Applications Development and Diagnostics Team Report

Mark DeMaria, NESDIS/STAR

Dave Zelinsky, NCEP/NHC

Input from HRD, EMC, NRL, JPL,

CSU/CIRA, UW/CIMSS, SUNYA, UCLA

HFIP Review Conference Call

November 7, 2012

Outline

- ADD Milestones
- Summary of diagnostics workshop
- Product development milestones (Zelinsky)
- Diagnostics milestones (DeMaria)
- Additional accomplishments
- Summary

HFIP Diagnostics Workshop

- Mostly Virtual from EMC, Aug 10th 2012
  - http://rammb.cira.colostate.edu/research/tropical_cyclones/hfip/workshop_2012/
- Participants
  - NOAA/NWS
    - EMC, NHC
  - NOAA Research
    - ESRL,GFDL, HRD, NESDIS
  - NCAR
    - DTC, TCMT
  - NASA
    - JPL
  - University
    - CSU, FSU, SUNYA, UCLA
- Progress review of the ADD Team milestones
- Ensure coordination with EMC and NHC priorities

FY12 ADD Milestones -1

- 6.1.1 NHC-specific ATCF tasks (NRL)
- 6.1.2 HWRF and global model derived satellite products (NHC, EMC, NESDIS)
- 6.1.3 Provide HWRF diagnostics products to NHC (NHC, EMC, NRL)
- 6.1.4 Develop multi-layer vertical shear product (NHC)
- 6.1.5 TC structure verification using real and model imagery (NHC)

- 6.2.1 NHC Visiting Scientist Program

FY12 ADD Milestones -2

- 6.1.6 Maintain/Enhance data service (TCMT)
- 6.1.7 Deliver GOES data for HWRF synthetic imagery evaluation (NESDIS, EMC, NRL)
- 6.1.8 Large-scale diagnostic code for HWRF evaluation (NESDIS, EMC, NRL)
- 6.1.9 SPICE model development (NESDIS, ESRL, NRL)
- 6.1.10 Environmental parameter verification from AHW and HWRF (SUNYA, EMC)
- 6.1.11 Ensemble-based sensitivity analysis (SUNYA, EMC)
- 6.1.12 Storm-relative post-processing (EMC, AOML)
- 6.1.13 Vortex/convective scale HWRF analysis (AOML, SUNYA, NCAR)

HFIP Annual Meeting: NHC Activities Slides

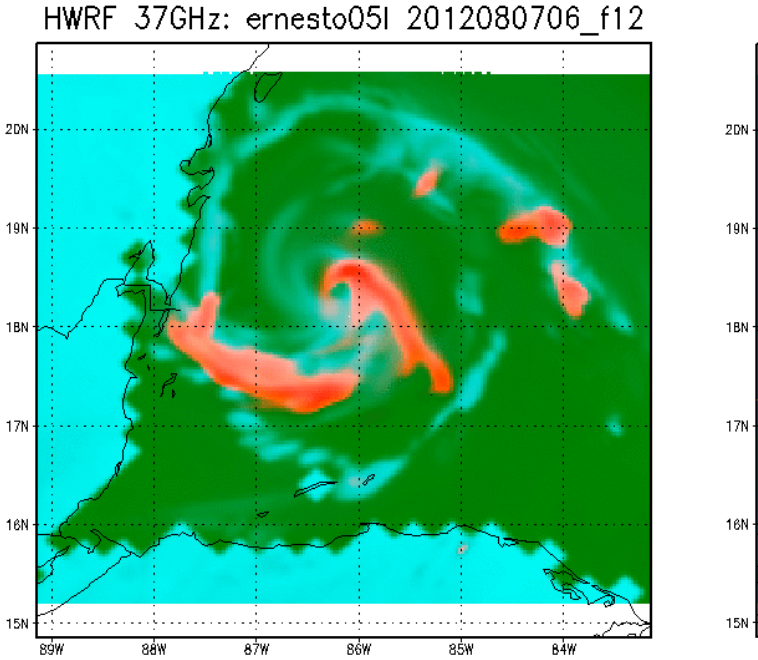
David Zelinsky, James Franklin, Wallace Hogsett, Ed Rappaport, Richard Pasch

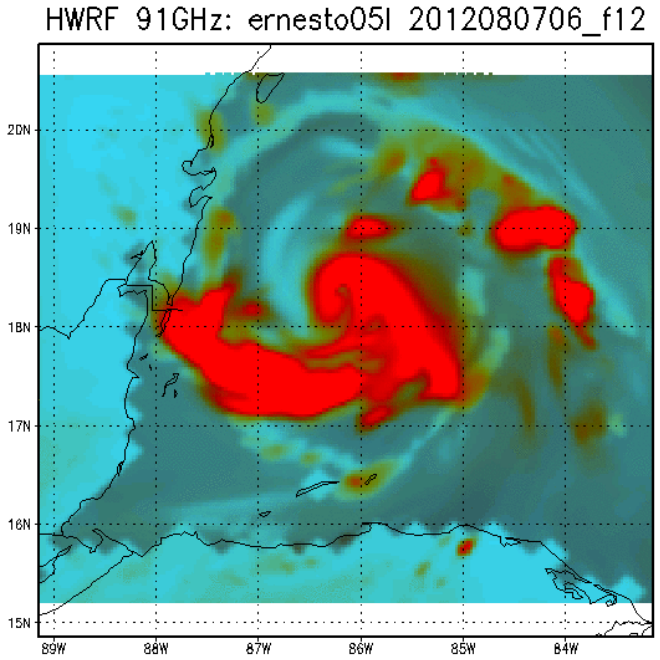
NHC Activities

Activities where NHC is the lead:

- **6.1.2** Provide real-time HWRF model-derived satellite imagery products for NHC forecasters. (completed)
- **6.1.3** Provide real-time high temporal resolution HWRF track/intensity/ structure diagnostic products to NHC forecasters. Extend products to other regional models as data is made available. (completed)
- **6.1.4** Develop experimental vertical shear text diagnostic product for various layers within select operational global and regional models. (GFS prototype developed, experimentally expanded to ECMWF)
- **6.1.5** Conduct a TC structure verification study comparing regional model simulated satellite/radar with satellite observations. (Ongoing, preliminary results presented in September. Complete season verification presented at AMS Annual Meeting, and probably a future HFIP Telecon)
- Developed (along with HRD) GrADS scripts for displaying deterministic regional and global model fields on the HFIP products website. (Completed for 2012, scripts may be updated for future seasons)

6.1.2 Provide real-time HWRF model-derived satellite imagery products for NHC forecasters.

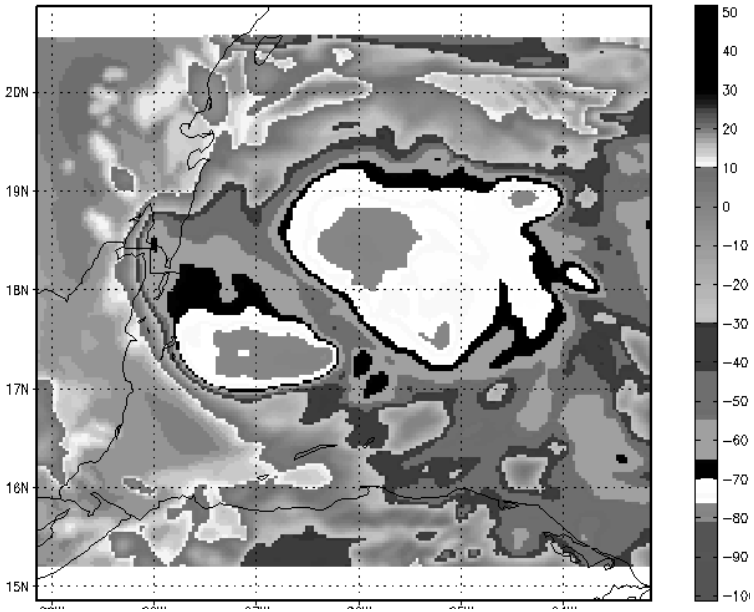




Forecast Valid:
18Z07AUG2012

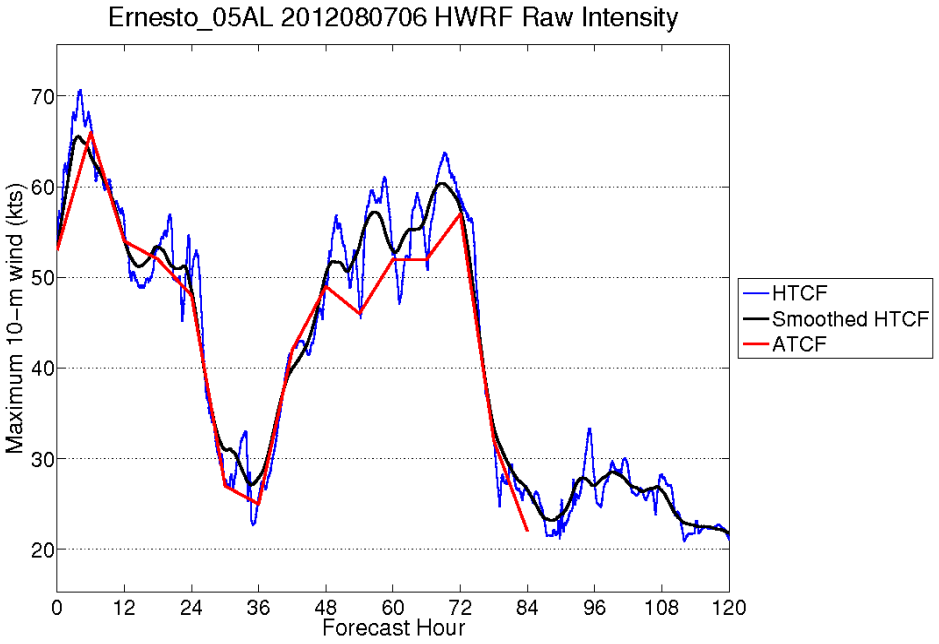
Storm Center:
18.4N
86.4W

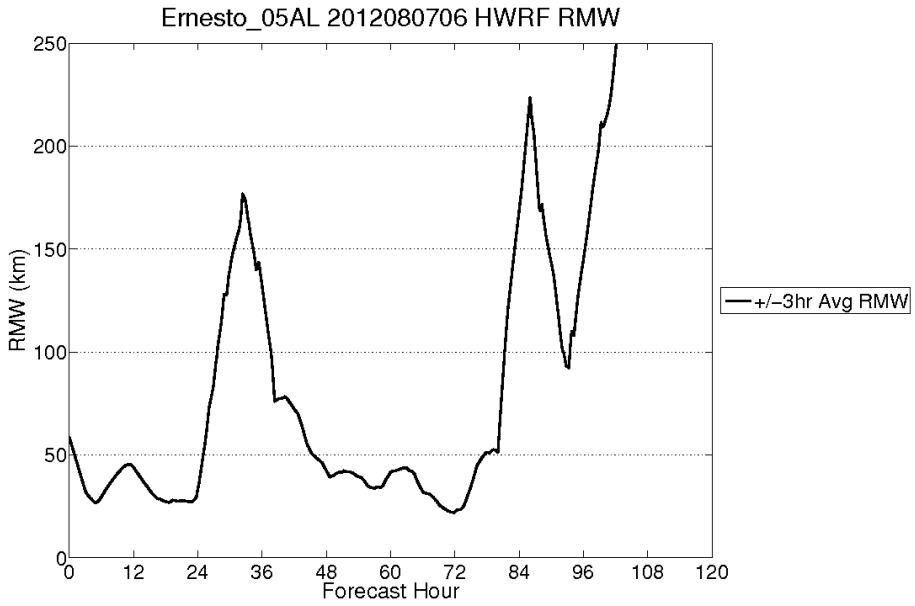
Intensity:
54.0kts



- Products were delivered beginning June 1.
- All products available in real time via NHC's intranet.
- 37 and 91 GHz color composites, and IR-Dvorak imagery being archived at NHC for later verification purposes.
- EMC also producing some imagery, which is available on the EMC-HWRF website

6.1.3 Provide real-time high temporal resolution HWRF track/intensity/ structure diagnostic products to NHC forecasters. Extend products to other regional models as data is made available.





- HWRF products were delivered beginning June 1.
- All products available in real time through NHC's intranet.
- Products also available on the HFIP website.
- AHW4 and UWN8 are also providing data; all products available on the HFIP website.

6.1.4 Develop experimental vertical shear text diagnostic product for various layers within select operational global and regional models.

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GFS VERTICAL SHEAR
NWS NATIONAL HURRICANE CENTER MIAMI FL
0605 UTC TUE AUG 07 2012

SYSTEM NAME                     DATE/TIME         LOCATION
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TROPICAL STORM ERNESTO          07/0000 UTC       16.6N 82.1W

SHEAR ESTIMATED FROM 0000 UTC 07 AUG AVNO FORECAST...

SHEAR VECTORS CALCULATED AS VECTOR DIFFERENCES OF AREA-AVERAGED
WINDS FOR VARIOUS VERTICAL LAYERS WITHIN TC-CENTERED SQUARE BOX.

NOTE THAT THIS PRODUCT FOLLOWS AVNO...NOT OFCL...
AND NO ATTEMPT IS MADE TO REMOVE THE TROPICAL CYCLONE VORTEX.

SHEAR DIRECTION IN DEGREES FROM NORTH...AND MAGNITUDE IN KTS...
MAX LEV IS DEFINED AS THE LAYER...BOUNDED BY THE MANDATORY LEVELS
IMMEDIATELY ADJACENT TO THE CENTER LEVEL...WITH THE MAX SHEAR.

AVERAGING BOX SIZE = 8 DEGREES BY 8 DEGREES
LAYER(MB).....................FORECAST TIME.....................
....... 00H    24H    48H    72H    96H    120H   144H   168H
850-700 253/03 289/01 299/05 327/06 069/06 044/03 074/08 080/03
850-500 304/07 317/06 329/07 011/08 078/10 082/10 085/09 104/04
850-400 312/09 305/07 342/06 028/12 075/14 083/13 089/09 106/05
850-300 327/10 302/08 351/05 015/13 081/16 081/10 088/08 105/06
850-200 327/06 304/03 343/10 011/17 069/15 067/11 078/08 094/08
850-100 000/11 028/10 080/14 050/26 070/38 069/39 080/30 083/24
MAX LEV 500MB  700MB  700MB  500MB  200MB  200MB  850MB  200MB
MAX SHR 333/08 317/06 329/07 059/11 021/15 024/12 069/10 022/11
.............................................................
AVERAGING BOX SIZE = 5 DEGREES BY 5 DEGREES
LAYER(MB).....................FORECAST TIME.....................
....... 00H    24H    48H    72H    96H    120H   144H   168H
850-700 267/05 290/01 301/06 322/09 050/08 013/04 070/09 086/03
850-500 304/10 336/06 001/09 022/13 069/17 074/13 083/12 089/04
850-400 321/11 318/04 030/09 041/18 070/20 078/14 086/12 099/05
850-300 349/11 278/03 038/07 035/16 076/19 069/07 089/11 095/07
850-200 357/06 023/03 338/08 012/18 063/17 064/12 101/08 103/06
850-100 352/13 040/11 082/17 053/27 064/42 063/41 083/30 087/23
MAX LEV 700MB  250MB  500MB  500MB  700MB  200MB  850MB  200MB
MAX SHR 304/10 063/06 065/11 072/18 069/17 017/14 061/14 009/10
.............................................................
AVERAGING BOX SIZE = 2 DEGREES BY 2 DEGREES
LAYER(MB).....................FORECAST TIME.....................
....... 00H    24H    48H    72H    96H    120H   144H   168H
850-700 273/10 053/02 358/03 343/20 058/12 057/11 075/11 143/01
850-500 319/16 049/05 044/15 043/25 079/18 072/23 094/19 150/04
850-400 326/12 081/07 077/16 051/30 085/17 070/20 103/22 149/05
850-300 345/07 080/07 076/10 062/24 078/14 066/13 128/17 160/04
850-200 329/00 071/08 027/13 048/20 065/15 061/16 142/06 224/08
850-100 330/12 071/23 079/27 049/29 063/43 063/49 090/33 094/15
MAX LEV 700MB  500MB  500MB  500MB  700MB  700MB  700MB  200MB
MAX SHR 319/16 090/06 090/16 091/30 079/18 072/23 094/19 000/10
.............................................................

PLEASE SEE THE LATEST TROPICAL CYCLONE PUBLIC ADVISORY FOR THE
OFFICIAL TROPICAL CYCLONE FORECAST
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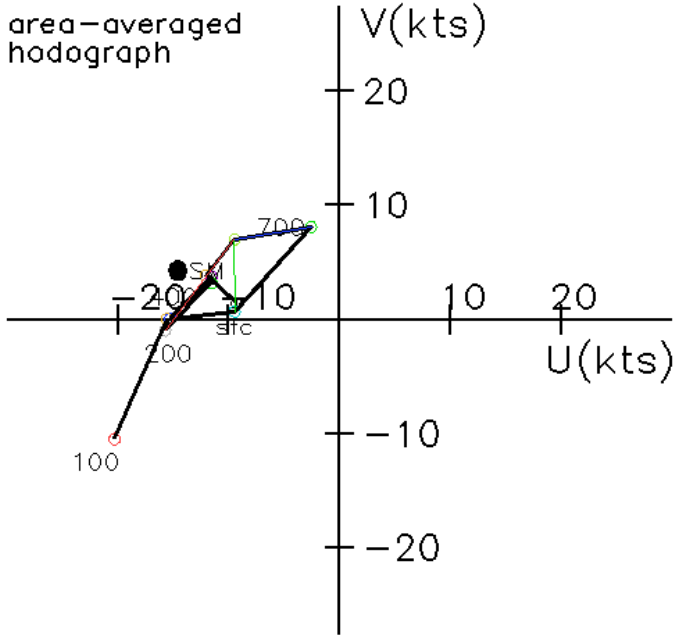
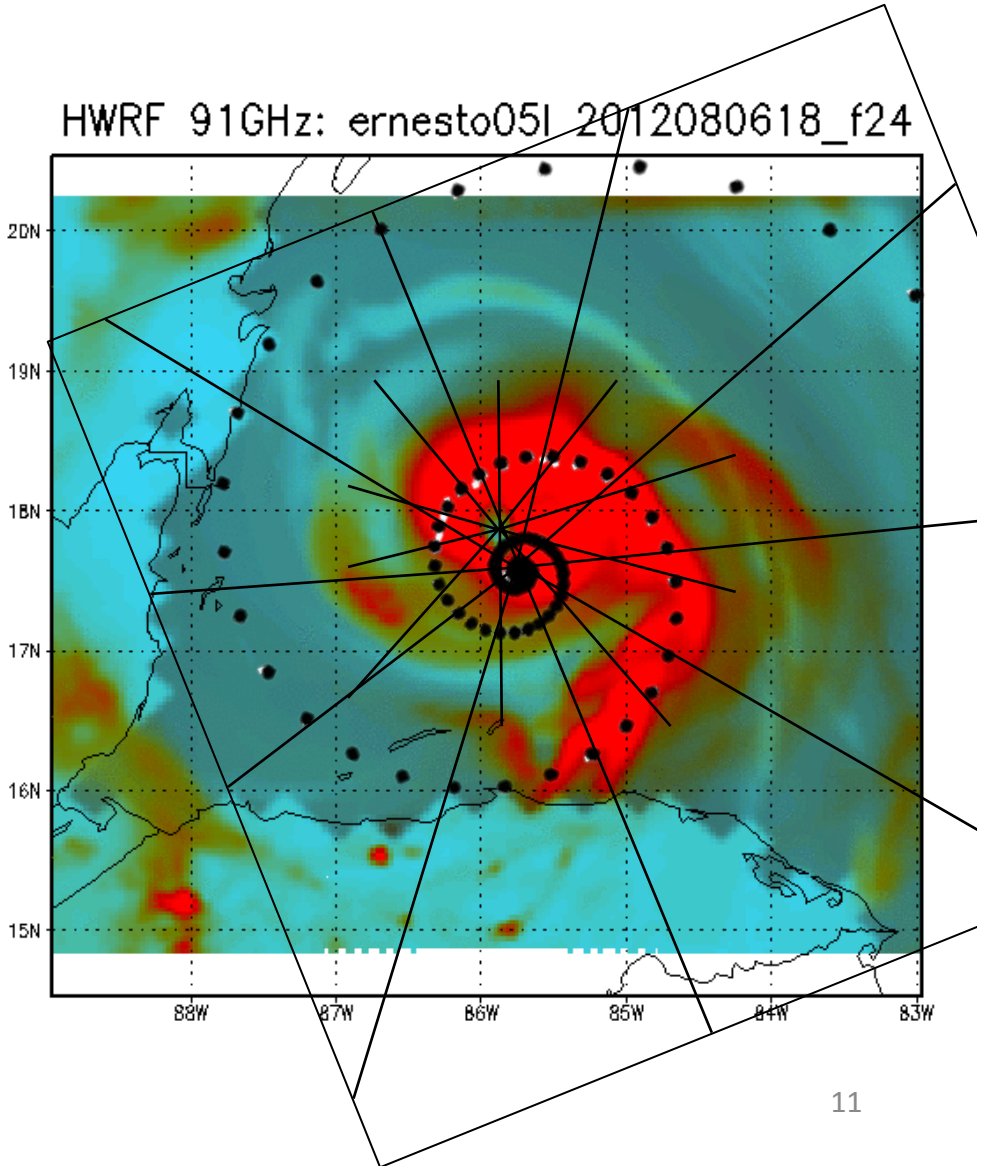


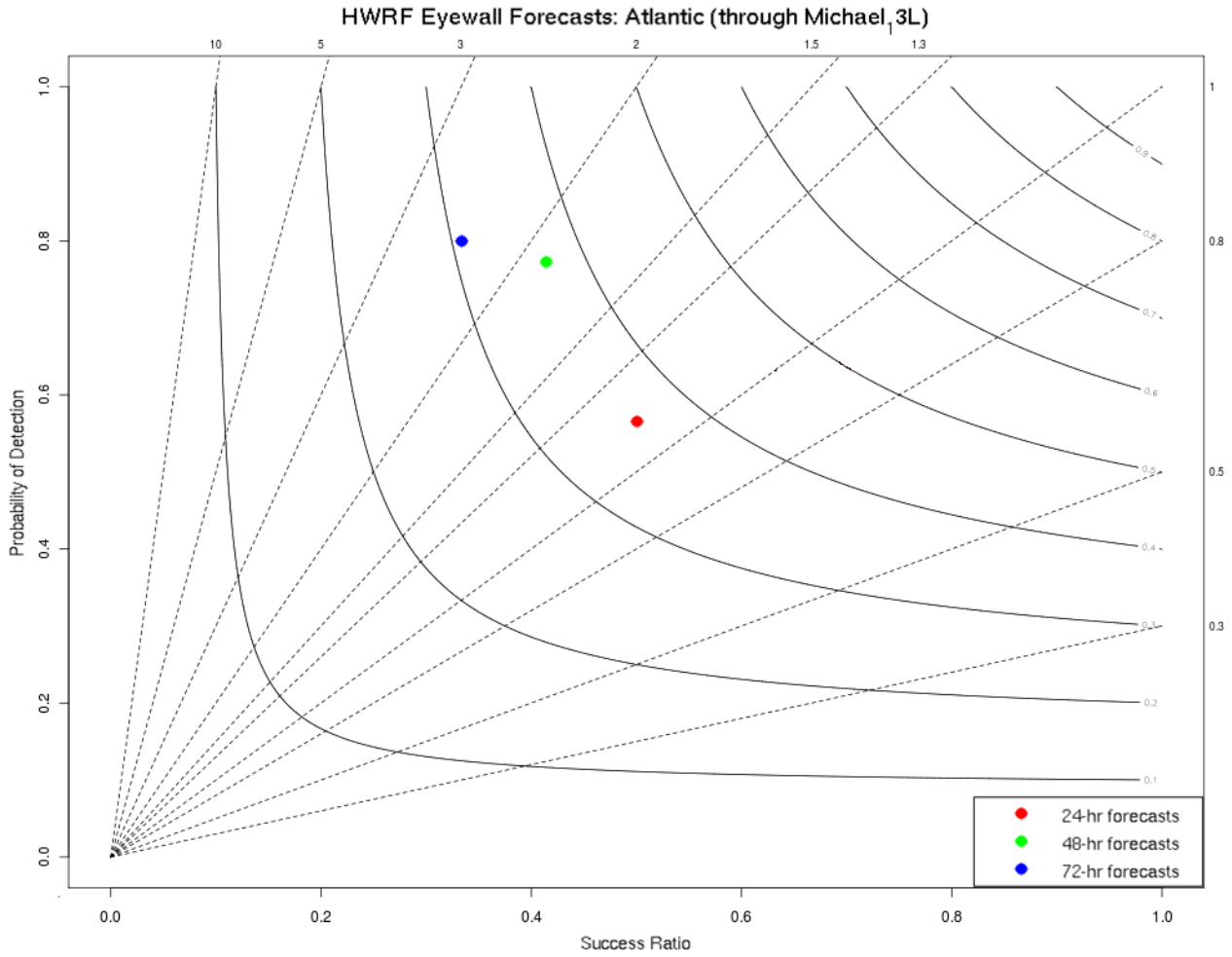
- Prototype for the GFS is currently running in real time, and is actively used by forecasters.
- Accompanying graphics have been developed.
  - Multi-layer streamline analysis
  - Hodograph
- Product also being developed for the ECMWF, and eventually the HWRF and GFDL.

6.1.5 Conduct a TC structure verification study comparing regional model simulated satellite/radar with satellite observations. (Ongoing, preliminary results in presented in early September).

- Evaluating operational HWRF structure by verifying synthetic satellite microwave imagery against real satellite observations.
- Utilizes color composites to minimize the impacts of resolution, assumptions in the BT generation, and instrument differences.
- Verification done by quantifying the presence of an eyewall (in tenths) and/or a primary band (using a Dvorak log-10 spiral) in 24, 48, and 72 hour forecasts, against the closest available satellite pass.



Preliminary Results



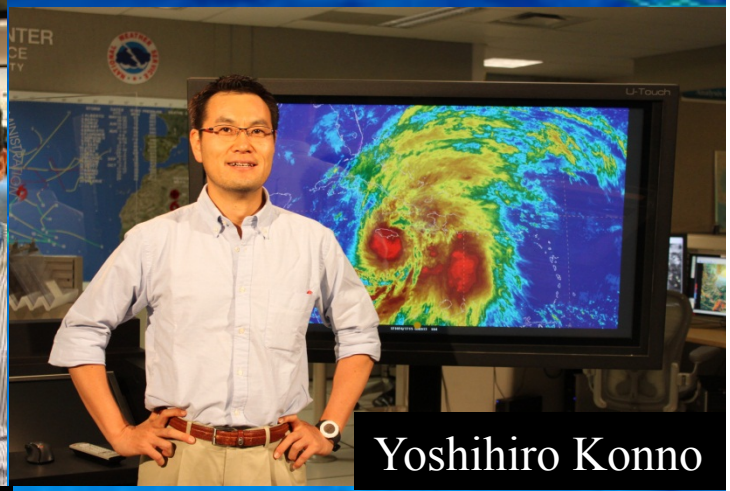
Stats

- High Probability of Detection, however there is also a very high bias.
  - 50% or more of "yes" forecasts are false alarms at all forecast hours.
- Overall accuracy is 70-75%
  - Buoyed by large number of correct null cases

6.2.1 The Visiting Scientist Program at the National Hurricane


Ryan Torn


Andre van der Westhuysen


Yoshihiro Konno

2012 Participants

Dave Nolan - University of Miami - genesis/structure -Jul 31-Aug 3
Hayden Frank - WFO Boston - forecaster - Aug 7-10
Clark Evans - UW-Milwaukee - genesis/extratropical transition -Aug 14-17
Vijay Tallapragada - EMC - modeling - Aug 20-23
Orlando Bermudez - WFO Austin - forecaster -Aug 28-31
Scott Prosise - OPC - forecaster - Sep 10-13
Josh Cossuth - FSU - genesis - Sep 19-22
Brad Klotz - HRD/CIMAS - stepped frequency microwave radiometer - Sep 24-27
Andre van der Westhuysen - MMA Branch - wave/surge modeling - Oct 1-4
Ryan Torn - SUNY-Albany - data assimilation/modeling - Oct 8-11
Yoshihiro Konno - Weathernews - forecaster - Oct 22-25

6.1.1 ATCF Upgrades

- **Note: No HFIP funding in FY12, but work continued under NRL Base**
- **31 NHC Improvements in FY 2011**
- **25 NHC Improvements in FY 2012**
- **Web ATCF implemented**

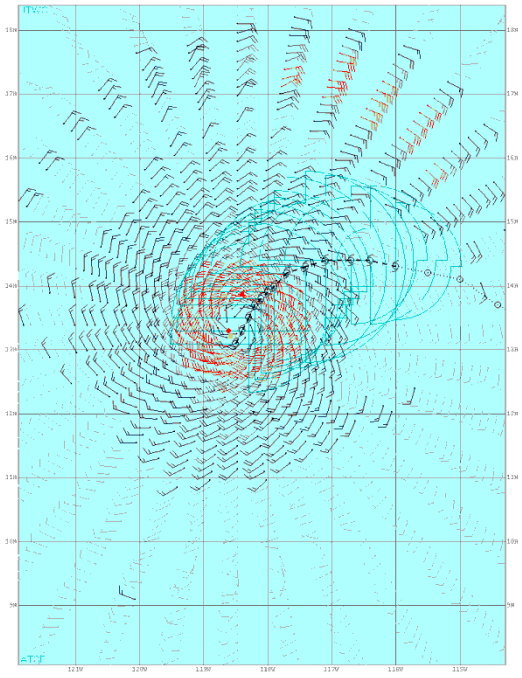
#153: Allow NHC to adjust period of interpolation phase out
#154: Reduce unrealistic intensity values from interpolator
#80: make a "colors by intensity" legend
#21: develop capability to handle large ensembles in a-decks.

Click Here for Yearly Requirements Meeting Documentation

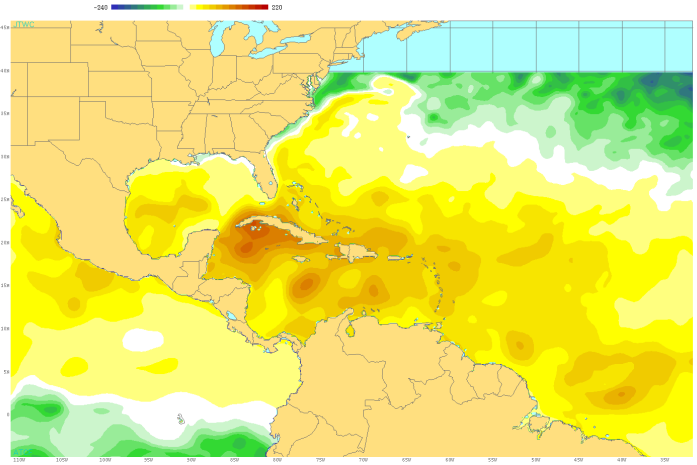
Web-ATCF: New data and capabilities

Uses:

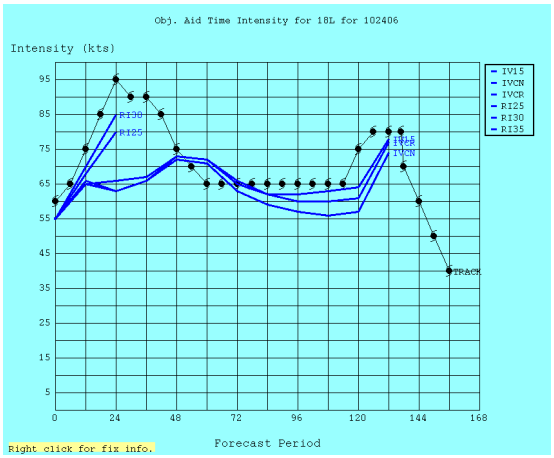
- **Situational awareness**
- **Training**
- **Demonstrations**
- **Research**
- **Statistics**
- **Graphics**



CIRA Sfc Winds



NCODA OHC



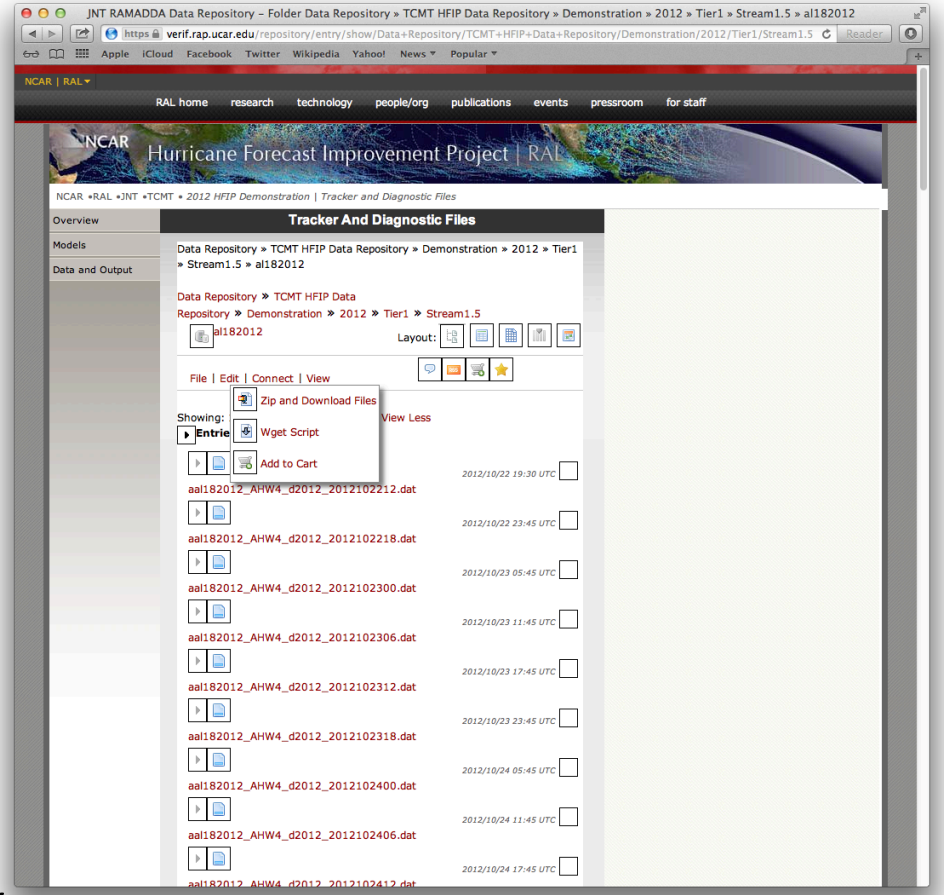
Deterministic RI guidance

- Added capability to email graphics
- Improvements to ATCF end up in Web-ATCF

6.1.6 TCMT HFIP Data Service

https://verif.rap.ucar.edu/ramadda

- Provides access to real-time and historical demonstration and retrospective ATCF forecast and diagnostic data to the HFIP community
- Password protected interface
  - Username & password: ***hfipteam***
- Demonstration data includes experimental stream 1.5, stream 2, and operational forecasts
- Retrospective data includes experimental stream 1.5 forecasts
- Future Enhancements:
  - Access to gridded Tier 2 data
  - Interactive graphical display capability

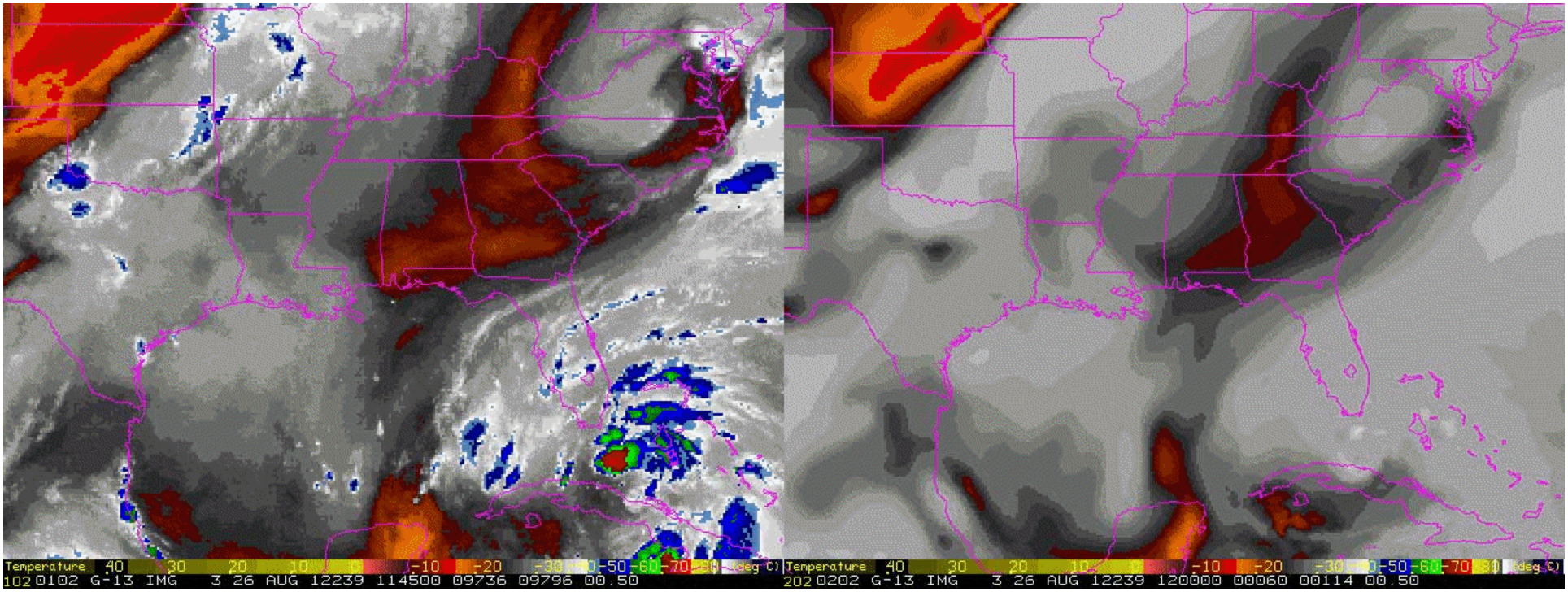


6.1.7 Deliver GOES data for HWRF synthetic imagery evaluation (NESDIS, EMC, NRL)

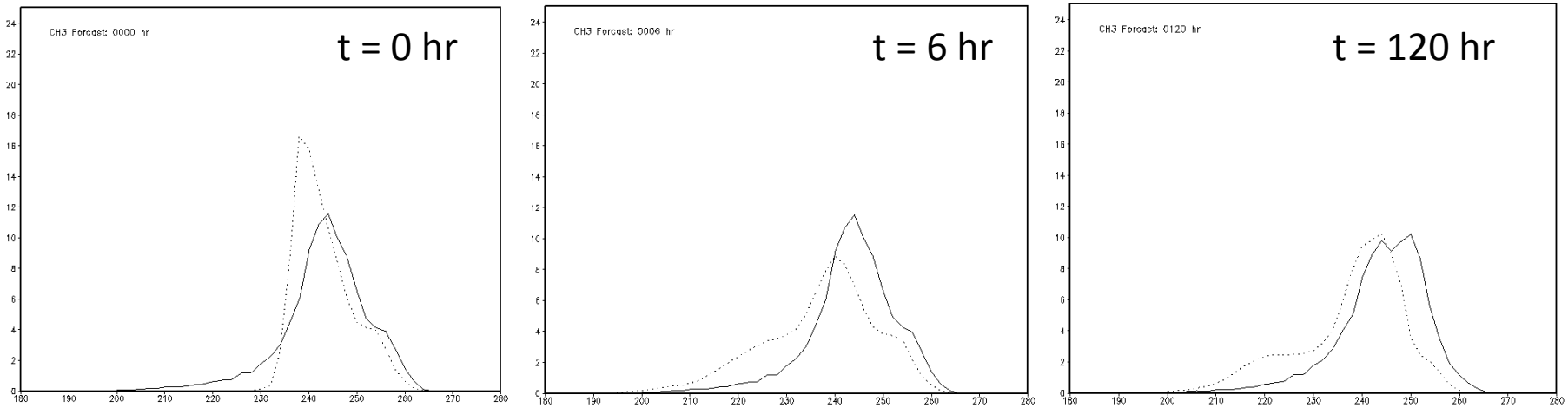
- Real GOES IR data collected for 2010, 2011, 2012
  - Channels 3 and 4
  - Atlantic completed, East Pacific underway
- Converted to binary form
  - For use outside of McIDAS environment
  - Available to all interested groups
- Used for comparison with HWRF synthetic imagery

Real and Synthetic GOES Water Vapor Imagery for Hurricane Isaac

5 Day Forecast Starting 26 Aug 2012 12 UTC



Histograms of Real and Synthetic WV Imagery for All Isaac Forecasts

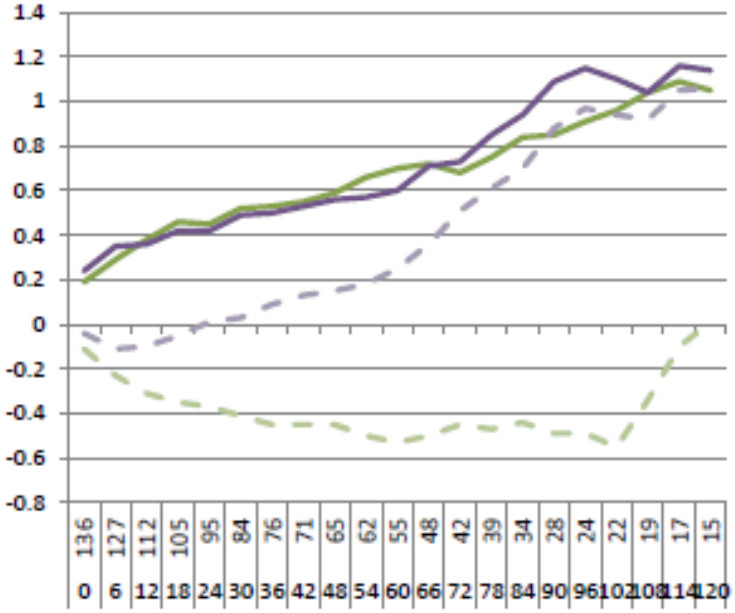


…….. HWRF Synthetic GOES Channel 3
_____ Real GOES Channel 3

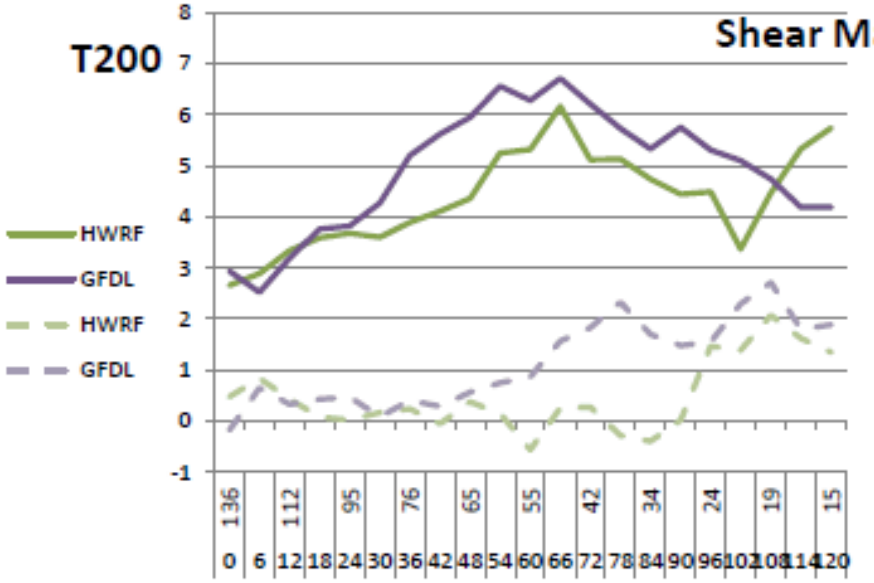
6.1.8 Large-scale diagnostic code for HWRF evaluation (NESDIS, EMC, NRL) and **6.1.10** Environmental parameter verification from AHW and HWRF (SUNYA, EMC)

- Large-scale diagnostics code calculates storm environmental parameters in simple ASCII format
- Used to evaluate model prediction of storm environmental parameters
- Can be used to run SHIPS and LGEM
- Distributed to several HFIP groups
  - EMC, NHC, NCAR, NRL, ESRL, SUNYA, UW
- Being run on some Stream 1.5/2 models and sent to DTC

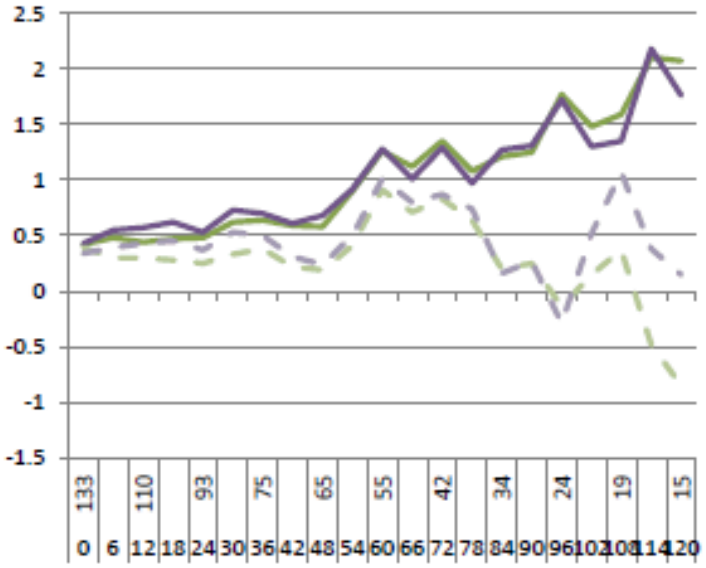
Diagnostic Verification – HWRF and GFDL 2012 AL



T200

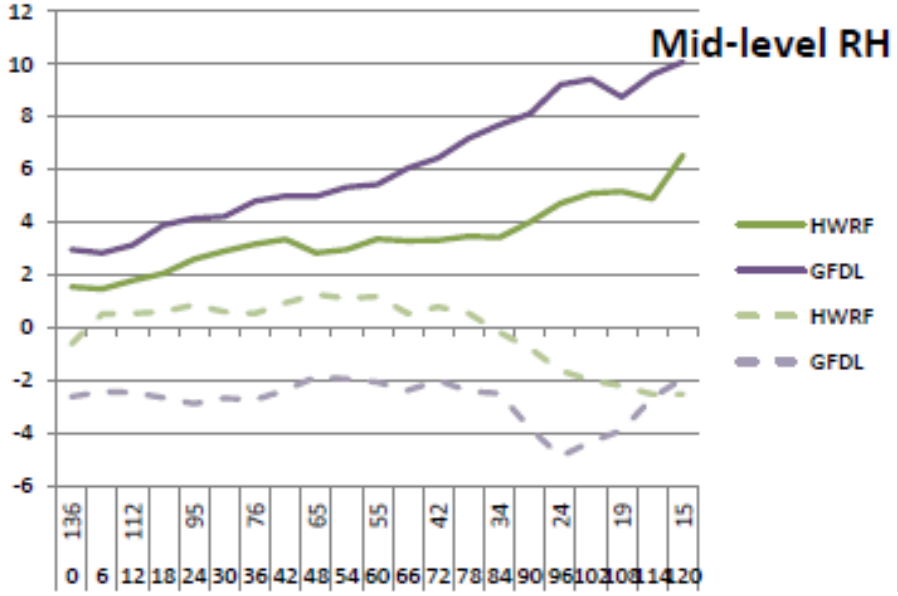


Shear Magnitude



SST

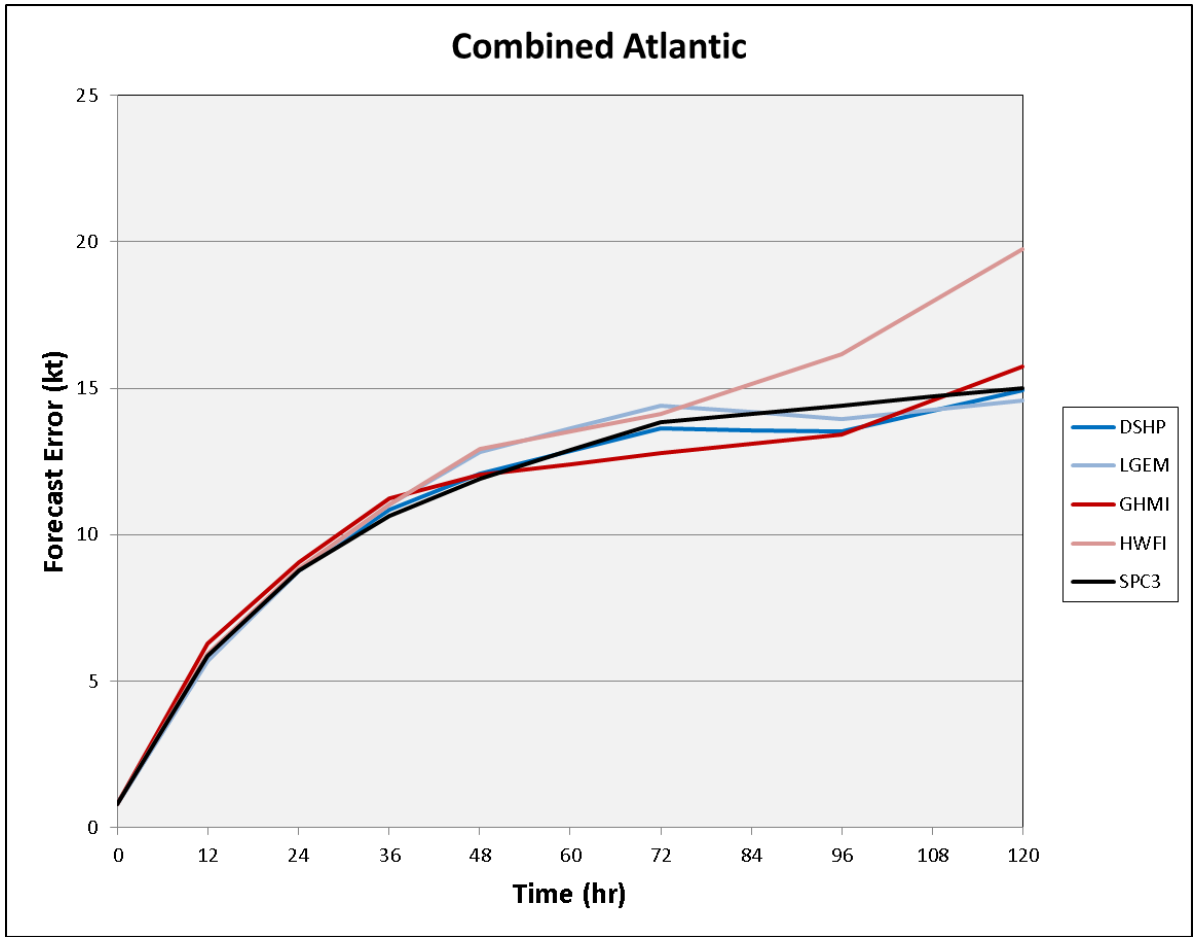
Mid-level RH



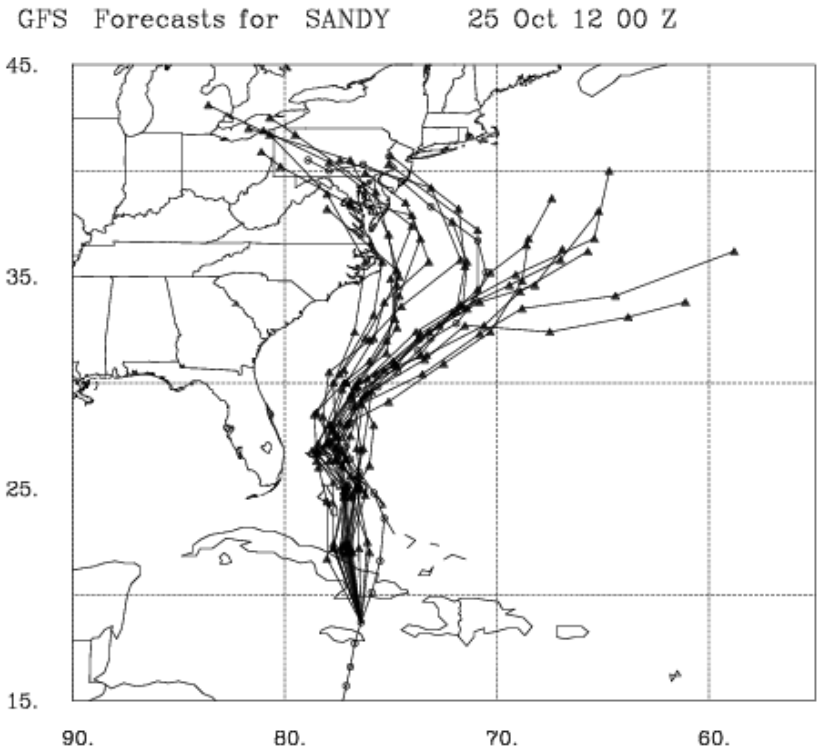
6.1.9 SPICE model development (NESDIS, ESRL, NRL)

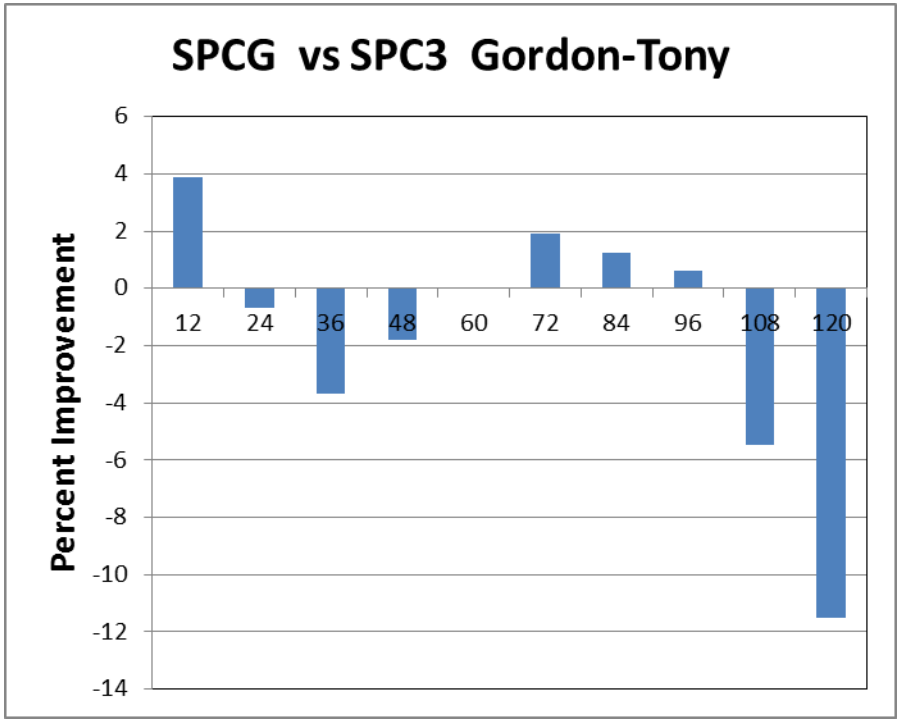
- SPC3 – 3 parent model version in Stream 1.5
  - GFS, GFDL, HWRF input to SHIPS and LGEM
  - Unequal weighting of SHIPS and LGEM based on past performance
- Stream 2 tests
  - Add other regional models as parent models
    - COAMPS-TC, AHW, UW Model
  - SPCG – Global model SPICE
    - 20 GFS and 10 FIM ensemble models
    - GFS, UKMet, ECMWF, NOGAPS, CMC, FIM base models
      - M. Fiorino (ESRL) input files

SPICE and Parent Model Errors Atlantic 2012 (Alberto through Tony)



SPCG Preliminary Results

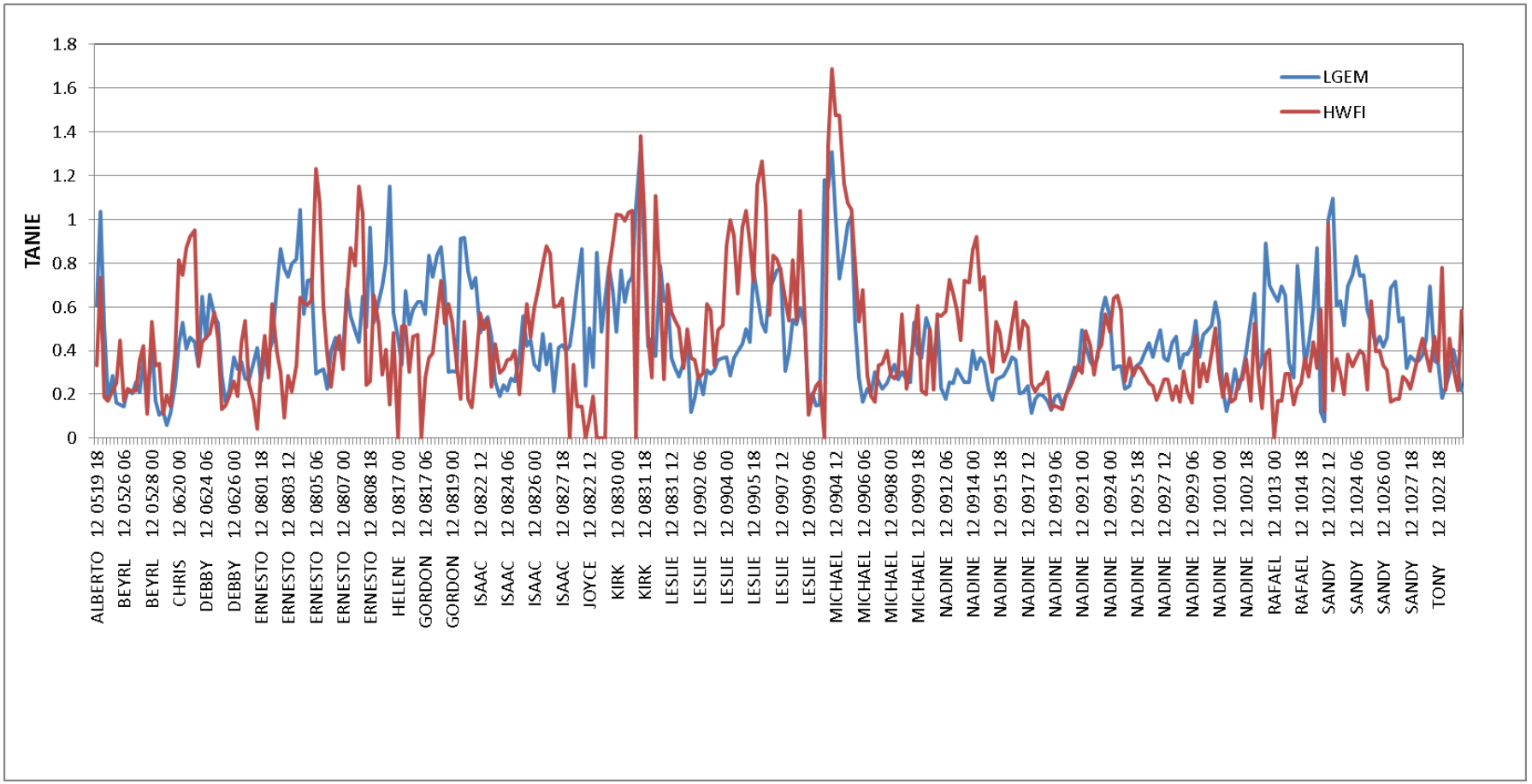




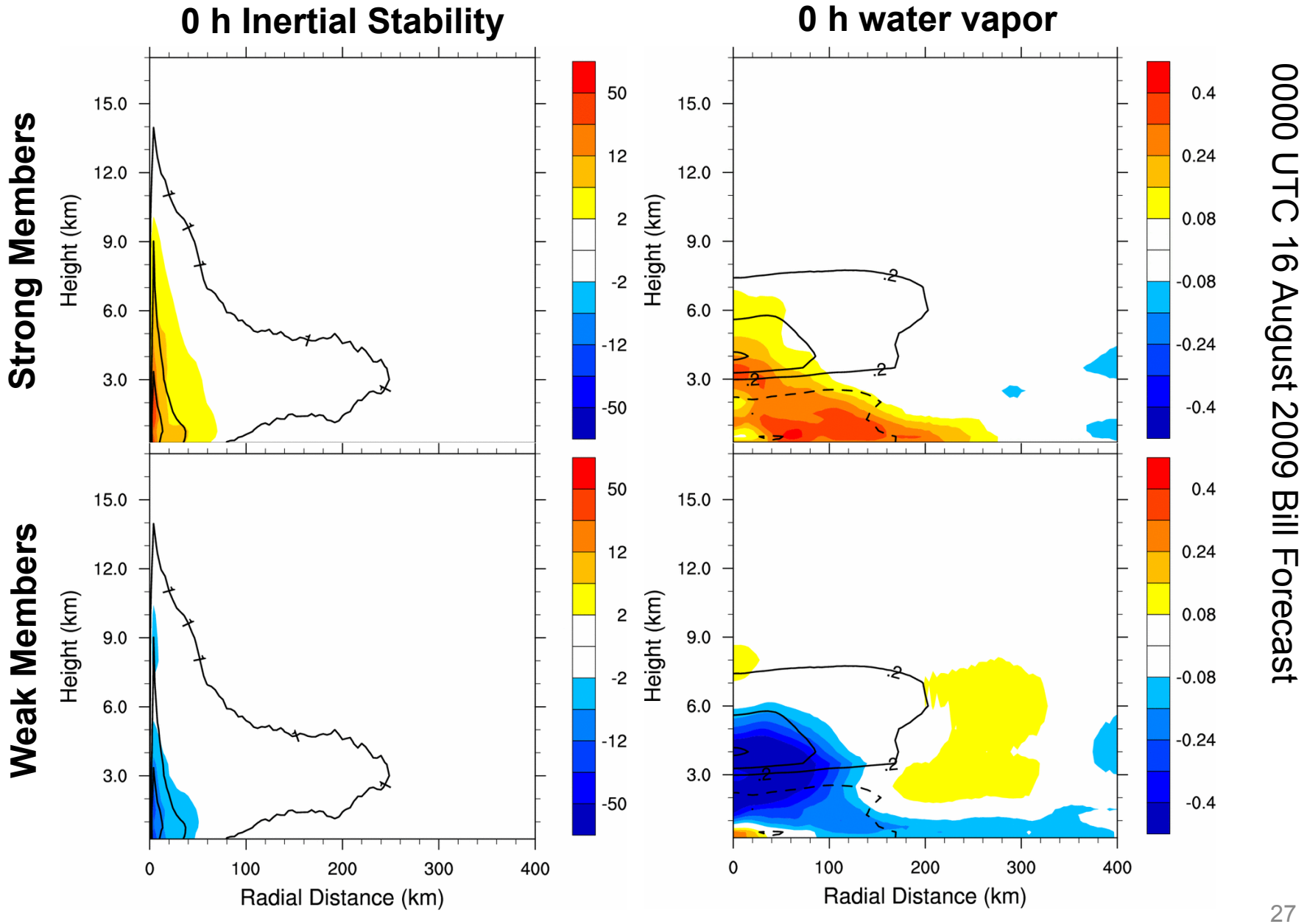
Time Averaged Normalized Intensity Error (TANIE)
Simple Parameter for Comparing Parent Models

- Calculate standard deviation (σ_t) of observed intensity changes at 12, 24, …, 120 hr
  - Use Atlantic 2006-2011 sample
    - 13, 19, 24, 28, 31, 32, 34, 36, 36 kt
- For each forecast case and model, divide intensity error at each time by σ_t
- Average normalized over forecast interval
- Provides one number per forecast time for inter-model comparison
  - Can also average over storm lifetime

TANIE for LGEM and HWFI
2012 Atlantic Sample



6.1.11 Forecast Sensitivity Analysis

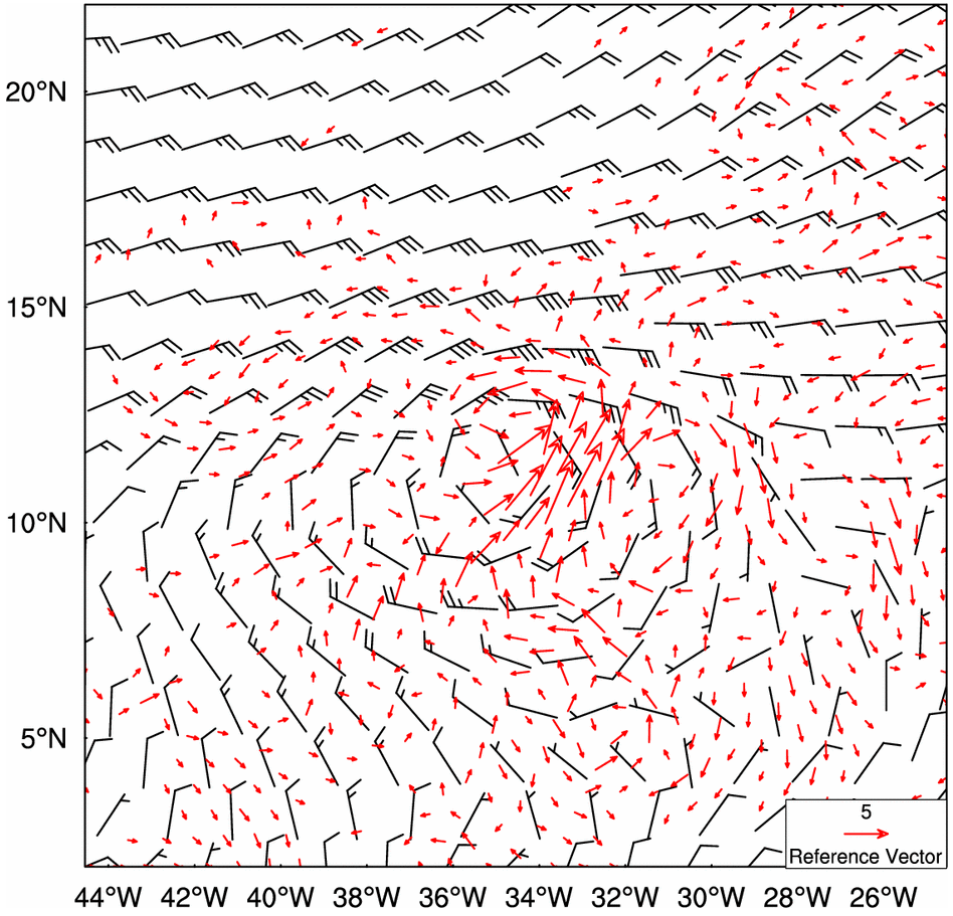


0000 UTC 16 August 2009 Bill Forecast

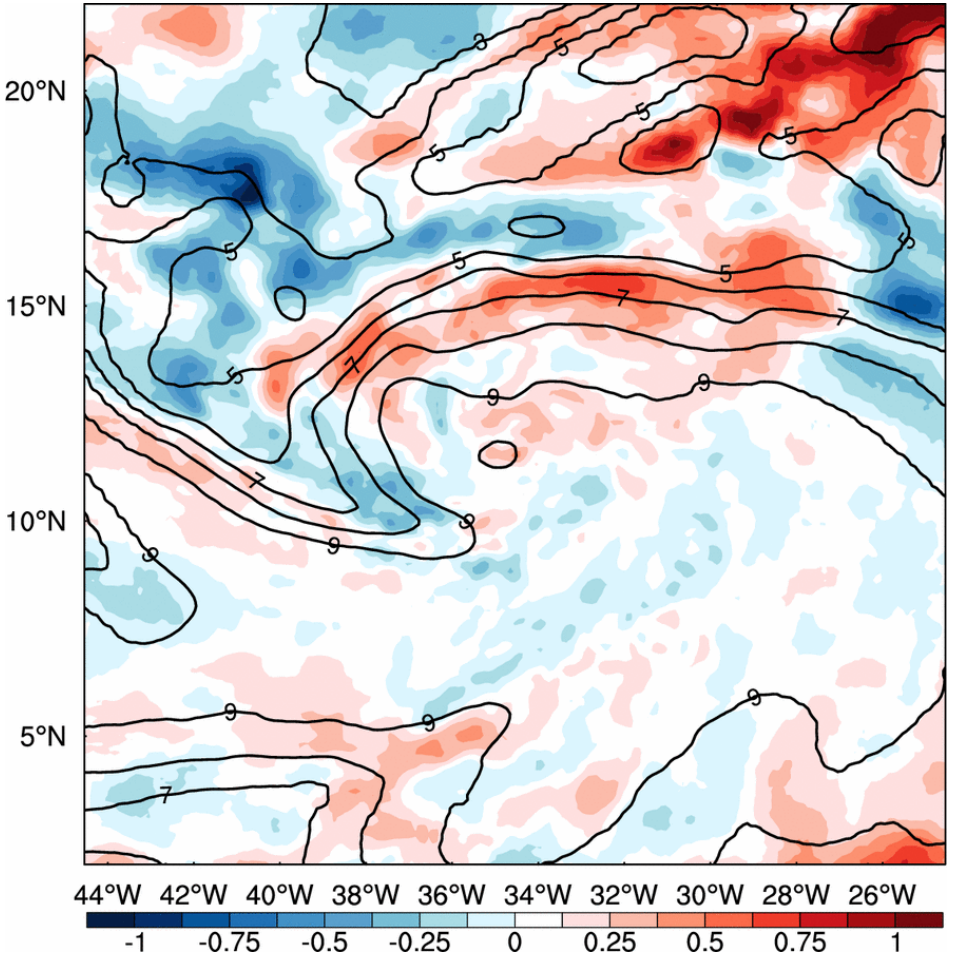
Ryan Torn, Univ. Albany

Forecast Sensitivity Analysis

700 hPa Wind



700 hPa Water Vapor



0000 UTC 16 August 2009 Bill Forecast

6.1.12 Storm-relative post-processing (EMC, AOML)

- EMC coordinating with HFIP groups on diagnostic tools
  - HRD – storm-relative analyses, in situ/radar data
  - NHC- Products and synthetic μ-wave imagery
  - CIRA – Large scale diagnostics, IR imagery
  - SUNYA – large scale, ensemble-based diagnostics
  - DTC – Basin wide HWRF evaluation
- In-house development of atmosphere and ocean diagnostics

Sample of EMC Real-Time HWRF Products Page

http://www.emc.ncep.noaa.gov/gc_wmb/vxt/index.html

Environmental Modeling Center

NCEP Hurricane Forecast Project

HWRF Runs: SANDY18L 2012

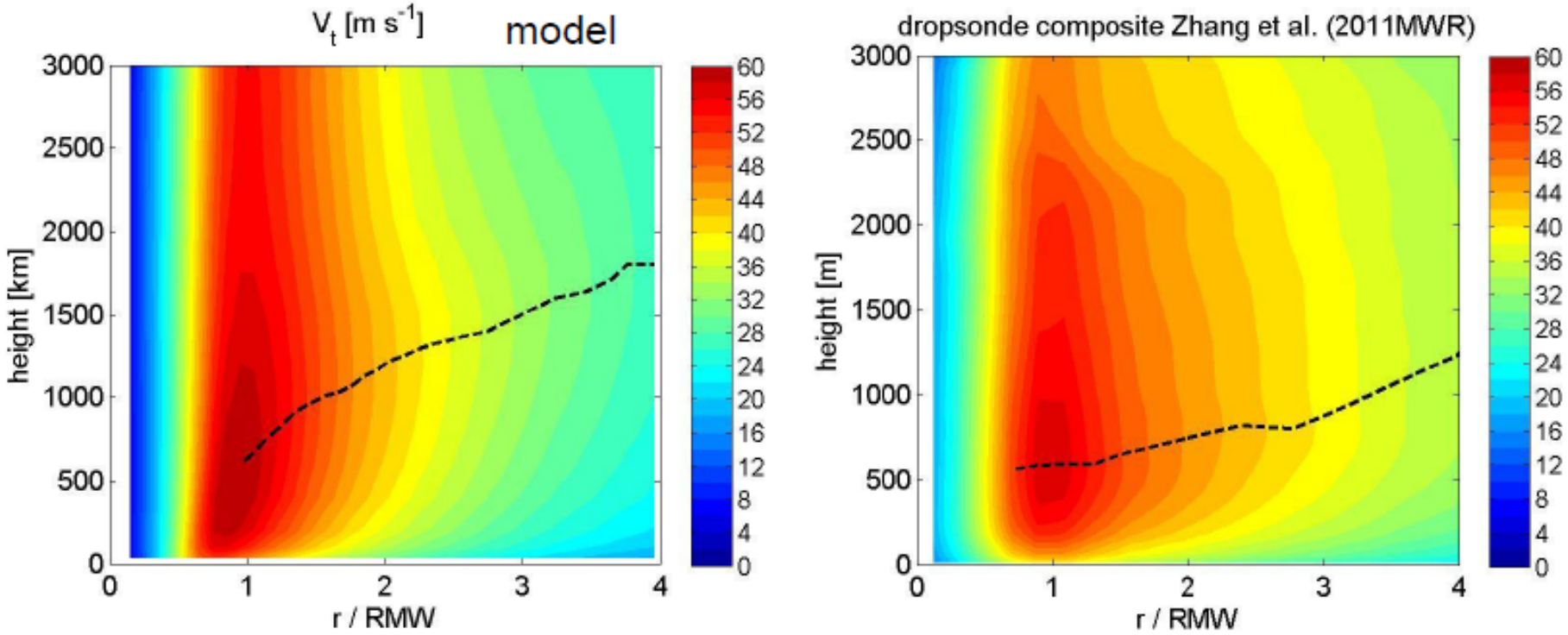
Back to HWRF Main Page

Experiment	Track/Intensity Forecast	Text Forecast		850 hPa Streamlines, Isotachs & swath			Large scale diagnostics (outer domain)					Simulated GOES & Microwave Images				EMC Module Plots>			Add'l Diagnostics	
SANDY18L.2012102918	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102912	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102906	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102900	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102818	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102812	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102806	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102800	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102718	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102712	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102706	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102700	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102618	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102612	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102606	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102600	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102518	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102512	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102506	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102500	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102418	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102412	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102406	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure
SANDY18L.2012102400	Track/Intensity	ATCF	Diag. Text File	Combined Domain	Vertical section	Rain/wind swath	Deep layer mean	Wind shear	Mid-High trough	500mb Rel Vort	Sfc pressure	GOES IR	GOES WV	37 GHz	89 GHz	Vertical X-Sect	Sfc Wind Field	Moisture X-Sect	Wind Structure	Thermal Structure

6.1.13 Vortex/convective scale HWRF analysis (AOML, SUNYA, NCAR)

- HRD Model Evaluations
- Comparison with in situ and radar data
  - Airborne Doppler, SFMR, GPS soundings, flight level data
- Composite vorticity structures, boundary parameters
- Low wavenumber wind fields

Height of Vtmax



Black dashed line represents the height of maximum tangential wind speed

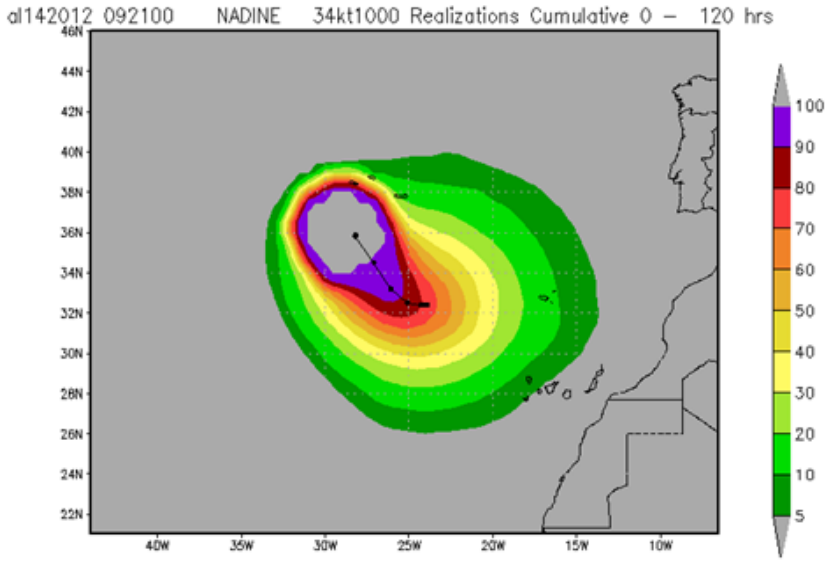
Additional Activities

- A1. CIRA Ensemble Product Development
- A2. FSU Correlation Based Consensus
- A3. DTC evaluation of basin-scale HWRF
- A4. GFDL model sensitivity studies
- A5. COAMPS-TC diagnostics
- A6. UCLA parameterization impacts
- A7. JPL Data Portal

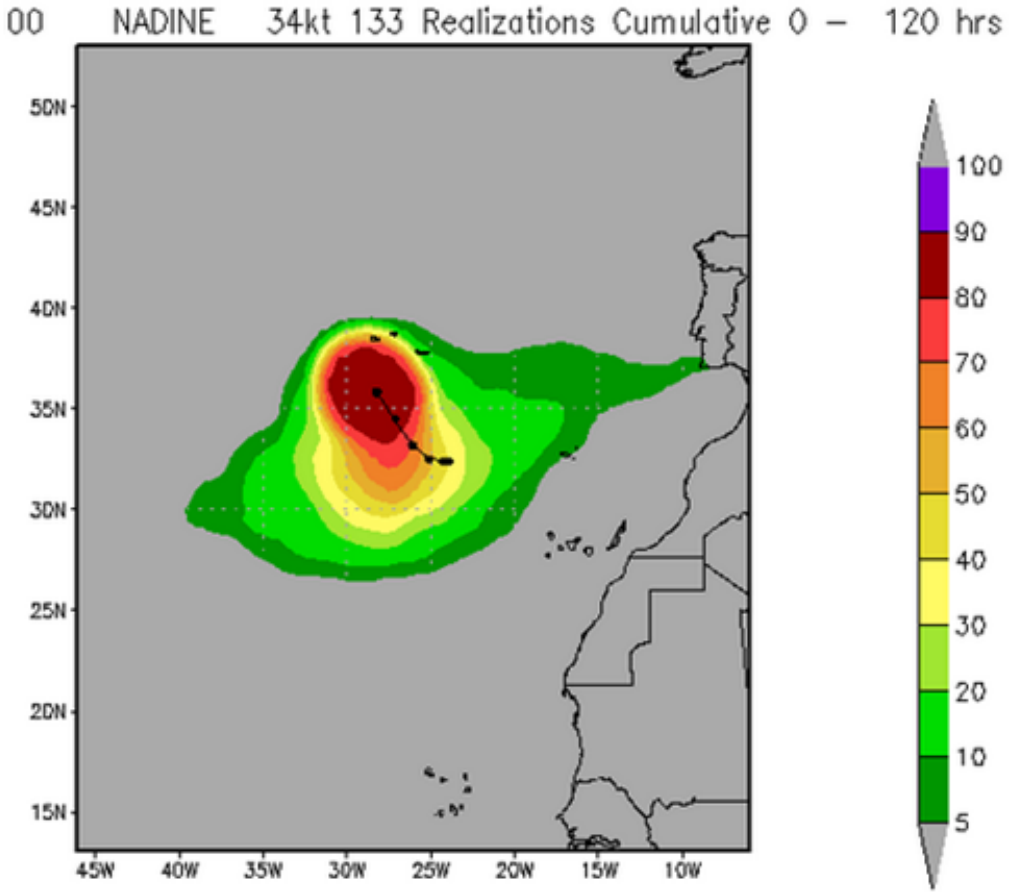
A1. CIRA Hybrid Wind Speed Probability Product

- Modify NHC's operational wind speed probability model
  - Tracks from global ensembles instead of statistical method
    - 133 tracks used: GFS (20), CMC (20), EMCWF (50), FNMOC (20), and UKMET (23)
  - Intensity, structure from operational statistical method
- Run in near real time, posted on HFIP products page
- Being evaluated using verification system for operational wind speed probabilities

Example of Hybrid and Operational 34 kt Wind Speed Probabilities

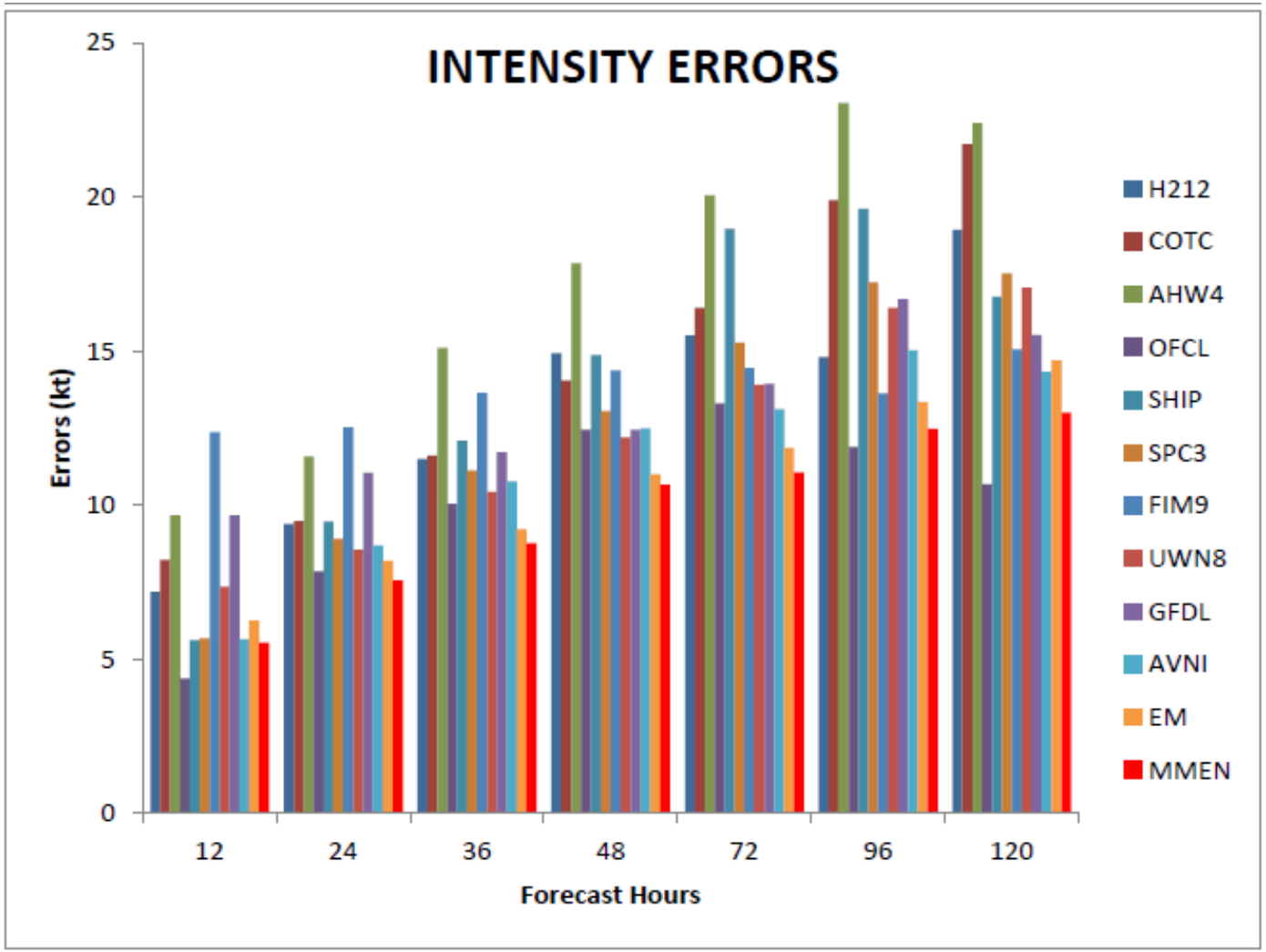


Operational

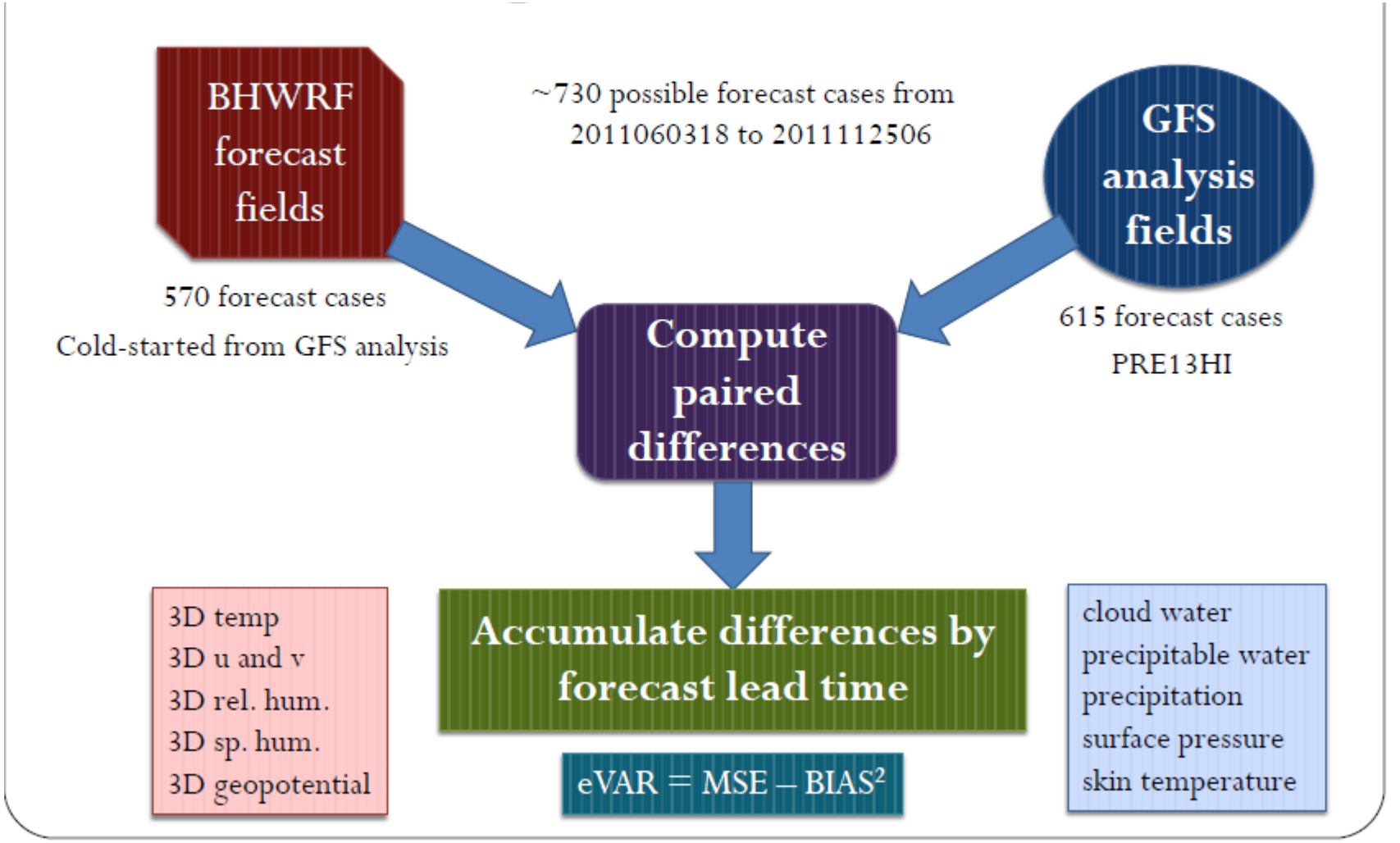


Experimental Hybrid

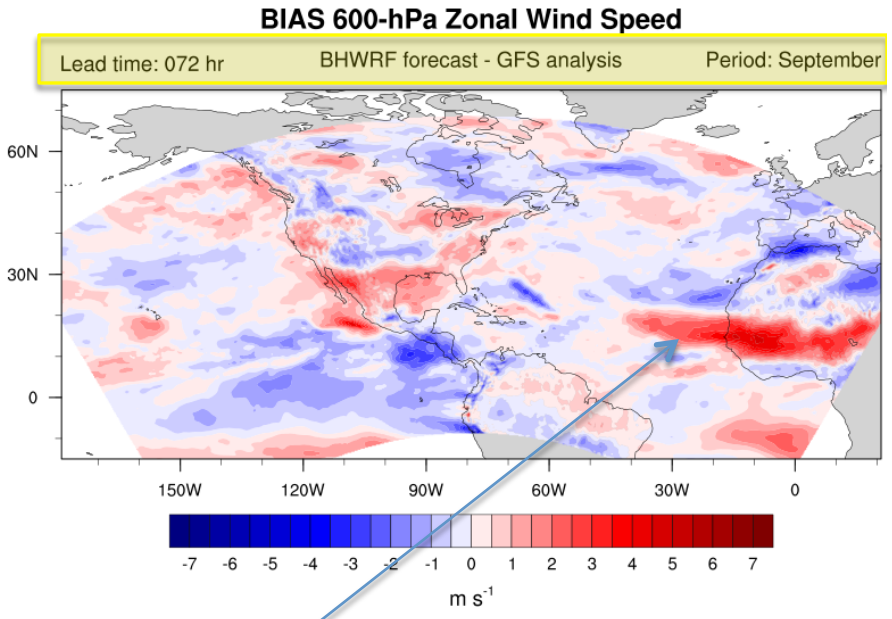
A2. FSU Correlation Based Consensus Method

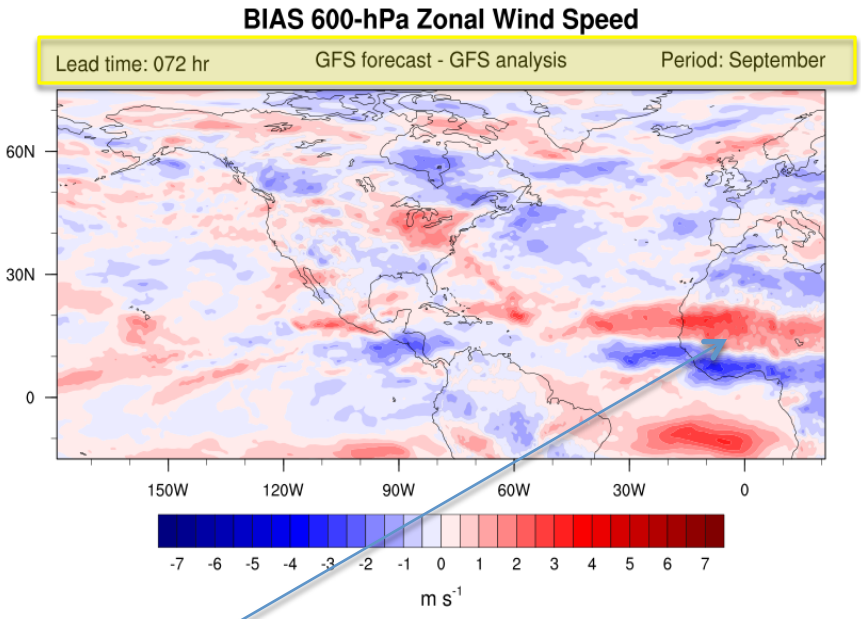


A3. DTC Evaluation of Basin-Scale HWRF



600 hPa zonal wind bias





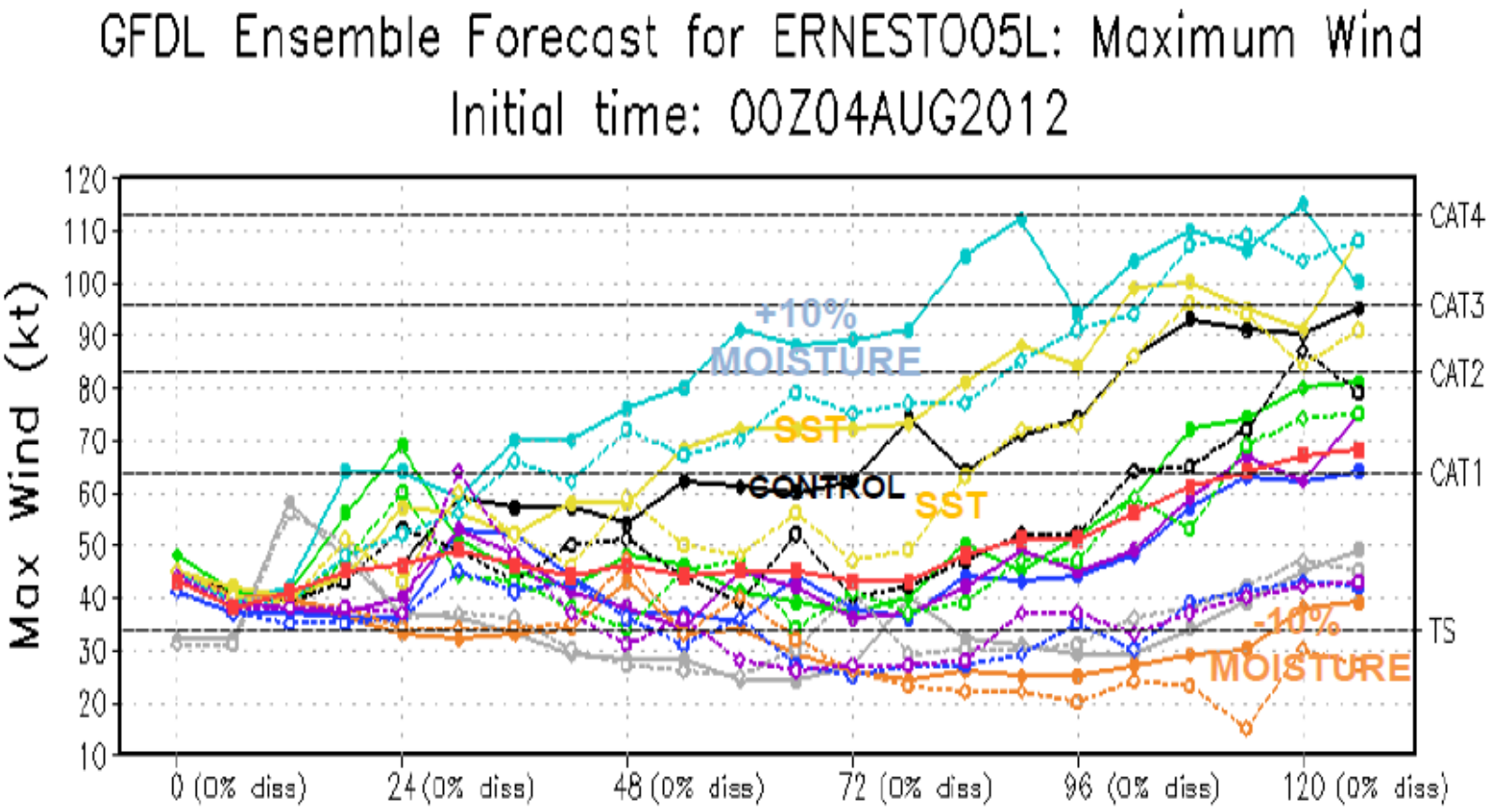
HWRF: African jet too weak

GFS: jet displaced to south

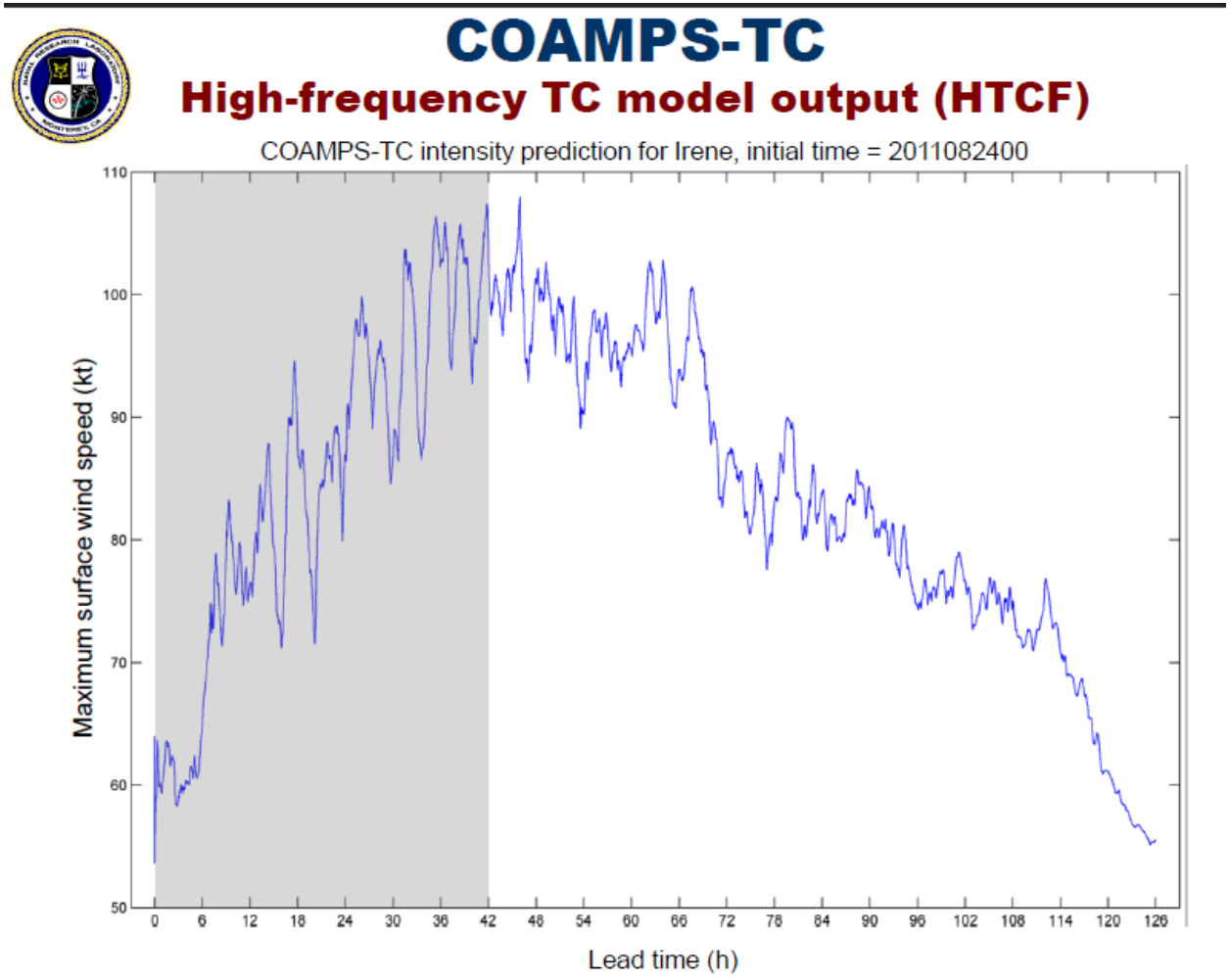
This example is the 600-hPa zonal wind bias for the 72-h forecast averaged over the entire month of September 2011

A4. GFDL Model Sensitivity Studies with Regional Ensemble System

The GFDL ENSEMBLE PRODUCT ALSO SHOWED HUGE SPREAD IN INTENSITY.
LARGEST IMPACT WAS WITH INCREASE /DECREASE OF INNER-CORE MOISTURE BY 10%
(PERTURBATION MAXIMUM AT STORM CENTER)
IMPACT OF MOISTURE MORE IMPORTANT THEN +1 degree C SST INCREASE



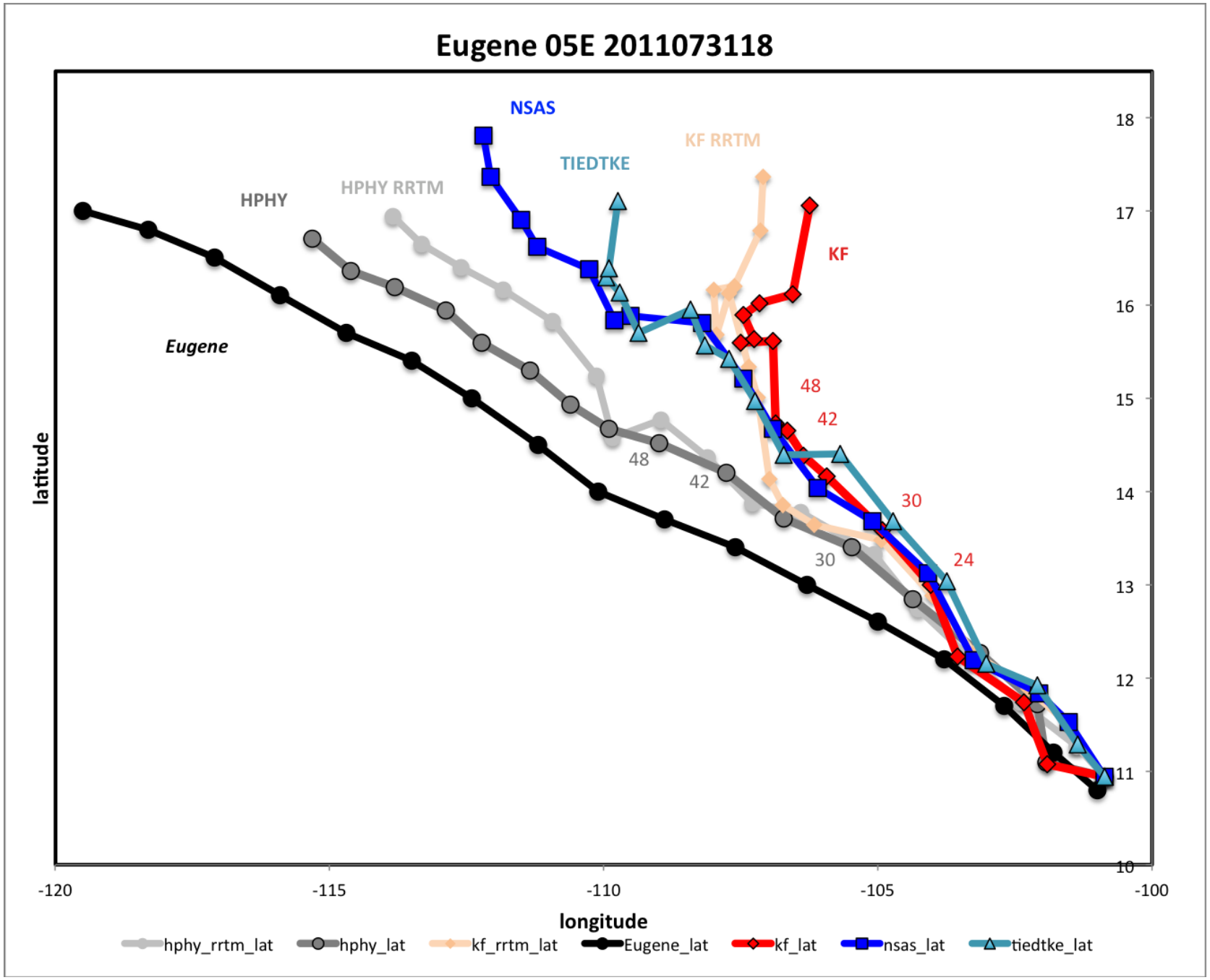
A5. COAMPS-TC Diagnostics



A6. UCLA Physics Parameterization Study

Using Motion and PV Diagnostics to Understand Differences

- *Goal #1*: To determine if systematic biases exist in various cumulus parameterization (CP) schemes
- *Goal #2*: To assess how well CP schemes work with microphysics (MP) and radiation assumptions
- *Technique*: construct vortex-following composite fields and analyze differences among physics-based ensemble members, including PV analysis
- Reminder: The PV equation diabatic heating (DH) term is based on gradients of diabatic heating (Q) and absolute vorticity ($\mathbf{q}$), not Q or vertical velocity itself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longitude
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13
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11
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-105
-100
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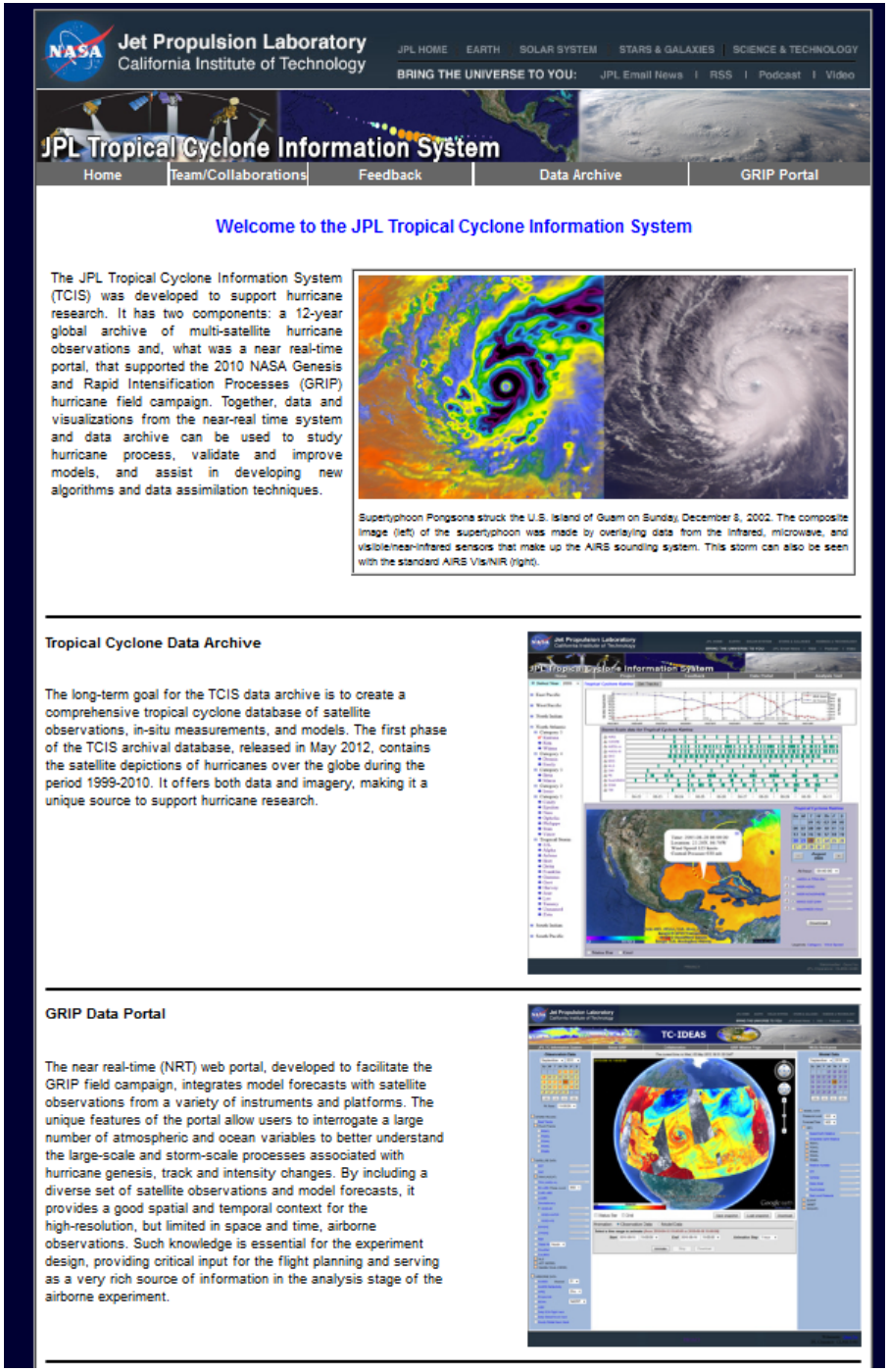
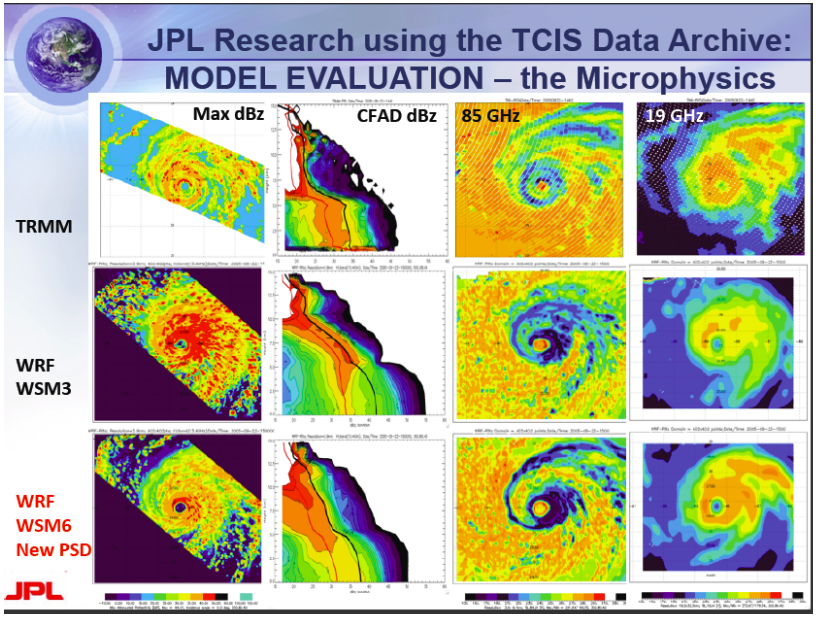
A7. JPL Tropical Cyclone Data Portal and Model Evaluation Studies





Summary

- Experimental products under development
  - Environment, storm-relative products, ensemble based probabilities, consensus methods
- Datasets for model evaluation
  - Aircraft, satellite, convention observations
- Many new diagnostic tools for model improvements
  - Basin wide, storm environment, vortex, cloud scale
  - Ocean data
  - Verification systems (deterministic and probabilistic)
- EMC coordination efforts very helpful for team interactions and code sharing