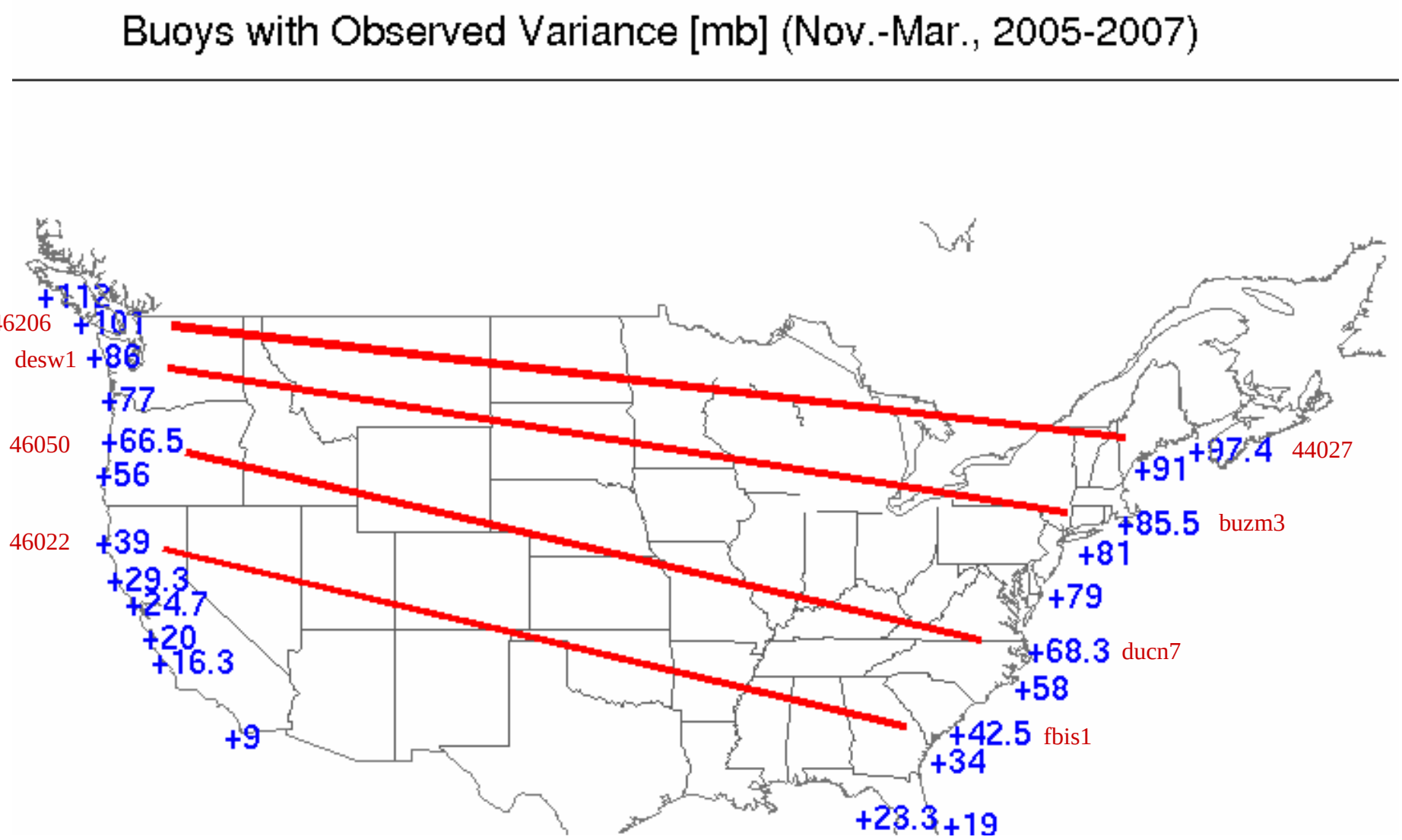
Motivation

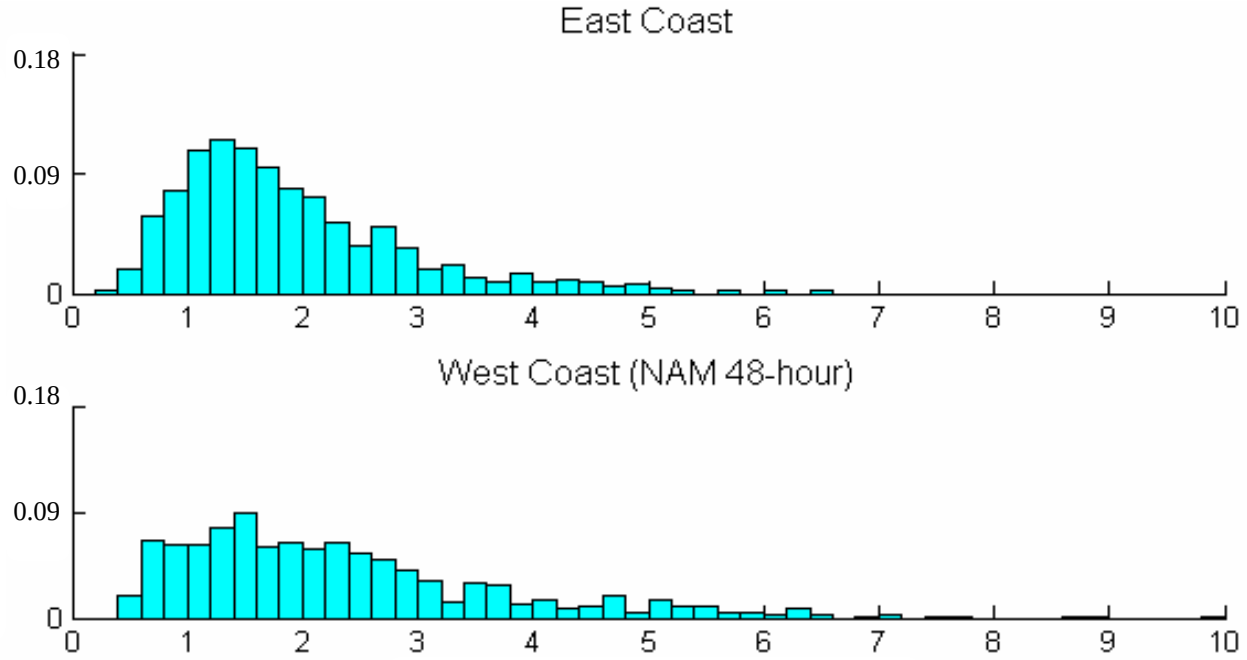
- **Previous studies have shown large West Coast forecast errors of the ETA model (McMurdie and Mass, 2004), and large errors associated with specific weather phenomena (i.e. Colle, 2004).**
- **How do models compare? It appears that when one "busts" they don't necessarily all; is one better than the rest?**
- **How do forecasts compare for different geographical regions?**
- **Some models have experienced major system updates. How has this affected performance?**
- **This study can provide a data set for examining predictability issues**

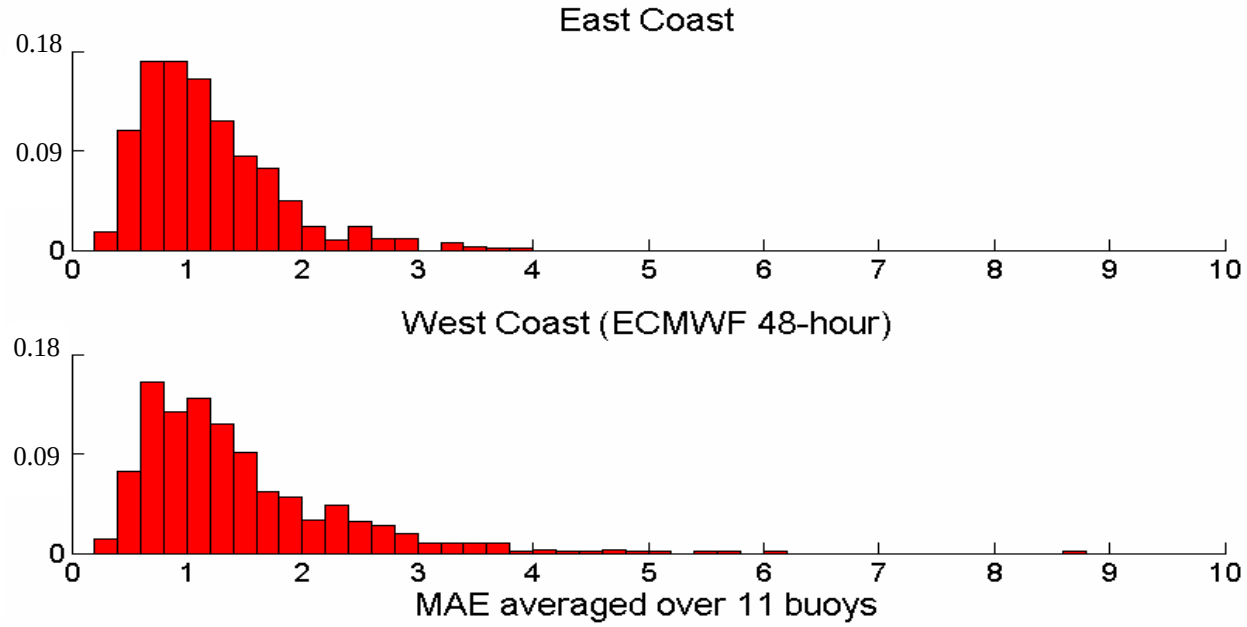
Method

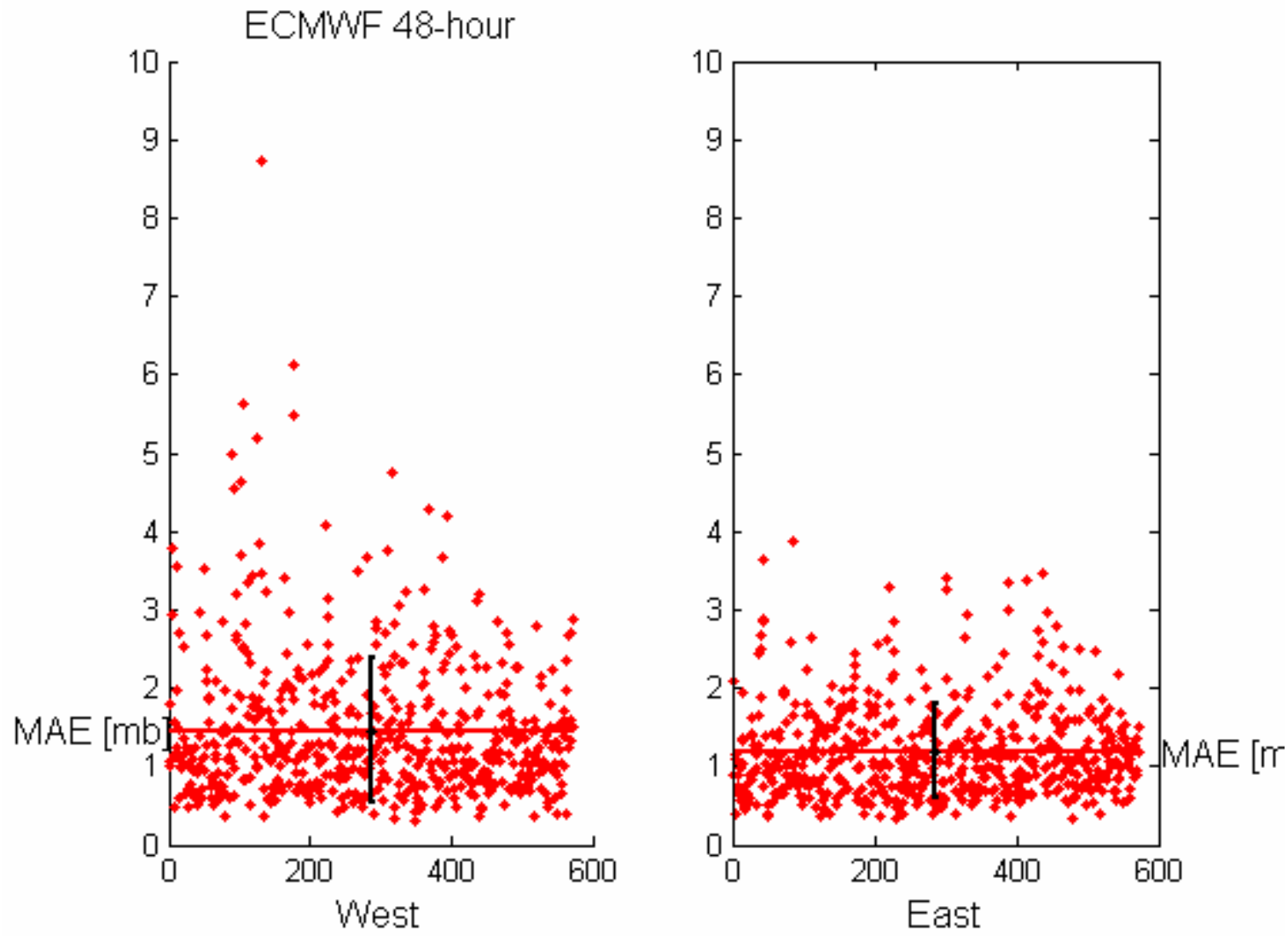
- Directly compare **observations** to interpolated model **forecasts**
- Limit study to the East and West Coasts
  - Buoys/CMANs eliminate terrain effects
  - Population centers
- Compare Sea Level Pressure errors
  - SLP is good indicator of model performance: is directly related to weather structures that extend above the surface
  - Insufficient offshore upper-level observations

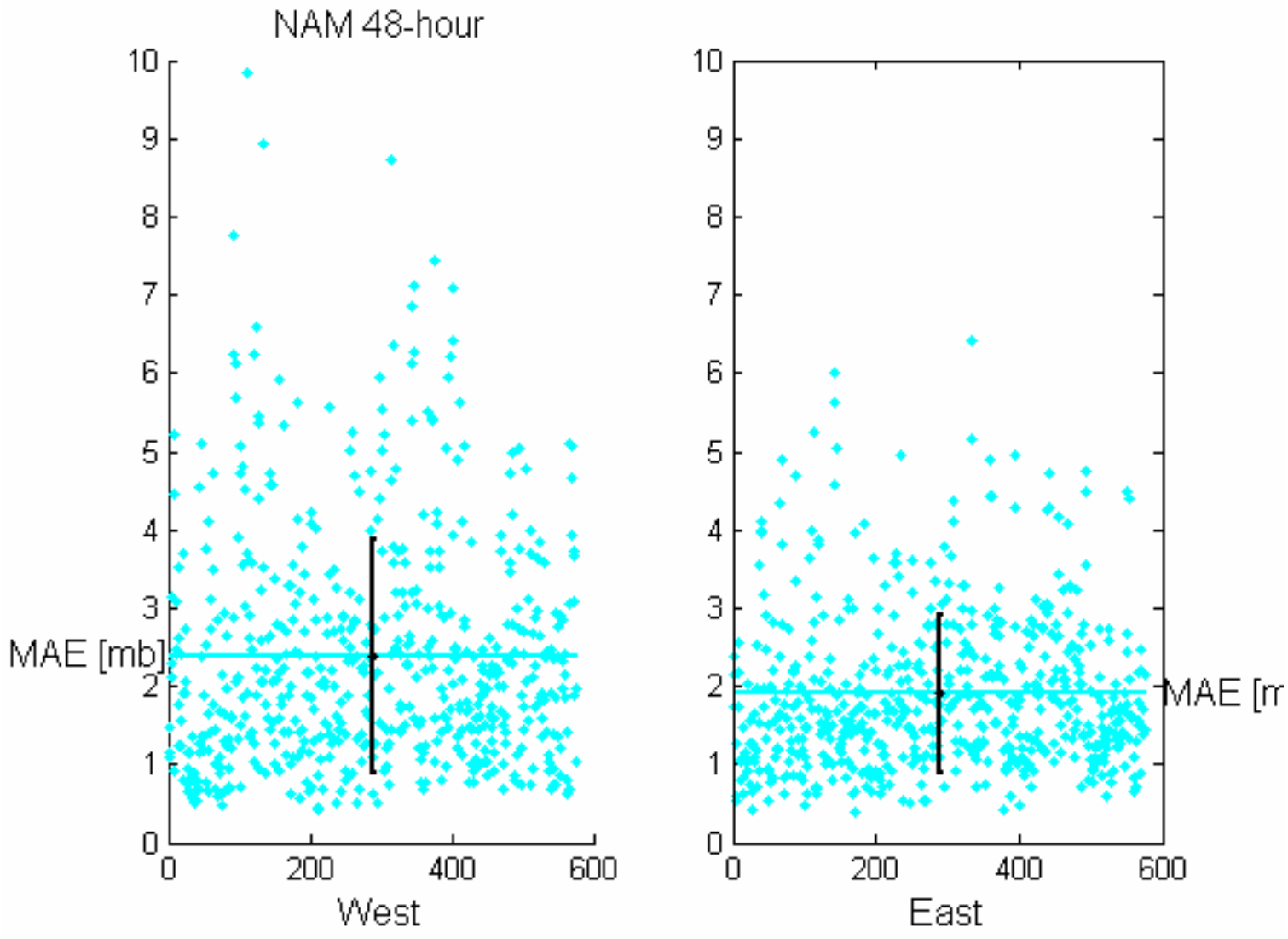
•Matching Variance in Sea Level Pressure:




East Coast
0.18
0.09
0
0 1 2 3 4 5 6 7 8 9 10
West Coast (NAM 48-hour)
0.18
0.09
0
0 1 2 3 4 5 6 7 8 9 10


East Coast
0.18
0.09
0
0 1 2 3 4 5 6 7 8 9 10
West Coast (ECMWF 48-hour)
0.18
0.09
0
0 1 2 3 4 5 6 7 8 9 10
MAE averaged over 11 buoys

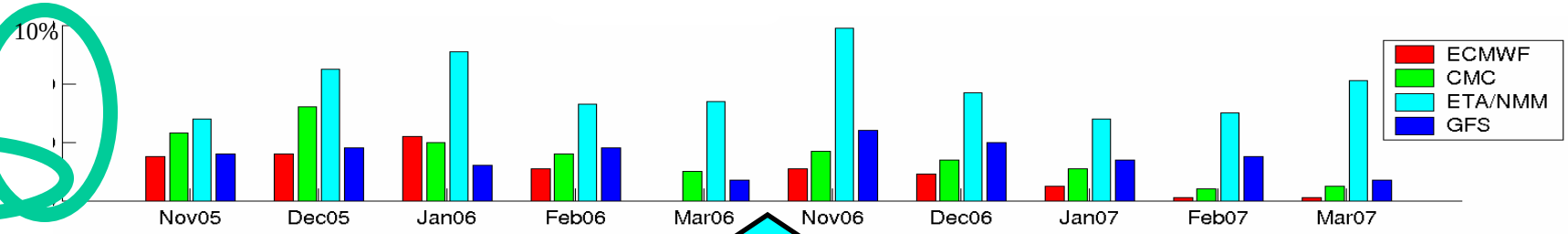

ECMWF 48-hour
MAE [mb]
0
1
2
3
4
5
6
7
8
9
10
0
200
400
600
West
East
MAE [m


NAM 48-hour
MAE [mb]
0
1
2
3
4
5
6
7
8
9
10
0
200
400
600
West
East
MAE [m

West Coast: Number of **Large** Errors by model and month

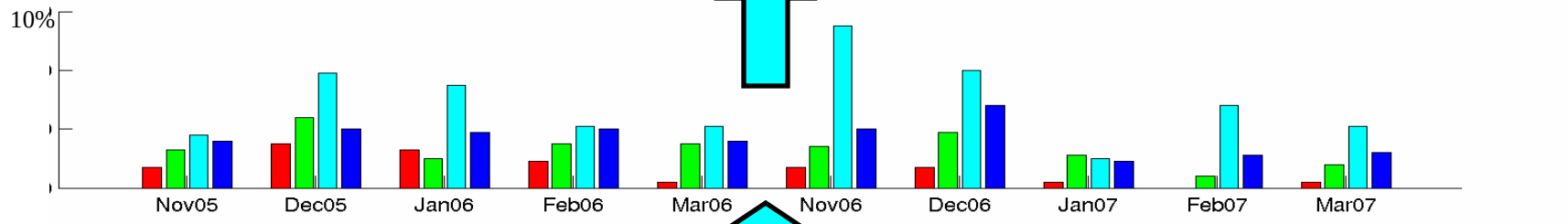
> 3 mb

24-hour



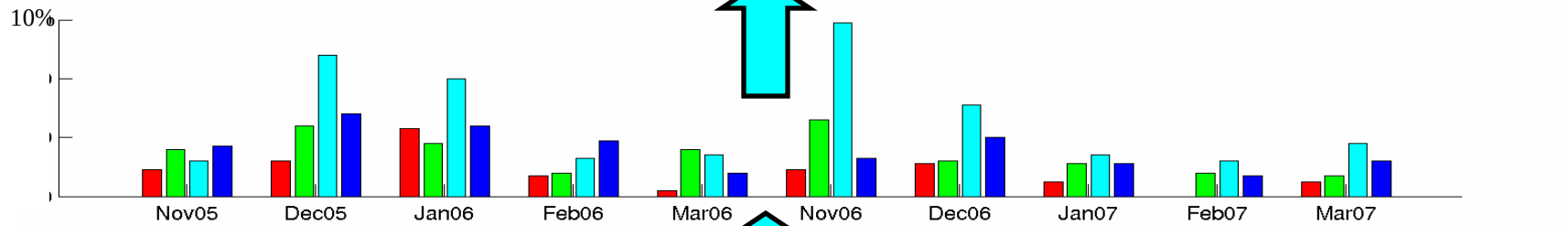
> 5 mb

48-hour



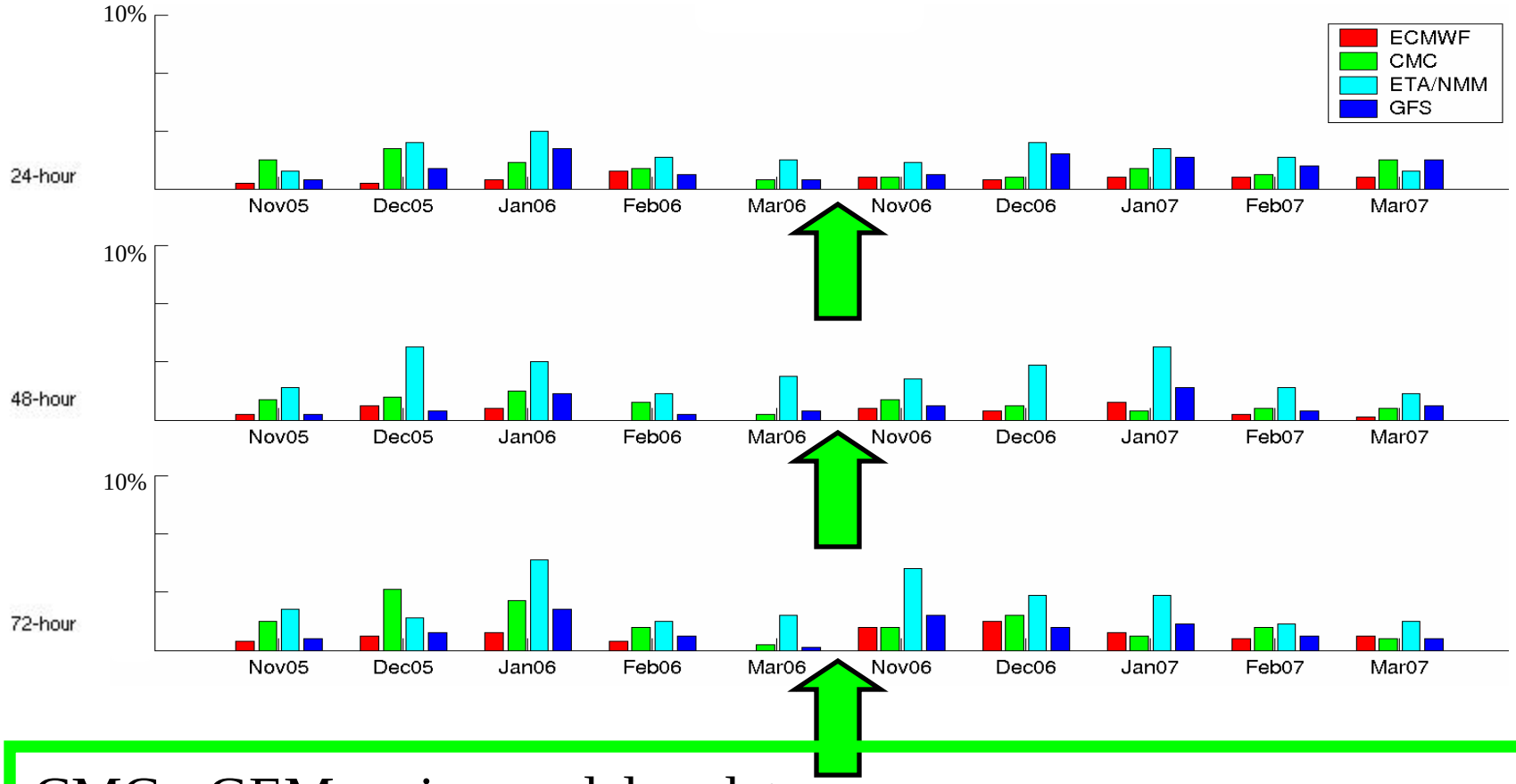
> 7 mb

72-hour



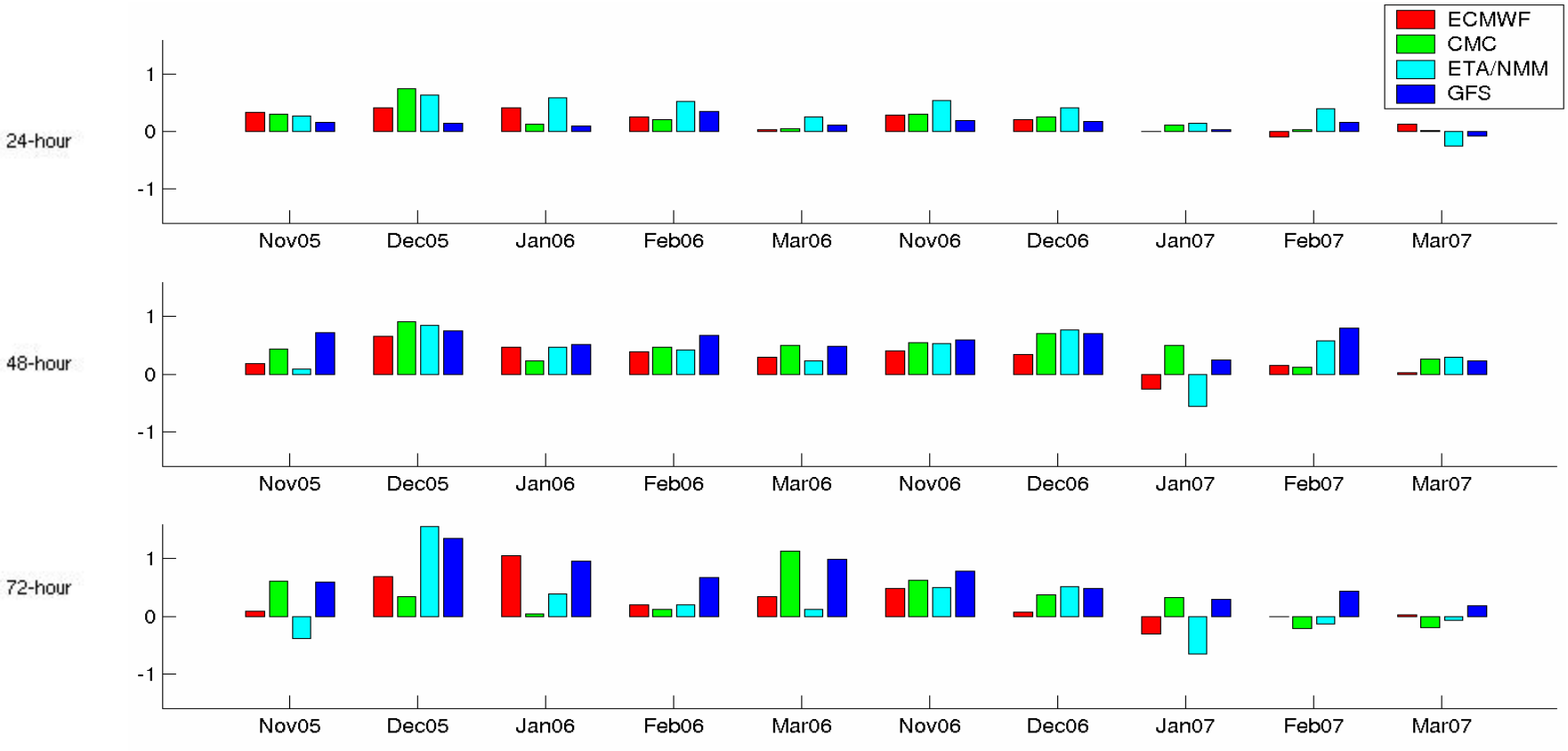
Eta to WRF-NMM operational switchover

East Coast: Number of **Large** Errors by model and month



CMC - GEM major model update. Included: increase in vertical and horizontal resolution, new physics scheme, decreased time step, data assimilation changes

Mean Absolute Error: West Coast ***minus*** East Coast



For reference, typical MAE values: GFS West Coast average:

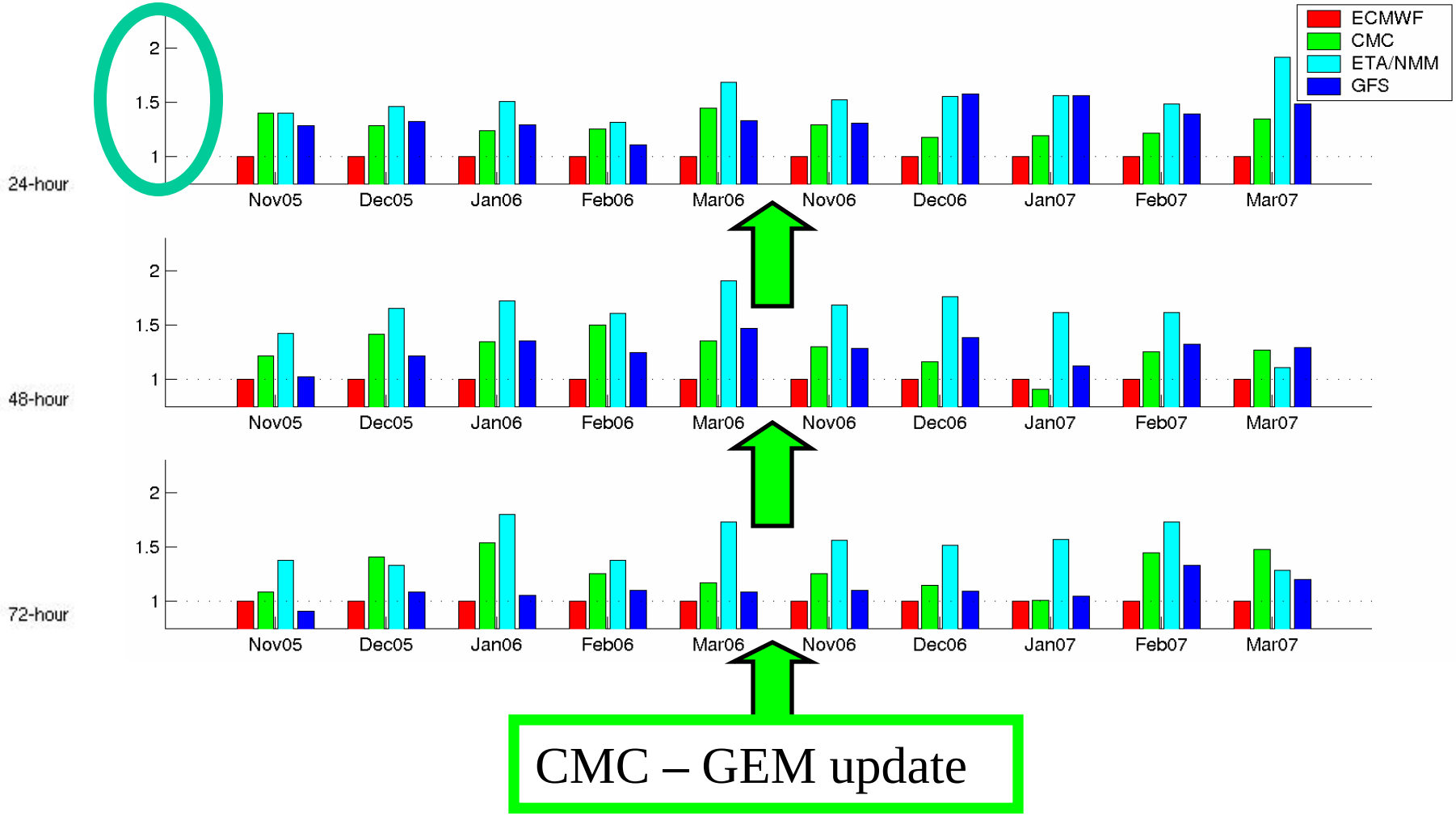
24-hr: 1mb; 48-hr: 1.4 mb; 72-hr: 2.0 mb

Which Coast is Better Forecast? Some numbers…

Considering all 4 models:

- On average, more than 2/3 of the individual months show beyond 95% confidence that West Coast MAE is greater than East Coast MAE
- For the two-season data-set, there is greater than 99.9% confidence that West Coast MAE is greater than East Coast MAE

Comparing models: East Coast Mean Absolute Error
***Standardized* to ECMWF**



Have Some Models Improved?

All Forecast Lead Time (24-, 48, 72-hour) Considered

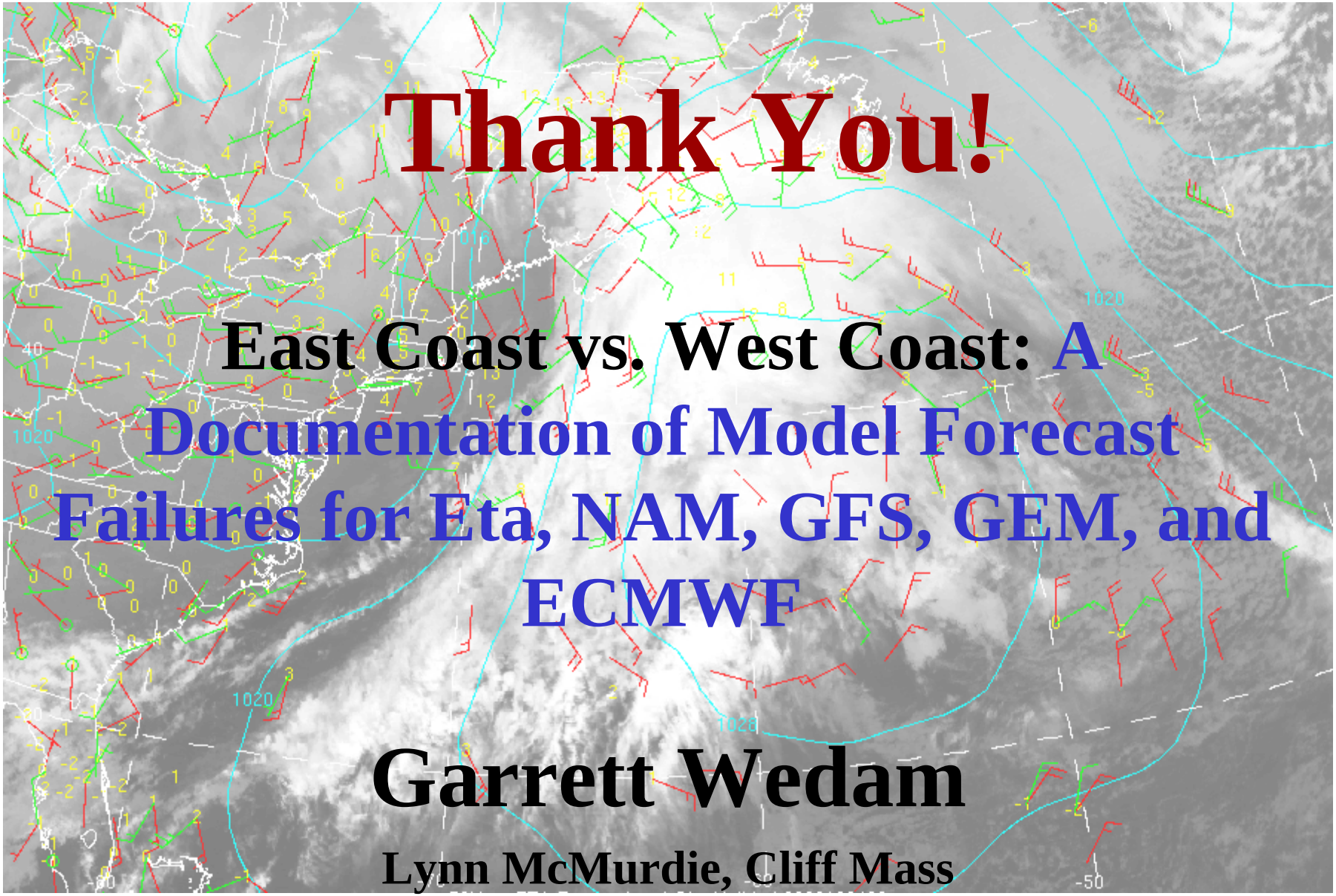
Compare Models Relative to Others

- GEM model was one of the more skilled two models < 30% of the time during the first cool season, but > 60% of the time for the second

- NAM and GFS had significantly greater MAE during the second cool season, while GEM and ECMWF had lower MAE (significant/not significant)

Results Summary

- Comparing models: ECMWF generally outperforms and NAM underperforms others. There are indications that ECMWF and CMC-GEM model updates resulted in significant improvement.
- Forecasts of SLP along the East Coast result in smaller MAE's than along the West Coast
- More "large error" events occur on the West than East Coast for 24, 48, and 72 hour forecasts



Thank You!

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