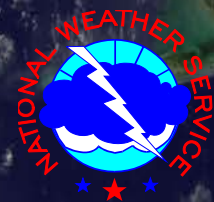
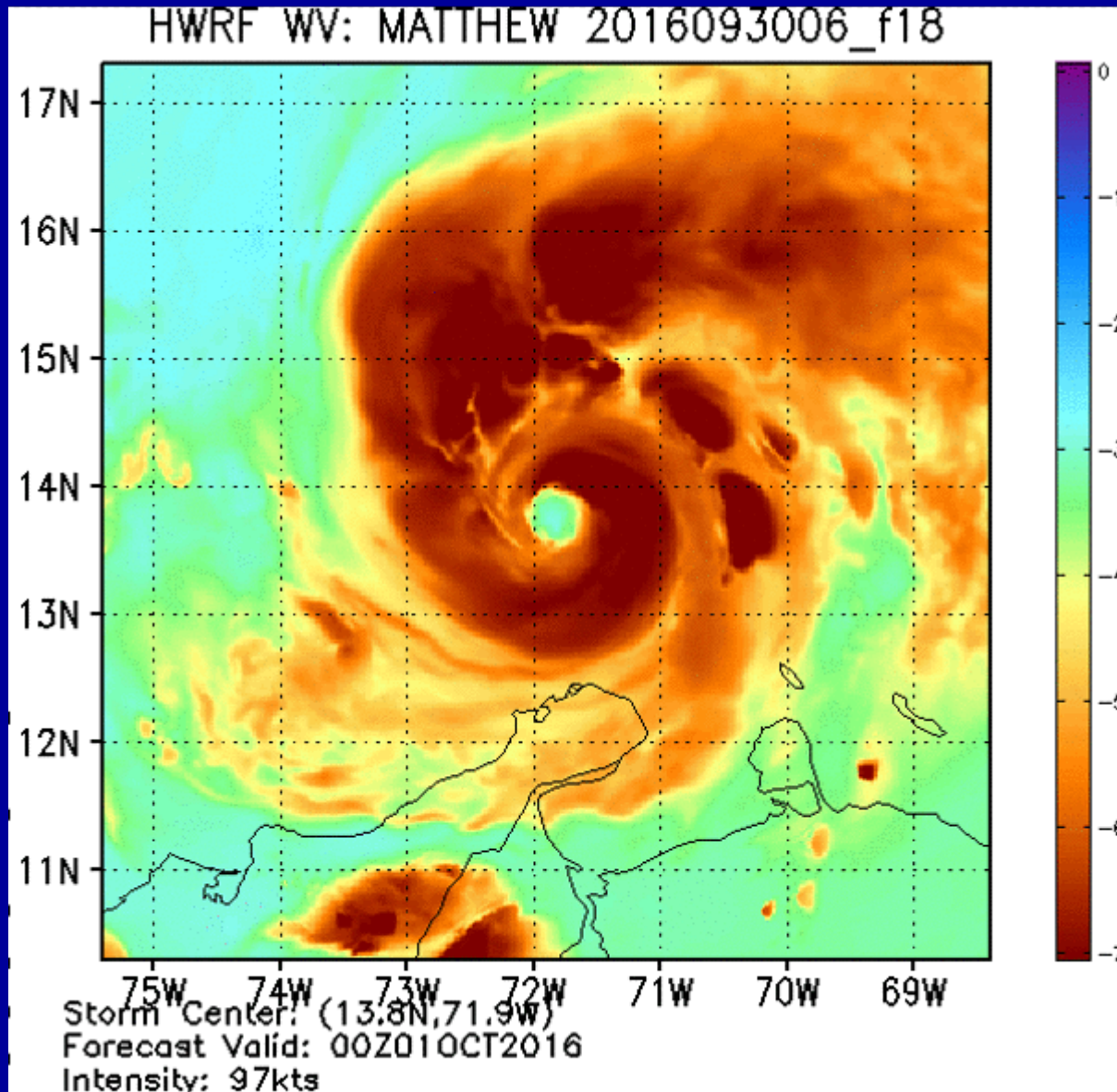


# Forecast Challenges of the 2016 Hurricane Season and NHC Priorities for 2017

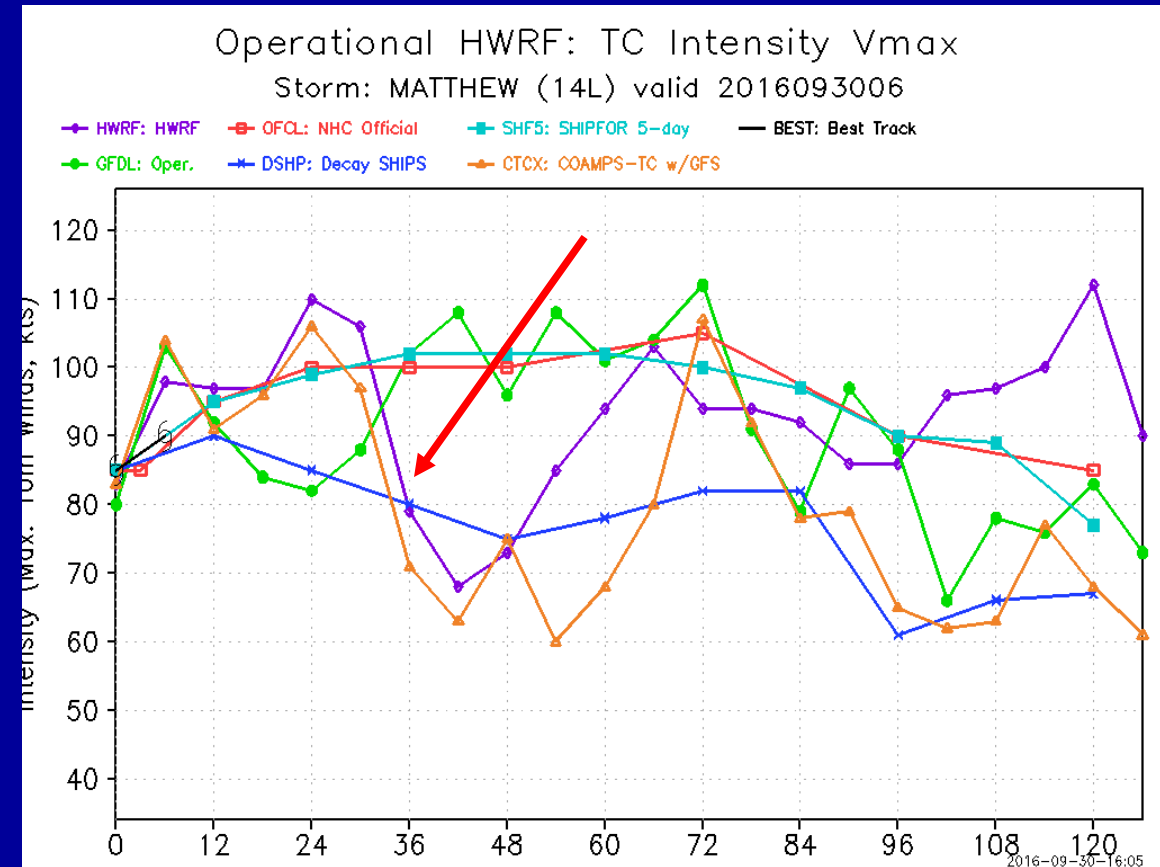
Eric S. Blake, Richard J. Pasch, Andrew Penny, Mark DeMaria  
Annual HFIP Meeting  
1/11/2017



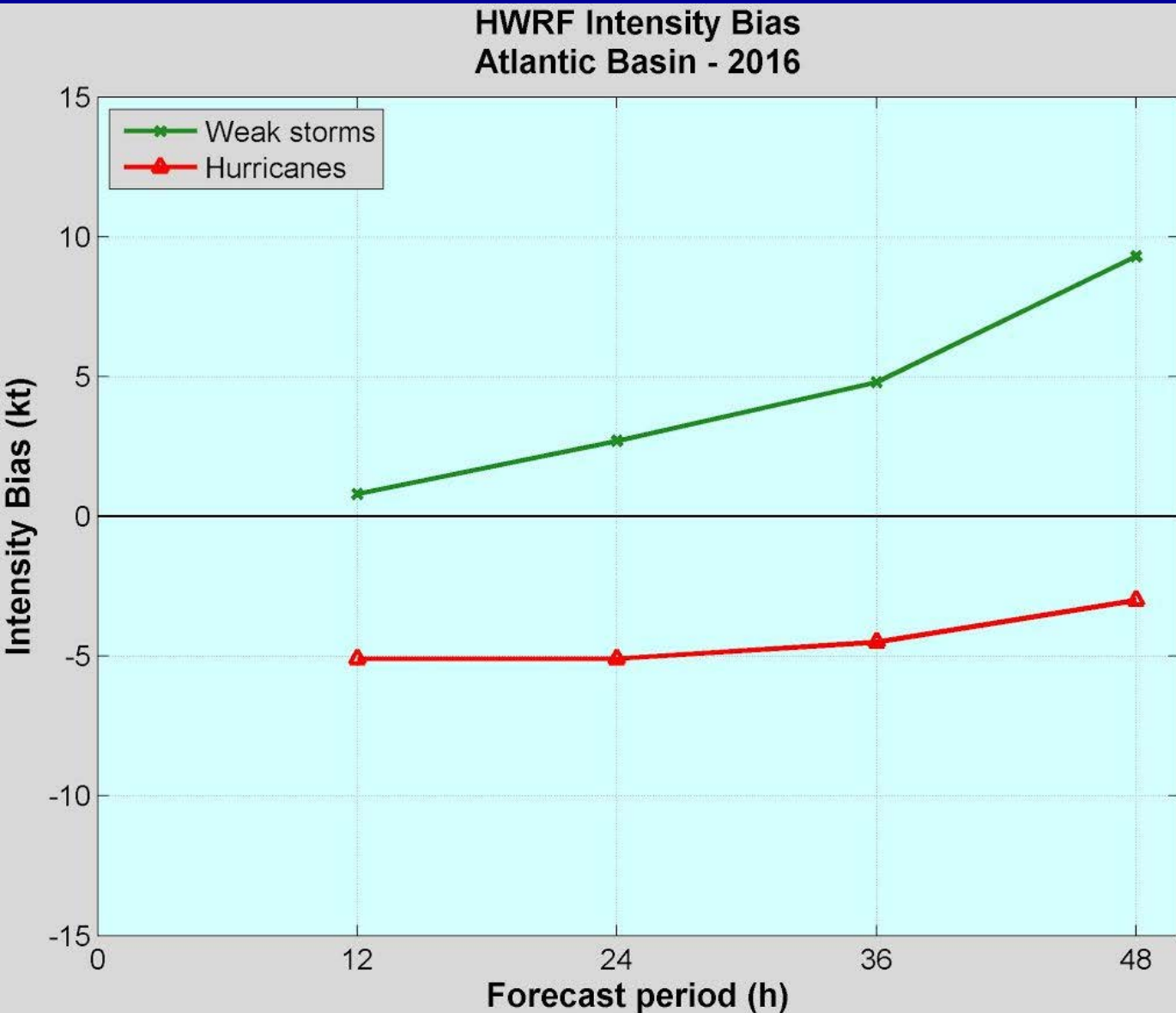
# Collapse of inner core of Matthew in HWRF



For some HWRF forecasts of Matthew when it was over the Caribbean, the eyewall unrealistically collapsed. This had to have an effect on the model-predicted intensity.



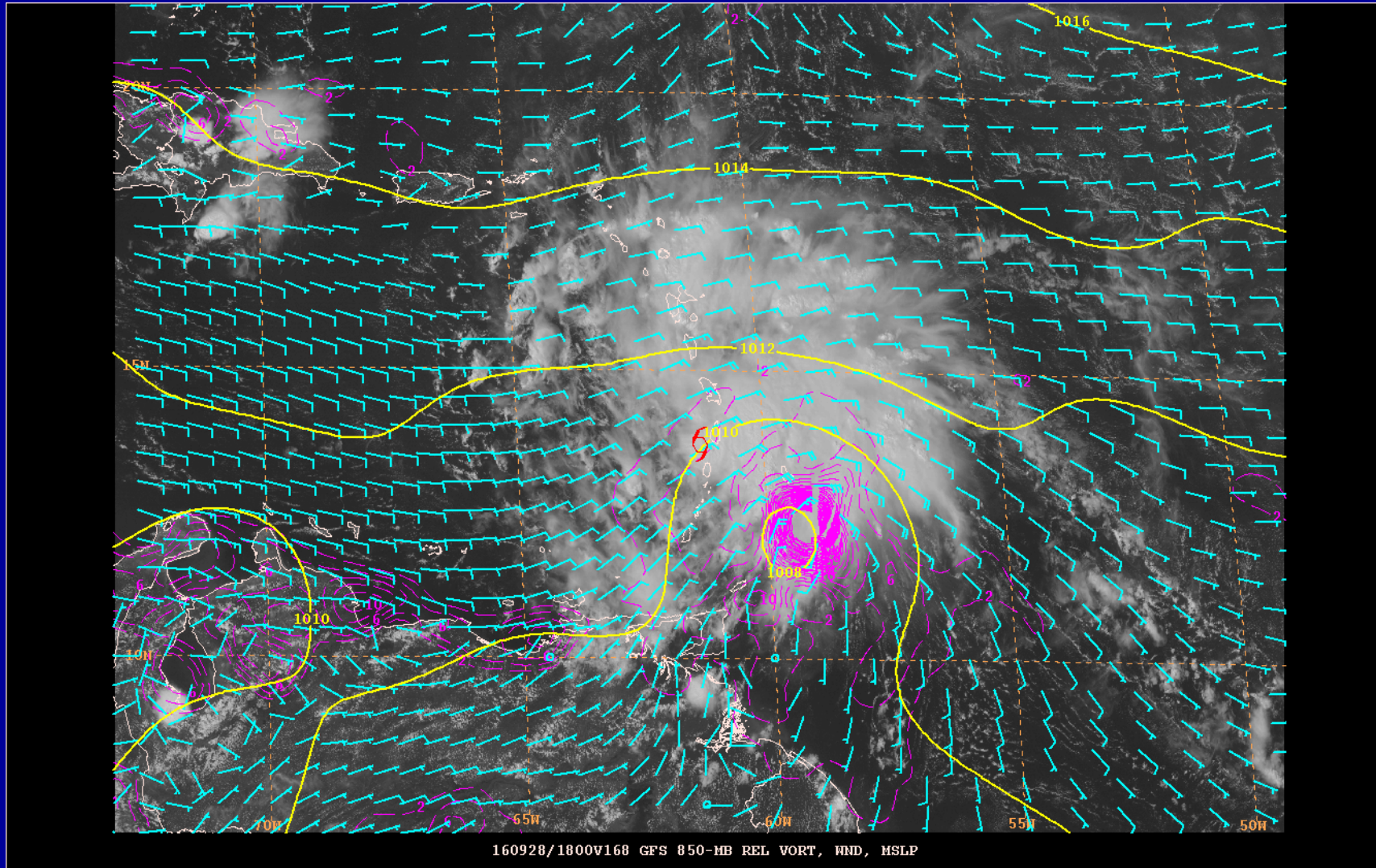
# HWRF bias



We noticed that early in a tropical cyclone (<50 kt), HWRF was too high and then as a hurricane, HWRF consistently too low

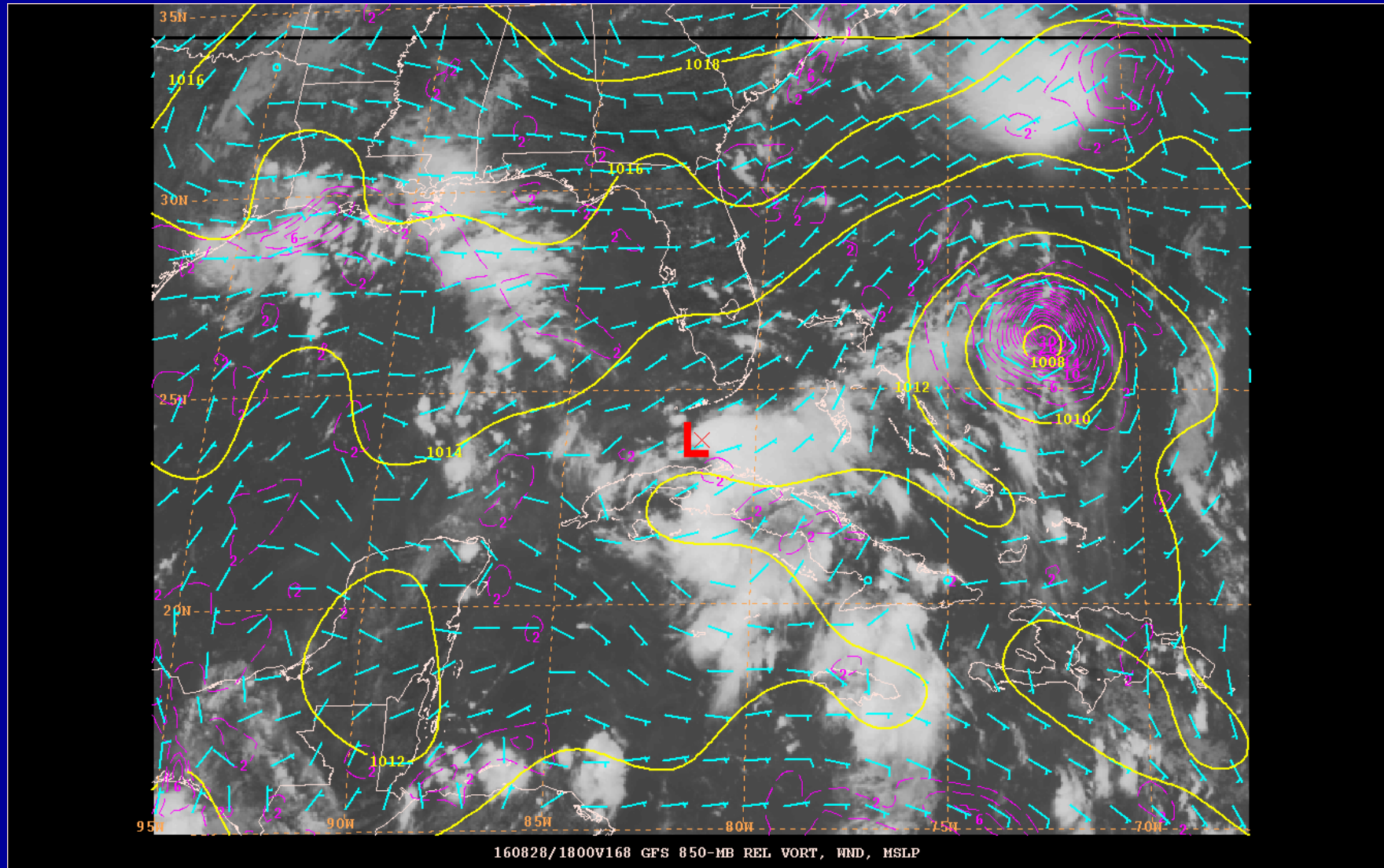
This type of changing bias is challenging for forecasters

# GFS genesis forecasts for Matthew



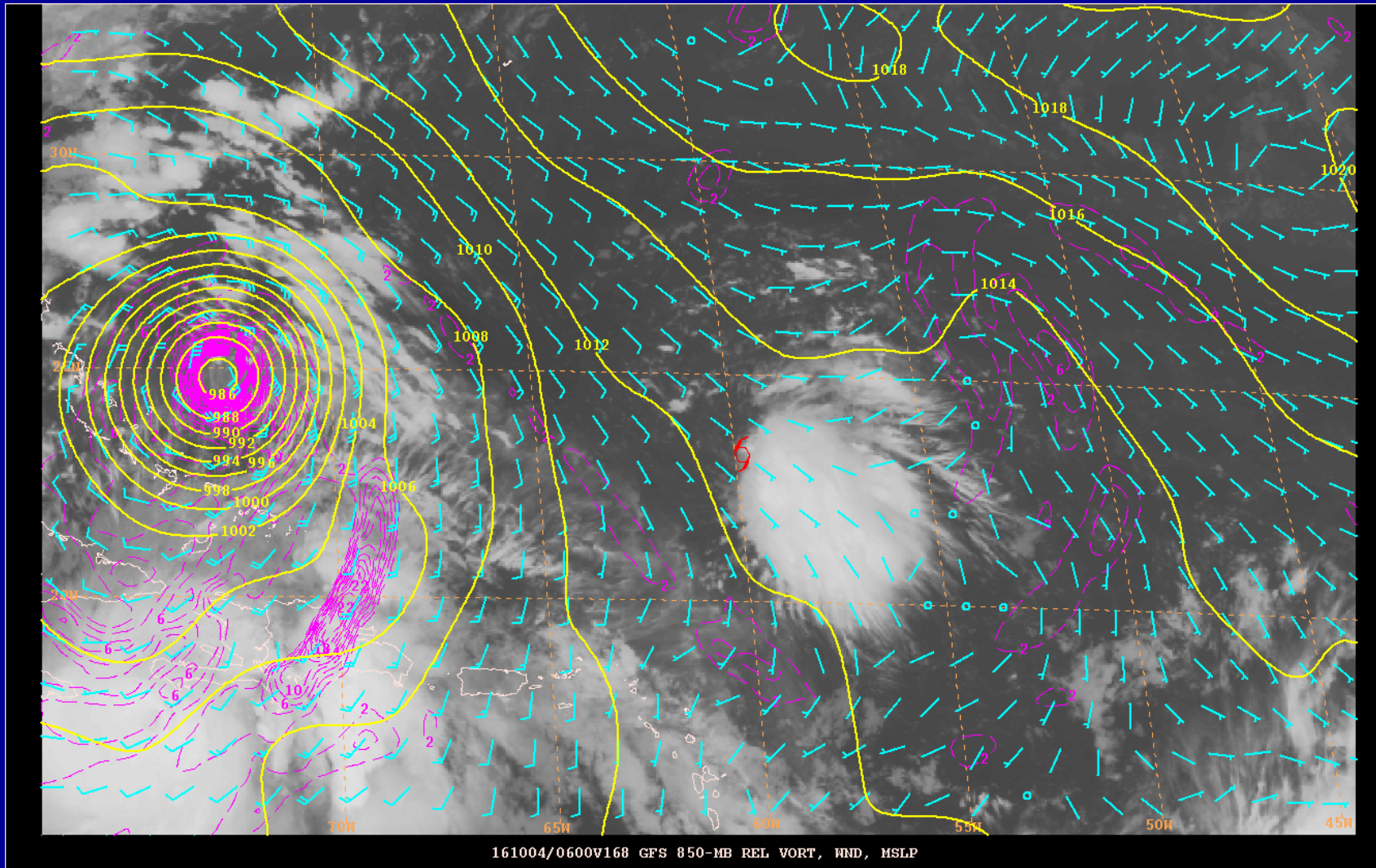
One of the best performances of the year, particularly in a geographic region where the GFS has historically struggled

# GFS genesis forecasts for Hermine



Mixed performance, wrong location at first, then only signal < 2 days from formation

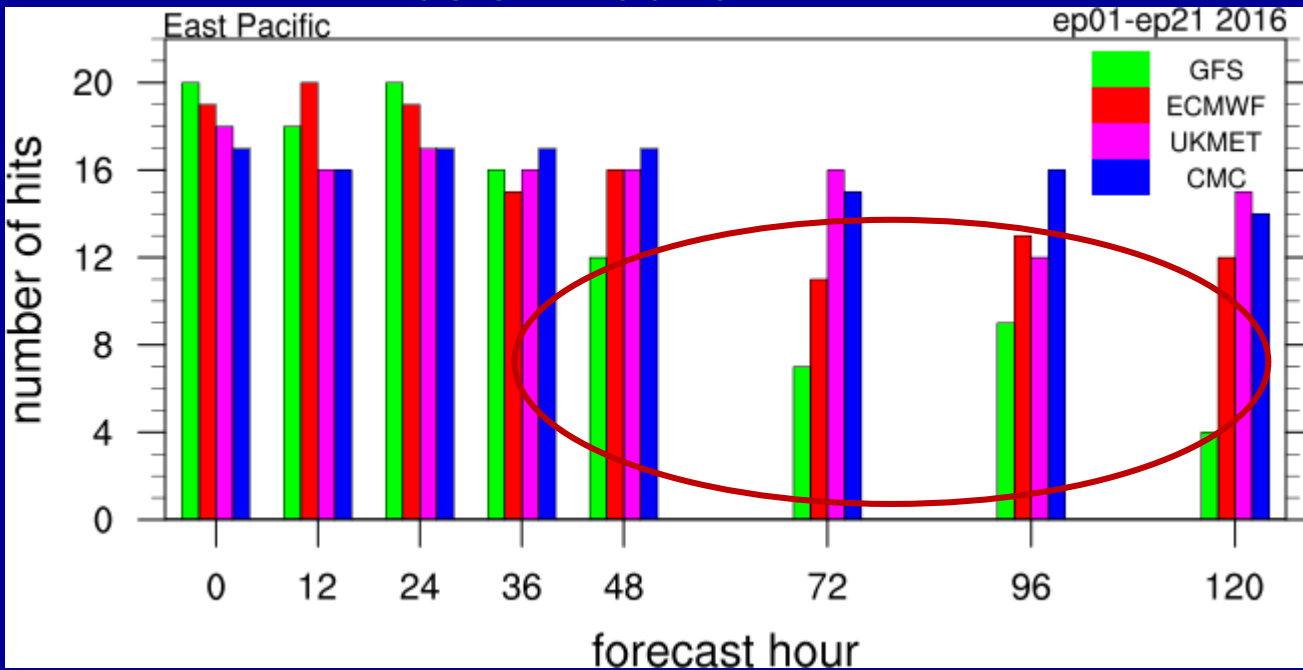
# GFS genesis forecasts for Nicole



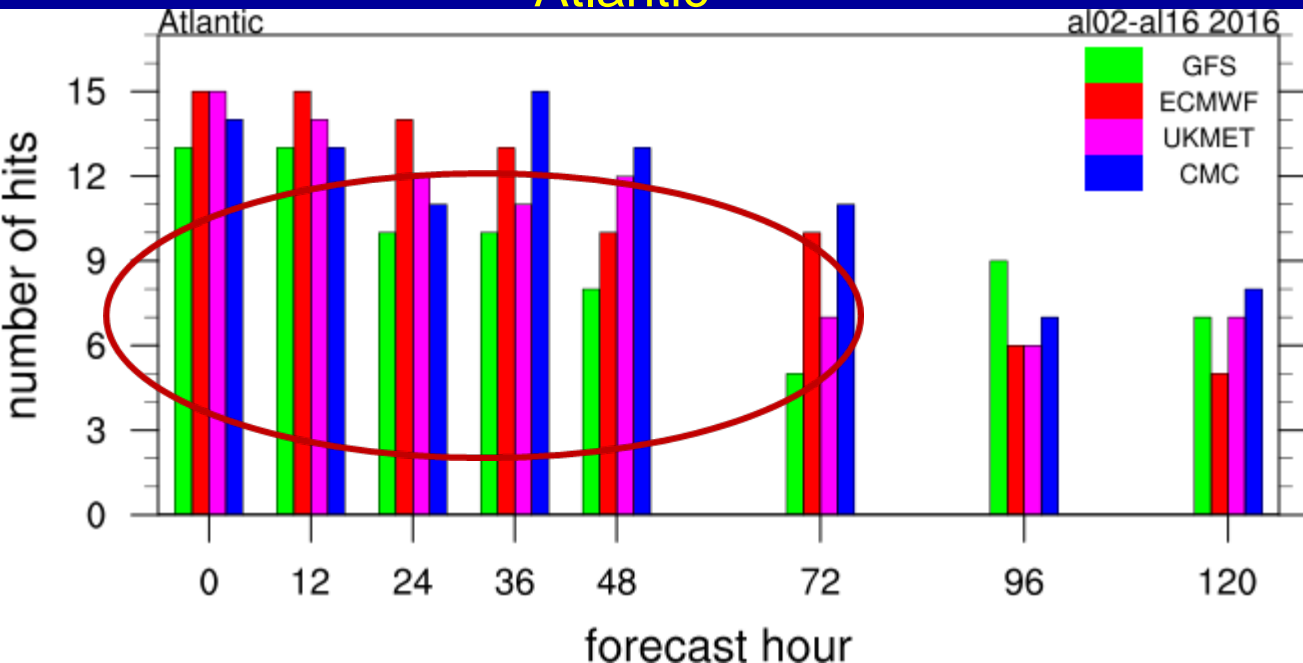
Probably the worst performance of the year, virtually no signal

# GFS genesis problems

## Eastern Pacific

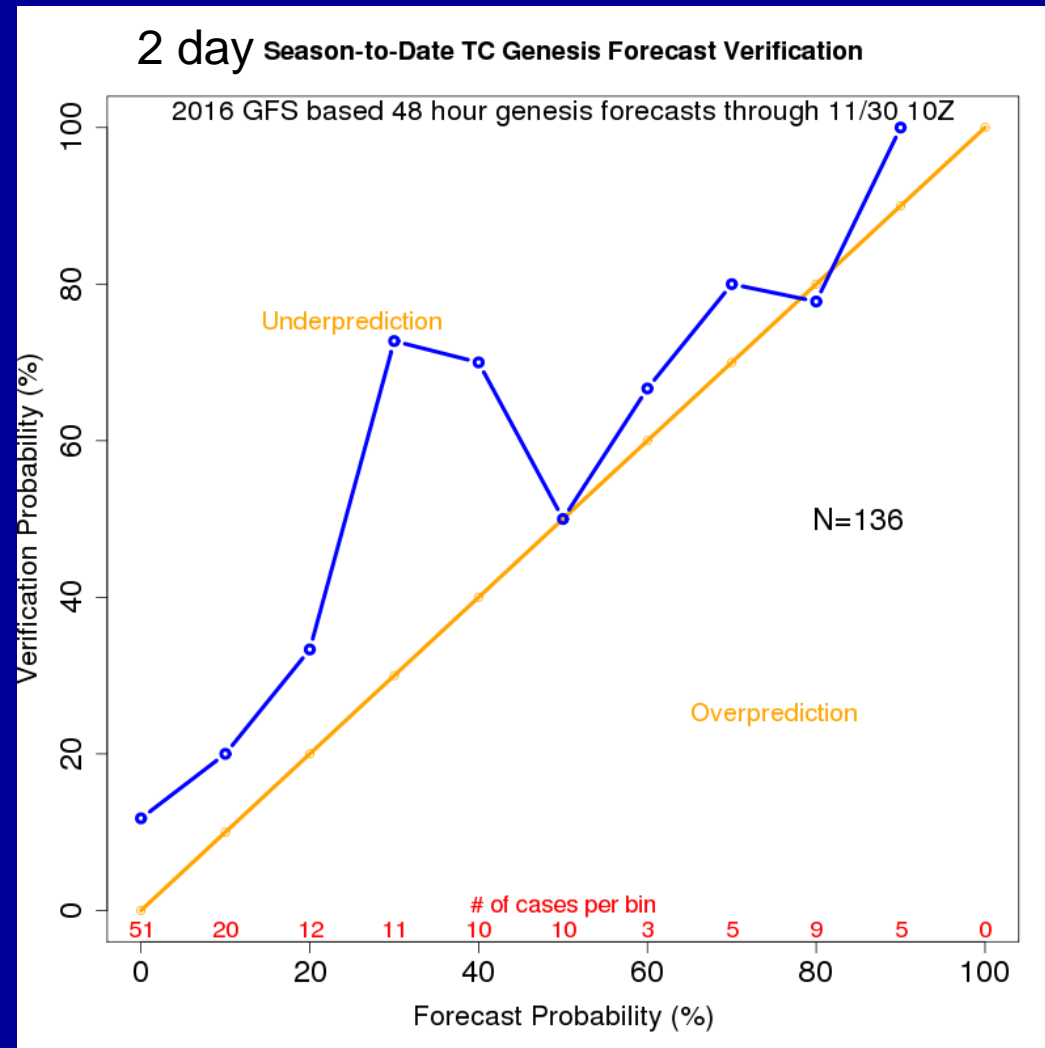
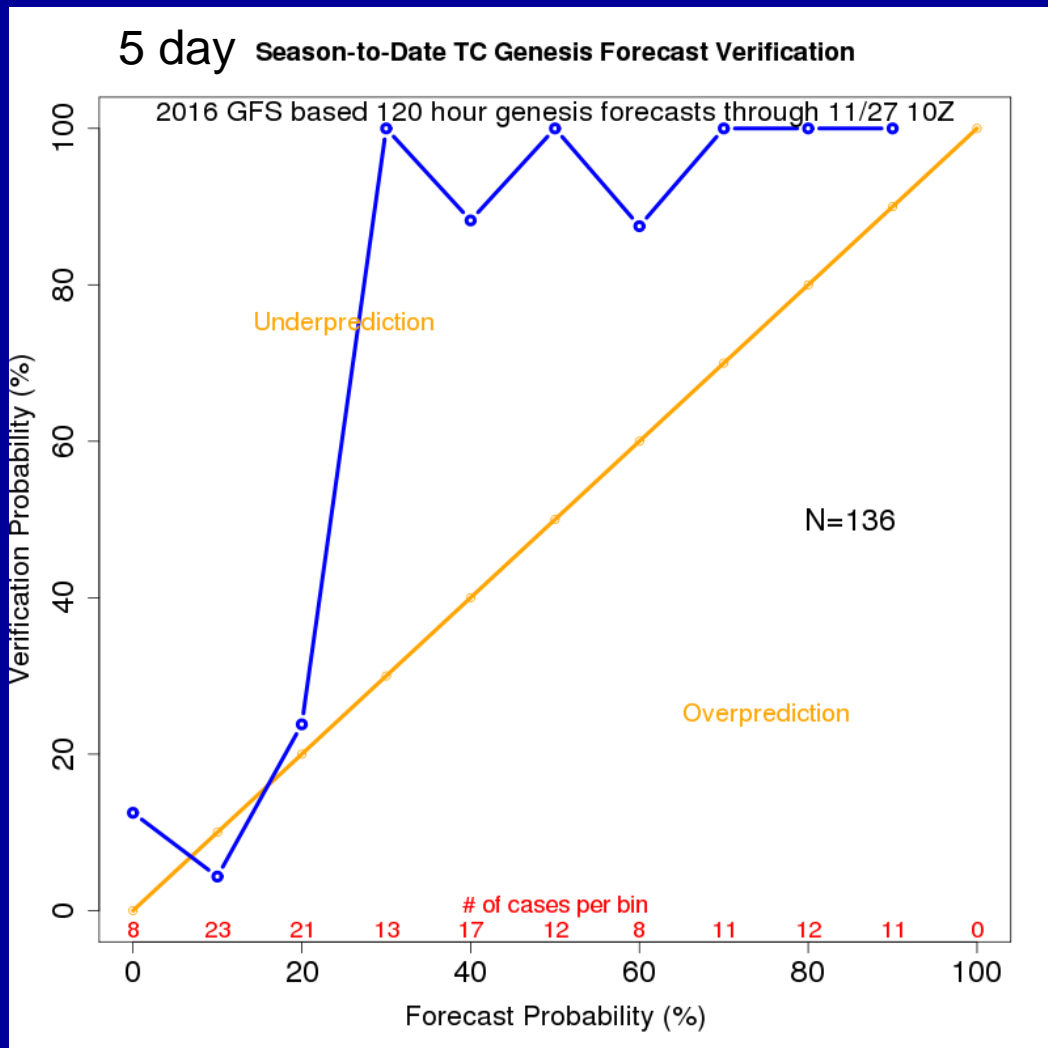


## Atlantic



- 2016 GFS underpredicted genesis in both basins
- Eastern Pacific continued trend from 2015 of very few hits at long-range compared to other models.
- Resulted in objective guidance having a low bias from the GFS, with other models better calibrated (not shown)
- Atlantic did better at long-range, but underforecast bias persists through day 3.
- For example, GFS forecasted only about half of the Atlantic TC formations 48 hours in advance.

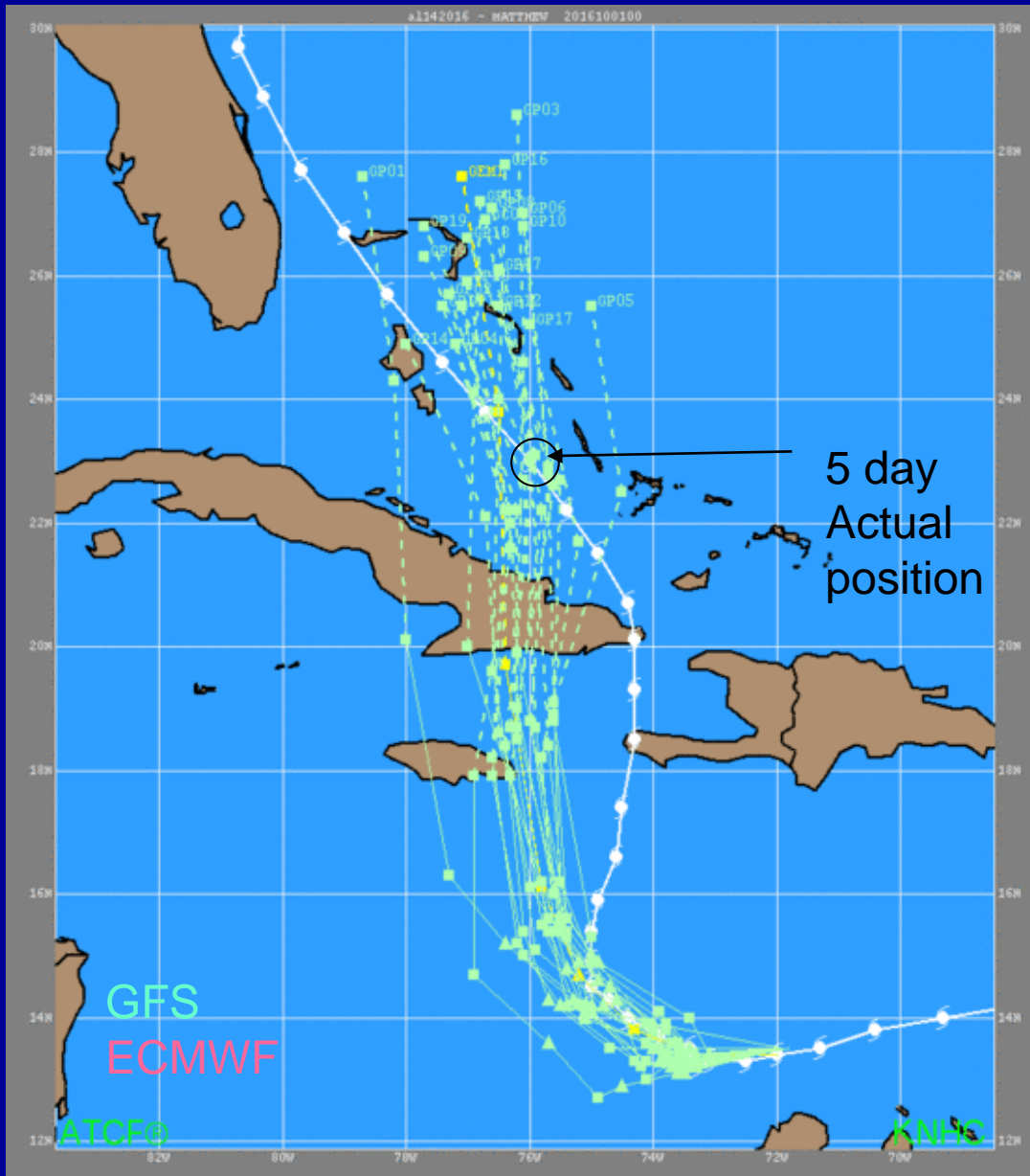
# Atlantic genesis forecasts



- 5 day forecasts had a huge underprediction bias
- 2 day is better, but only 20 forecasts all year in the high category from the model (NHC issued ~50 based on all guidance including non-NCEP models)



# Matthew ensemble guidance 1 Oct 00 UTC

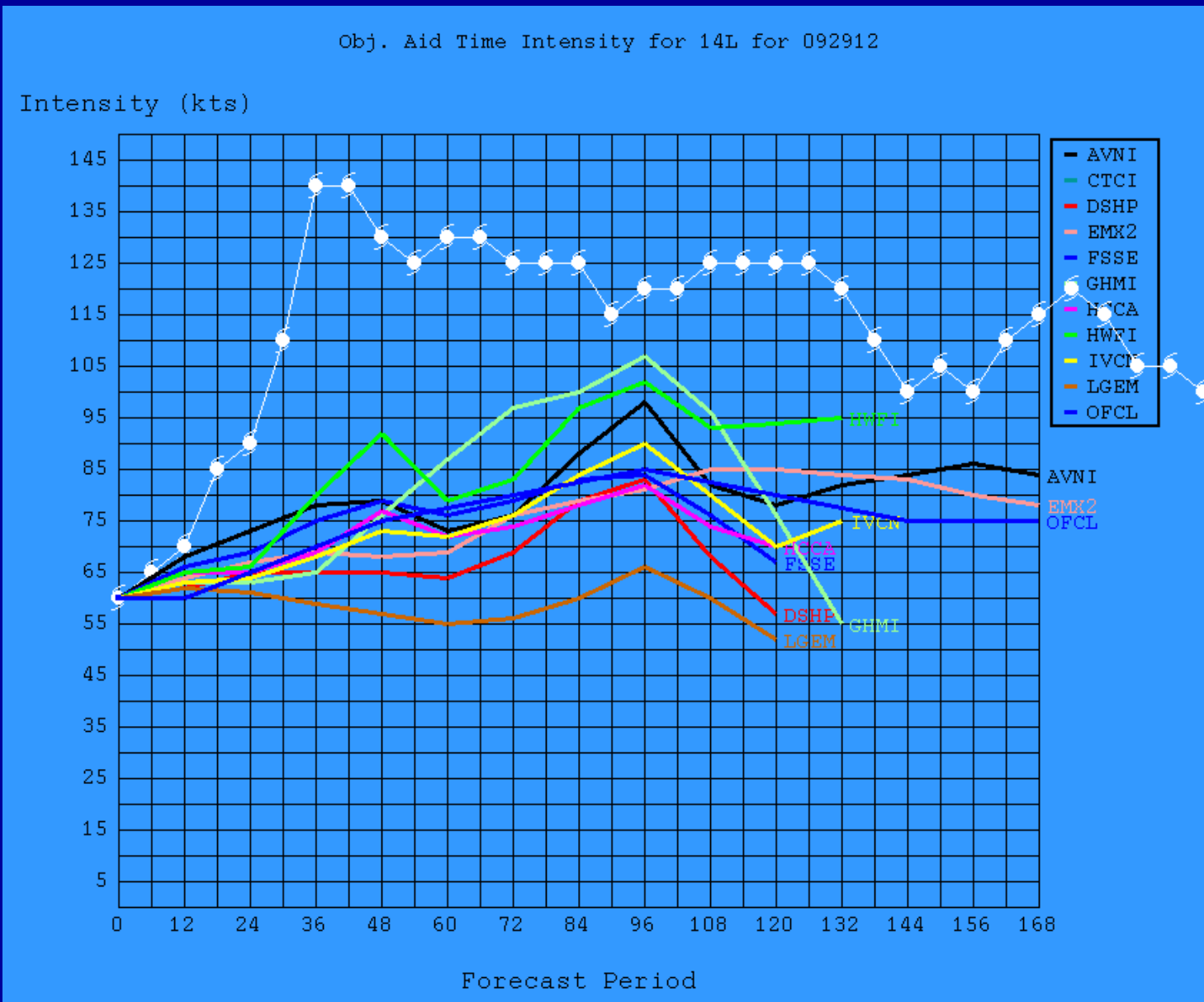


GEFS (blue) too underdispersive, especially in Caribbean

Every single GEFS member also too fast at 5 days

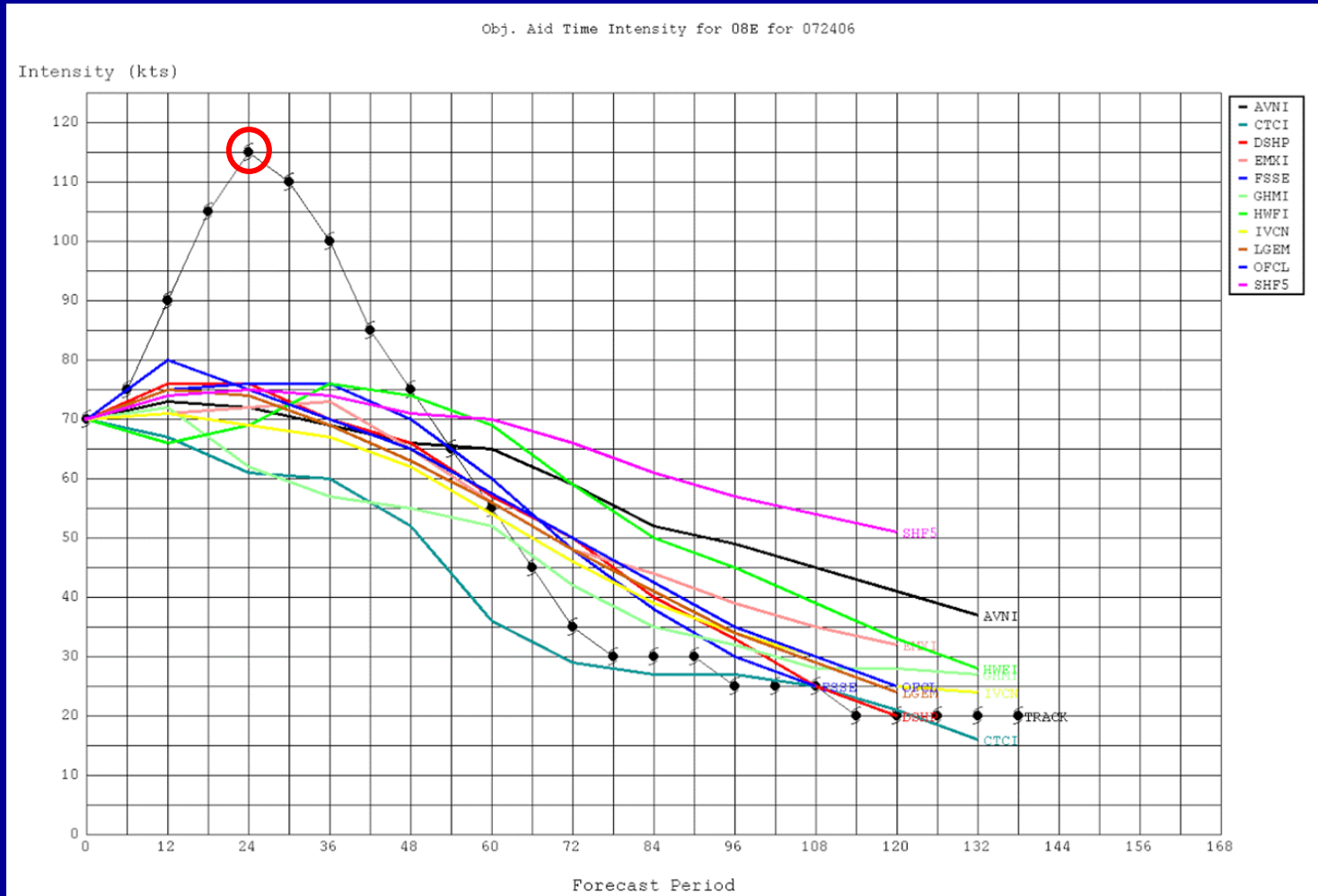
ECMWF (red) has more realistic spreads, albeit potentially too large

# Matthew intensity models before rapid intensification



Model performance was terrible

# Georgette intensity guidance 24 Jul 0600 UTC



All guidance showed little change or weakening, when in reality it intensified 45 kt in the next 24 hours!

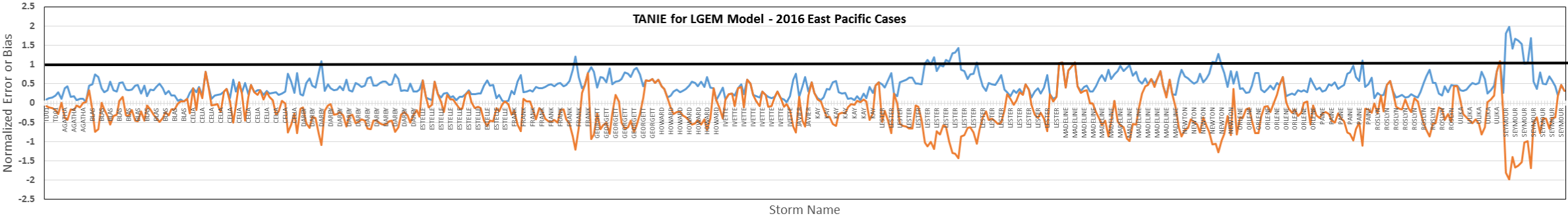
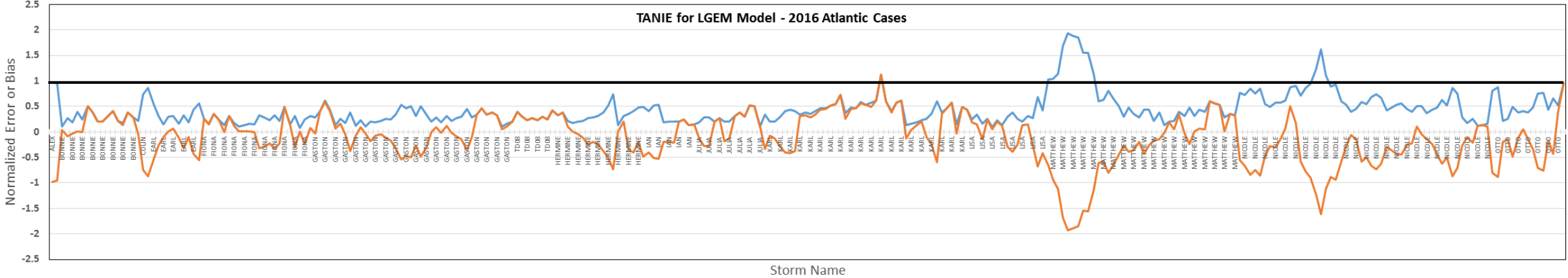
# NHC Modeling Priorities for 2017

- Continue to improve HWRF, especially for RI cases
- Work towards a less under-dispersive ensemble system
- Address low bias in GFS intensity forecasts
- Develop methods to assimilate GOES-16 and JPSS data
- Demonstrate HNMMB capabilities for TC forecasting

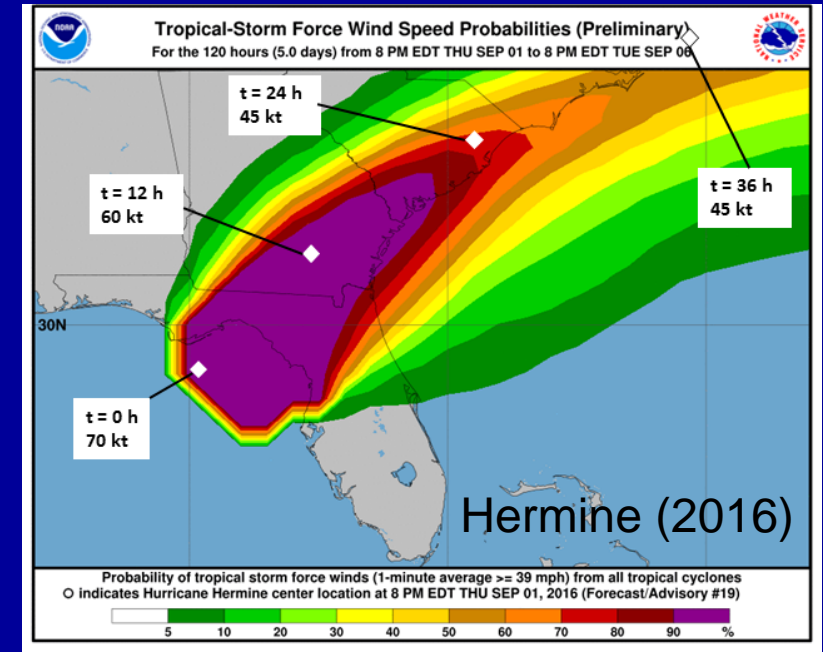
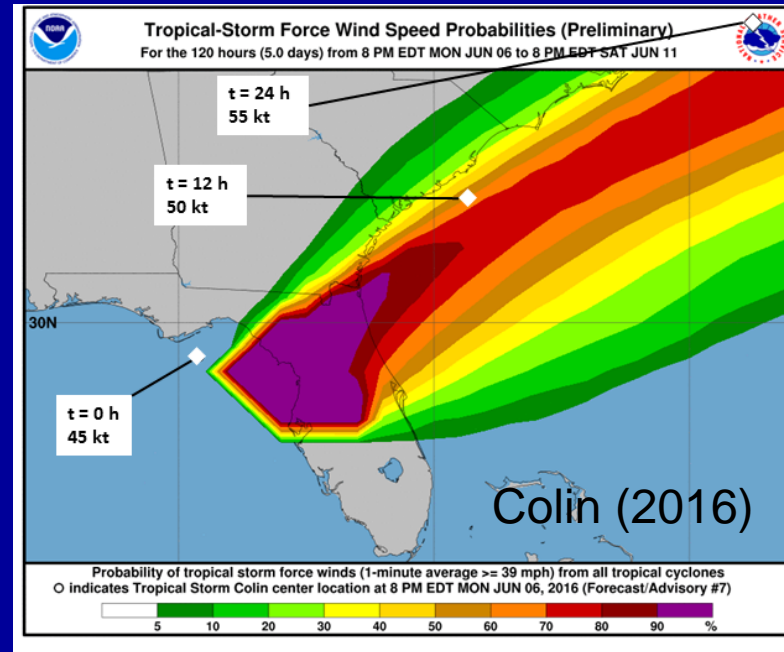
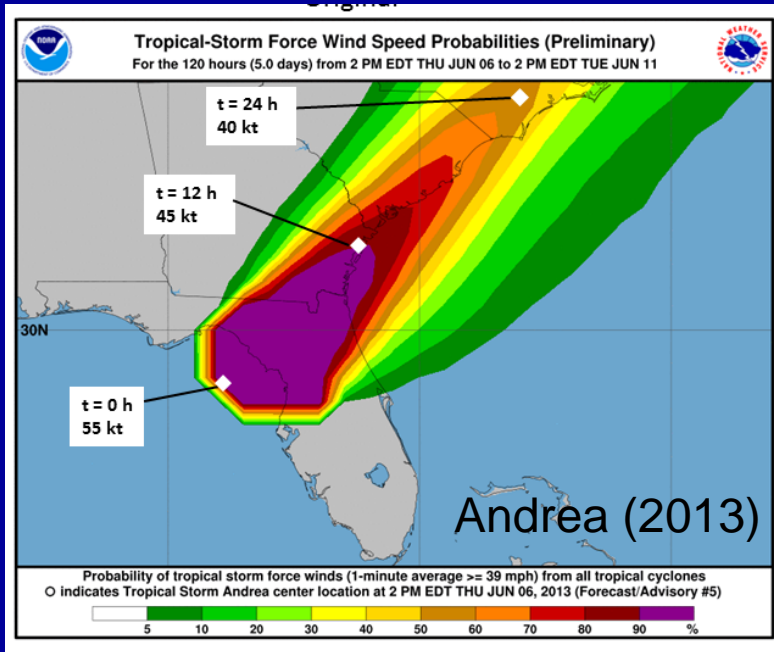
# Time-Averaged Normalized Intensity Errors (TANIE)

- Tool developed to provide quick look at model errors for entire season and outlier identification
- Method
  - Normalize 12, 24, ..., 120 hr forecast errors for single forecast time by NHC official error standard deviations from past 5 years
  - Average normalized errors from 12 to 120 hr
  - Average normalized bias from 12 to 120 hr
  - Provides 2 numbers (error and bias) per forecast time per model
  - Entire season can be displayed in one time series

# TANIE for 2016 LGEM



# 34 kt Wind Speed Probabilities for Recent Florida Landfalls



# NHC Products/Post-Processing Priorities for 2017

- Continue to improve statistical models
  - SHIPS/LGEM/RII improvements, and adapt to GOES-16
  - Work with TSB to make HCCA operational, add CPHC forecasts
- NHC Wind Speed Probability model
  - Improve probabilities for land cases
  - Coordinate with SSU on unified methods for track/intensity/size realizations
- Continue development of NHC graphical products
  - New time of arrival of 34 kt winds
  - Updated TC graphical suite, including pre-genesis modifications
- Continue diagnostics to help identify areas for HWRF improvement
- Continue ensemble product development
  - Repeat Tiger Team demo at NHC in 2017
  - Use of ensembles to improve NHC deterministic forecast
- ATCF upgrades
  - Annual requirements for NRL
  - Continue ATCF in AWIPS project



# Summary

- The 2016 Hurricane Season provided challenges, especially for intensity and genesis prediction
- Model emphasis for 2017 is on RI forecasting, reducing low bias for TC genesis, developing more dispersive ensembles, and assimilating new data (GOES-16, JPSS)
- Product Development and Post-Processing priorities
  - NHC guidance suite, WSP model
  - New public-facing graphical products
  - Ensemble and consensus products for NHC forecasters
  - ATCF improvements and migration to AWIPS2
  - Model diagnostics