Stream 1.5 Runs of SPICE

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Vijay Tallapragada, NOAA/NWS/NCEP/EMC

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CIRA

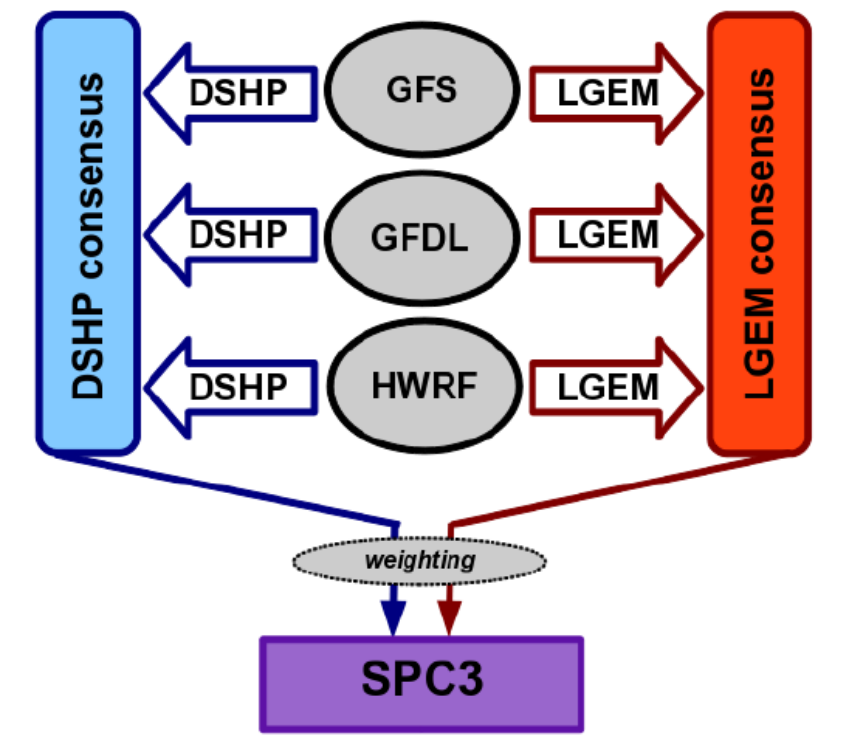
NOAA HURRICANE FORECAST IMPROVEMENT PROJECT

Outline

- SPICE Overview
- 2012 Verification
  - NHC Delivery (Stream 1.5) and Full Season (Combined)
- Global SPICE
- Diagnostic Code Updates
- Outlier Analysis
- Summary

SPICE (Statistical Prediction of Intensity from a Consensus Ensemble)

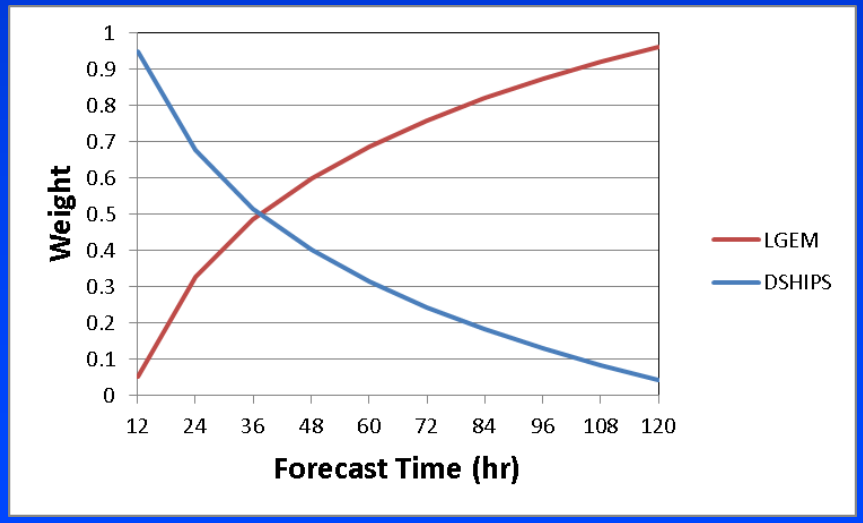
Model Configuration for Consensus



- The forecasts are combined into two unweighted consensus forecasts, one each for DSHP and LGEM
- The two consensus are combined into the weighted SPC3 forecast

- SPICE forecasts TC intensity using a combination of parameters from:
  - Current TC intensity and trend
  - Current TC GOES IR
  - TC track and large-scale environment from GFS, GFDL, and HWRF models
- These parameters are used to run DSHP and LGEM based off each dynamical model

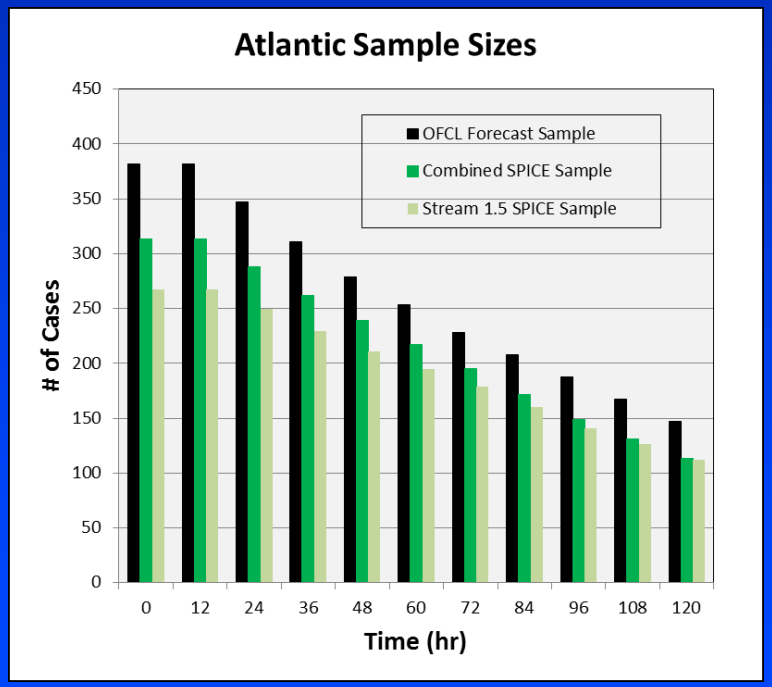
DSHP and LGEM Weights for Consensus

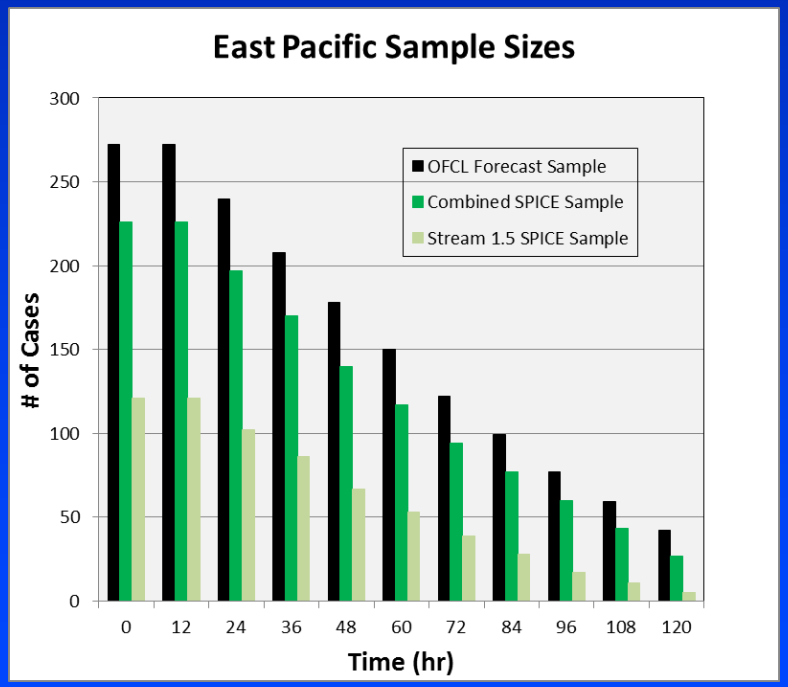


SPICE Verification

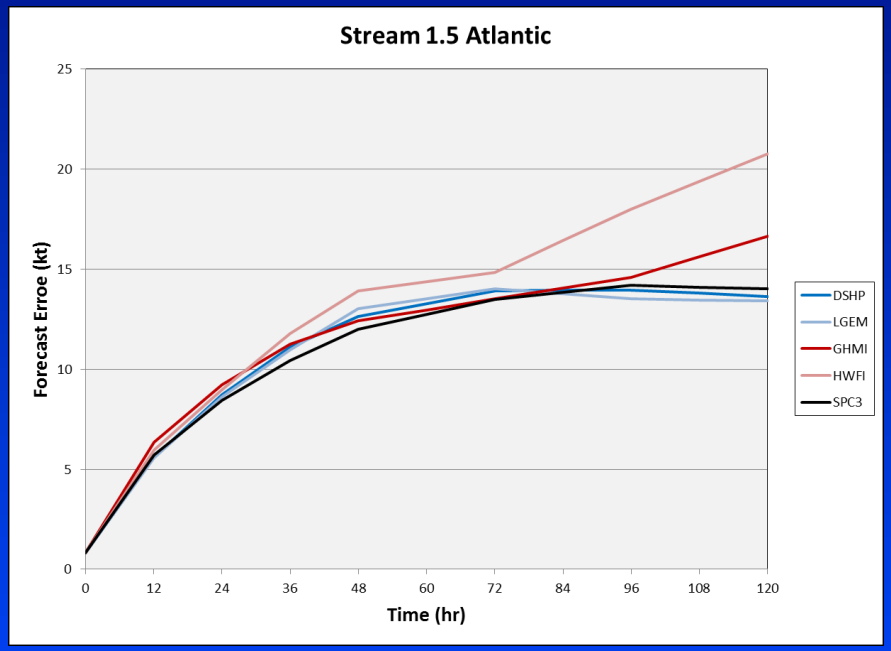
Compare with Parent Models LGEM, DSHP, GHMI, HWFI

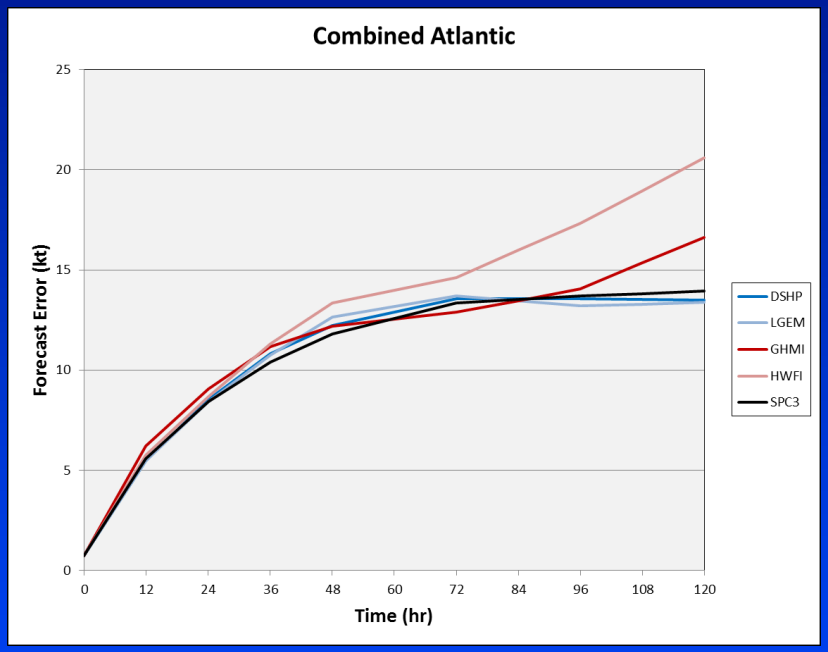
- Use working best track [through AL17 (Rafael), and EP16 (Paul)]
- NHC verification rules – Tropical, subtropical only
- Must also have OFCL forecast
- Stream 1.5 sample – Only those delivered to NHC
- Combined sample – Add cases run at CIRA but not sent to NHC



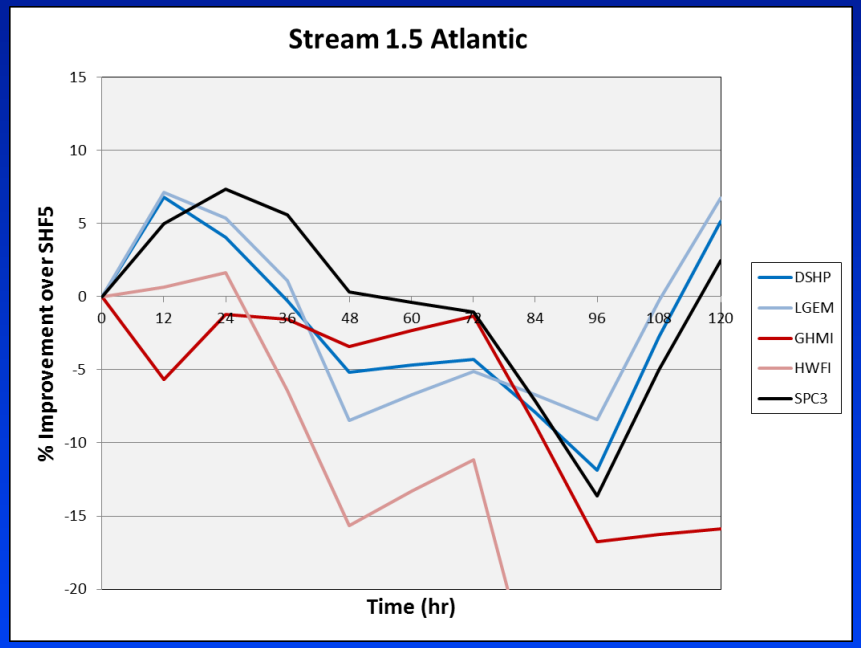


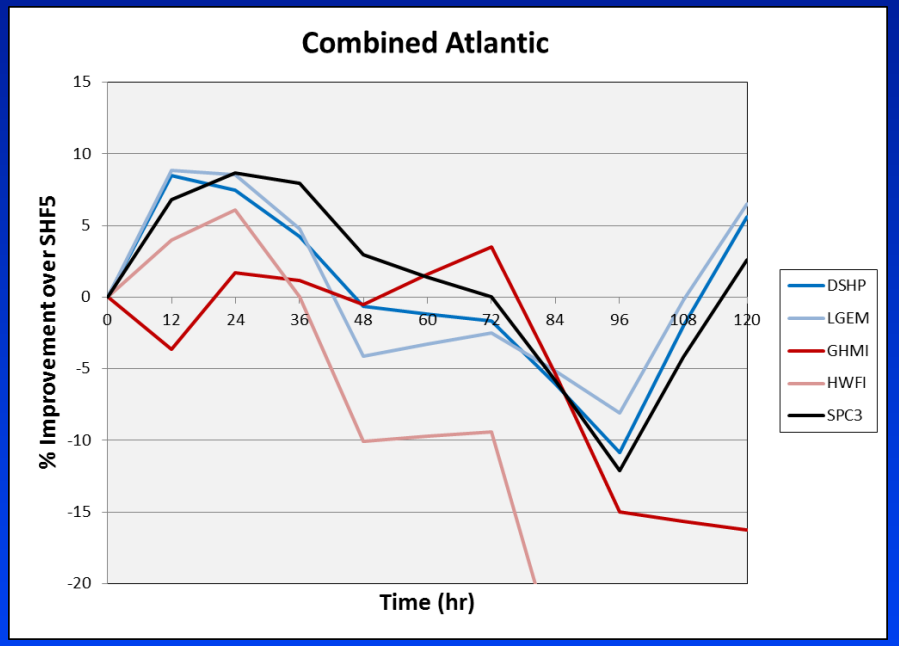
Mean Absolute Errors – Atlantic



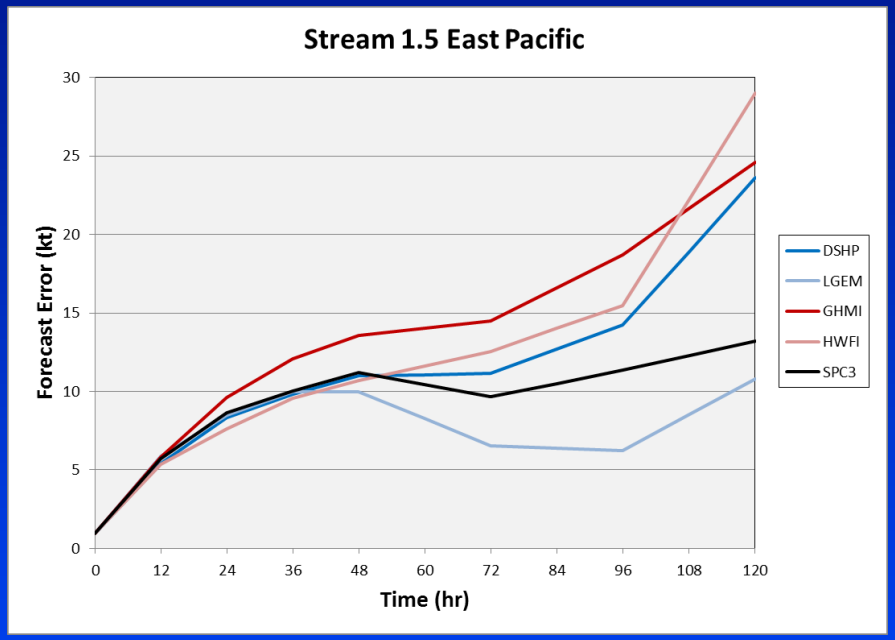


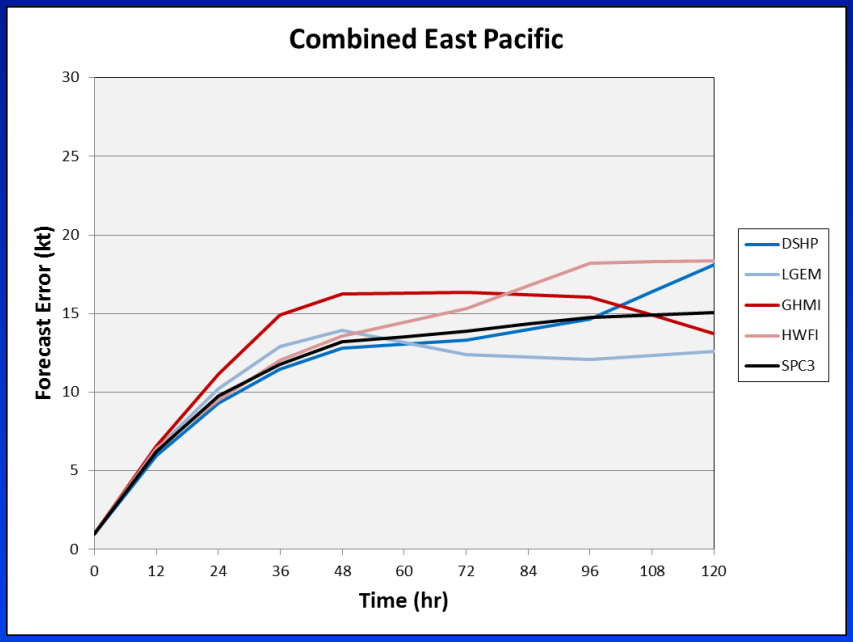
Skill Relative to SHF5 - Atlantic



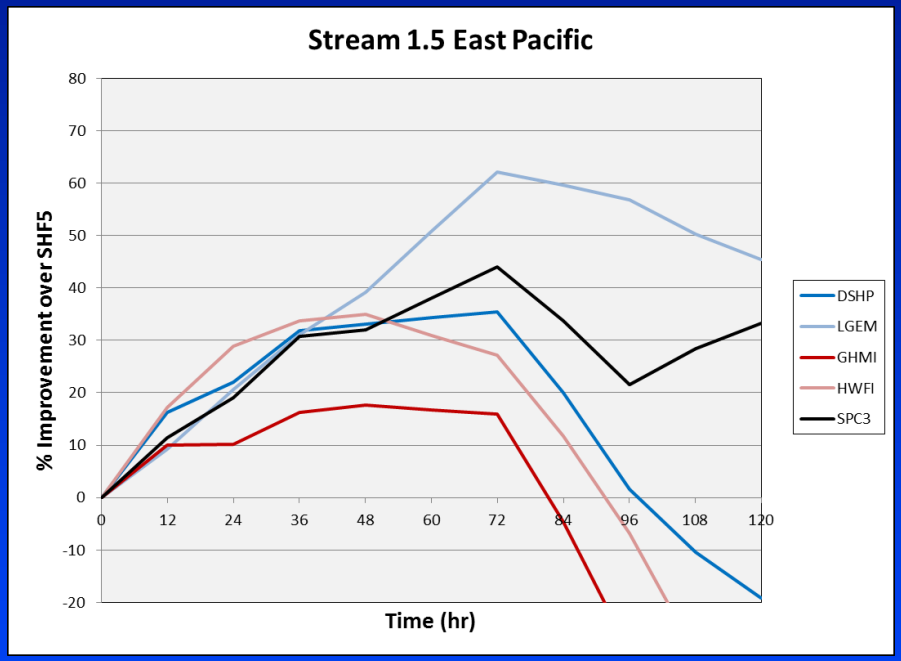


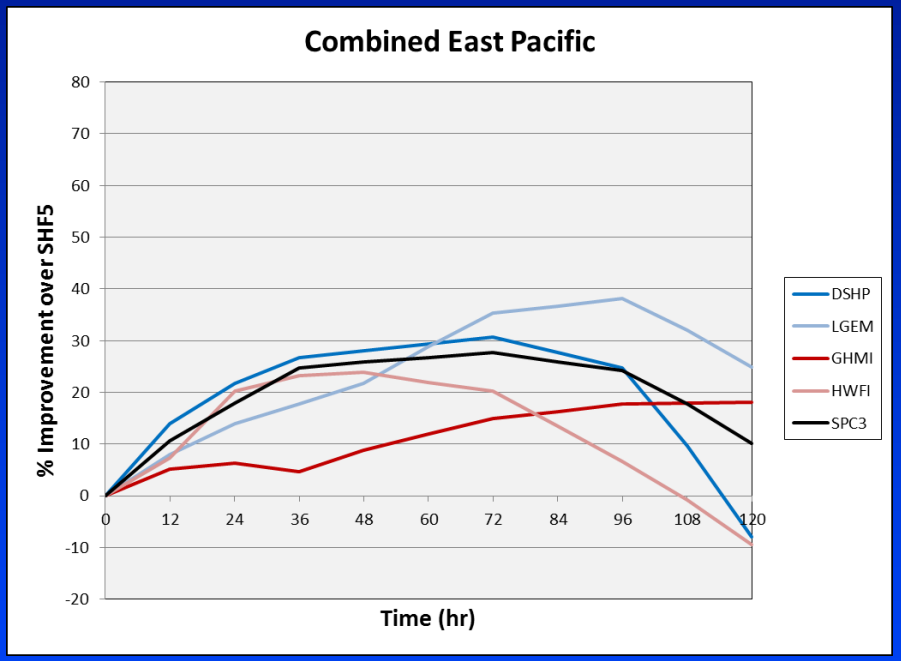
Mean Absolute Errors – East Pacific





Skill Relative to SHF5 – East Pacific





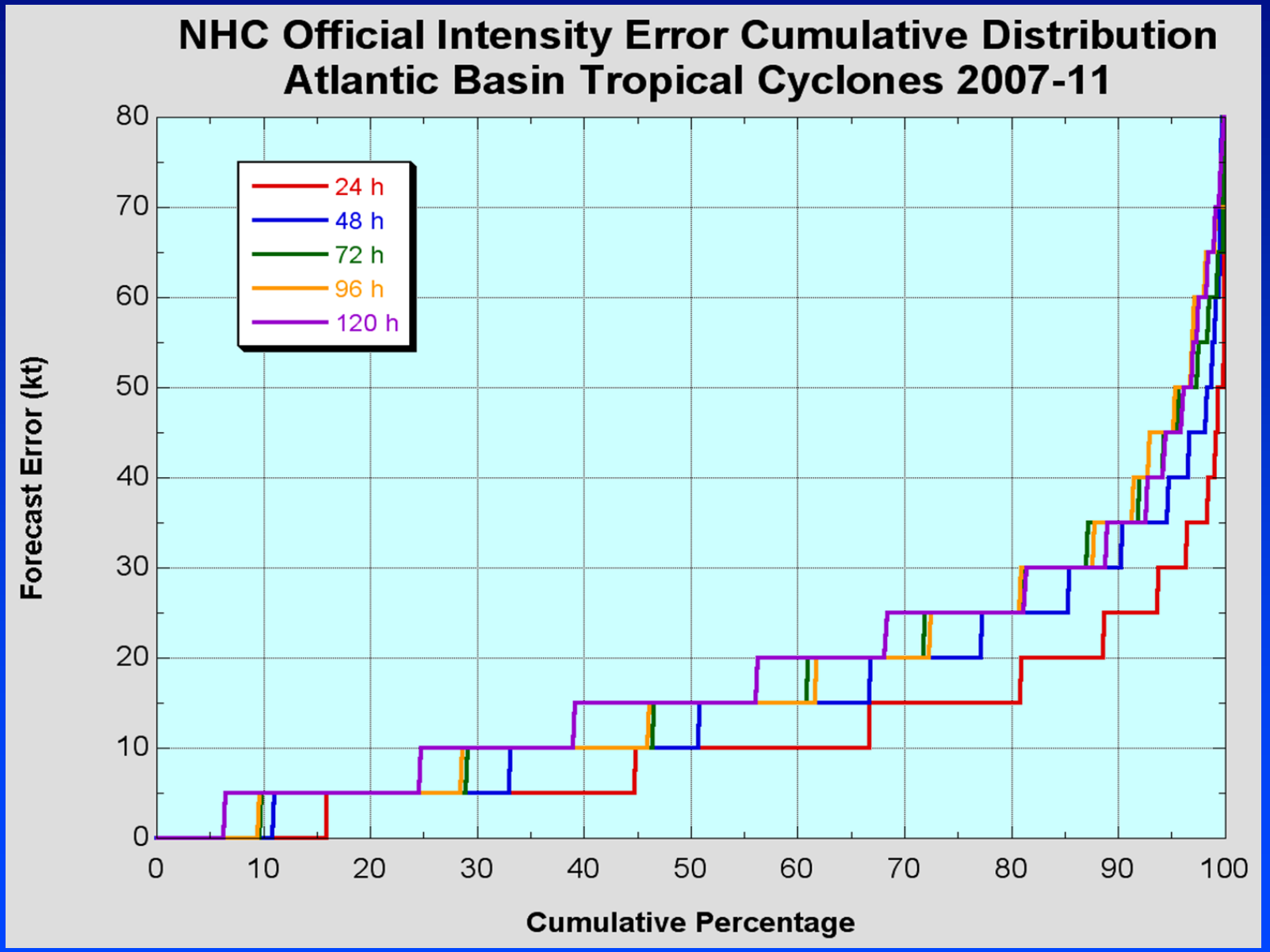
Global SPICE

- Producing diagnostic files from GFS EnKF 20-member ensemble starting 19 Aug 2012
  - 10,751 diagnostic files produced
  - Atlantic: 7,570 files; ~260 runs
  - East Pacific: 3,181 files; ~110 runs
  - Archive available to reproduce cases before 19 Aug 2012
- Diagnostic files provided by ESRL for ECMWF, CMC, NOGAPS, UKMET
- Collecting diagnostic files from NCAR for regional CoAMPS-TC, AHW4 models
- Results available for HFIP (virtual) Annual Meeting

Diagnostic Code Updates

- Code currently provided to:
  - EMC
  - NHC
  - NCAR
  - NRL
  - NOAA/ESRL
  - SUNY Albany
  - University of Wisconsin
- Code is currently being updated to remain consistent with latest version of SHIPS/LGEM
- Listed groups will be contacted in late November for inclusion of diagnostic code in retrospective runs
  - Unless otherwise indicated

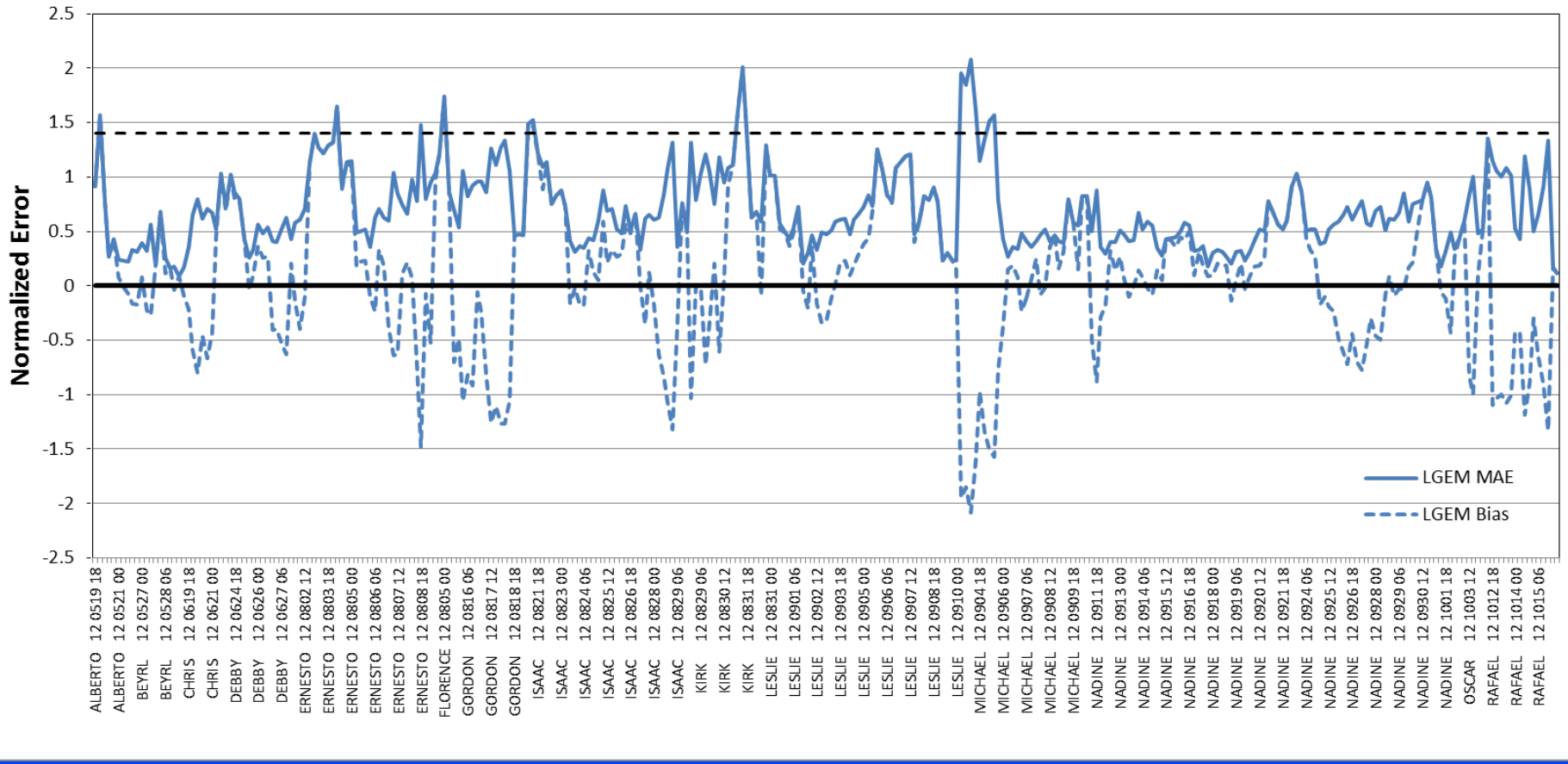
Outlier Analysis



Improvements to SPICE through Outlier Analysis

- Develop single parameter for intensity error for a given forecast case
  - Normalize error at each forecast time by standard deviation of intensity changes from best track over that time interval
  - Time averaged normalized intensity errors (TANIE)
  - Require verification out to at least 36 h
- Identify outliers
  - Look for common characteristics
  - Use as guidance for statistical model improvements
  - Adjust weights in SPICE if errors are systematic

TANIE for 2012 LGEM Forecasts



Top 10 TANIE Values for 2012 Models

	LGEM	DSHP	HWFI	GHMI
1.	Michael 090406	Kirk 083112	Michael 090406	Michael 090412
2.	Kirk 083112	Michael 090318	Michael 090418	Michael 090406
3.	Michael 090318	Michael 090406	Michael 090412	Michael 090400
4.	Michael 090400	Michael 090400	Michael 090400	Gordon 081518
5.	Florence 080500	Kirk 083106	Kirk 083112	Michael 090418
6.	Ernesto 080406	Michael 090412	Leslie 090606	Ernesto 080806
7.	Michael 090412	Leslie 083018	Ernesto 080506	Kirk 083112
8.	Kirk 083106	Alberto 052000	Leslie 090600	Michael 090500
9.	Alberto 052000	Kirk 083112	Leslie 083012	Michael 090506
10.	Michael 090512	Isaac 082112	Michael 090500	Nadine 092518

Blue = Low Bias Red = High Bias

Possible SPICE Improvements

- Low bias for RI cases
  - Use RII as predictor in SHIPS/LGEM
- High bias for nonlinear combination of dry air and shear (Kirk and several east Pacific cases)
  - New predictor for SHIPS/LGEM or modified MPI
- Shear direction relative to motion vector may be important (Ernesto, Gordon)
  - Modify shear direction predictor
- Larger uncertainty for low V(0), high SST cases
- Serial correlation of errors
  - SPICE weight adjustments

Summary

- SPICE was run for most cases during 2012 Hurricane Season
- Atlantic SPICE errors smaller than parent models for 24 thorough 72 hr
- East Pacific SPICE errors larger than some parent models at all forecast times
  - Mostly due to anomalously small LGEM errors
- Global Ensemble SPICE under development
- CIRA diagonstic code to be upgraded for 2013
- Outlier analysis may lead to SPICE improvements for 2013