Research to Operations (R20) Activities at HRD

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NOAA Hurricane R2O Programs

Goal: Improve TC forecast; our research is geared towards **operational priorities**

HFIP provides the basis for NOAA and other agencies to coordinate hurricane research needed to significantly improve guidance for hurricane track, intensity, and storm surge forecasts.

The goal of High Impact Weather Prediction Project (HIWPP) is to improve time-zero to two-week weather prediction of nature's most dangerous storms such as hurricanes, floods, and blizzards. The overarching initiative objective is to build a Next Generation Global Prediction System (NGGPS) that will be the foundation for the operating forecast guidance system for the next several decades.

AOML houses NOAA's Quantitative Observing System Assessment Program (QOSAP), which provides quantitative and objective assessment capabilities to analyze and evaluate current and future earth observation systems.

The mission of the Joint Hurricane Testbed is to transfer more rapidly and smoothly new technology, research results, and observational advances of the United States Weather Research Program (USWRP), its sponsoring agencies, the academic community and other groups into improved tropical cyclone analysis and prediction at operational centers.

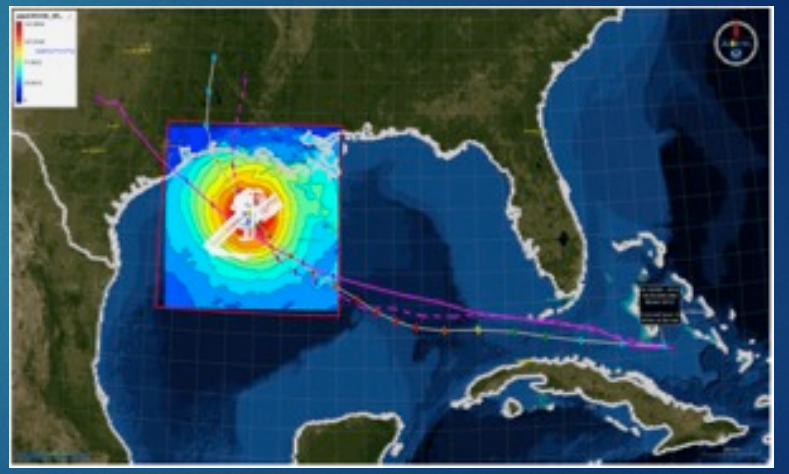
HFIP Activities

Traditional Hurricane Research Activities:

- Observations, analysis, database, & instrument R&D (IFEX)
- Statistical-dynamical model development
- Advances in operational models (Stream 1)

New HFIP Research Thrusts:

- Experimental global and regional hurricane model development (Stream 2)
- Data assimilation techniques and observing system strategy analysis development (Stream 1 & Stream 2)
- Model evaluation tool development (Stream 1.5)
- Application and tool development for forecasters

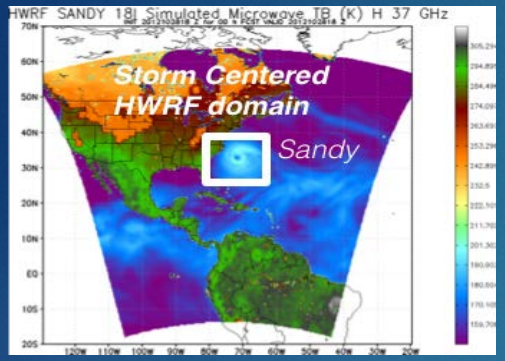


9:3 HWRF (2011): Stream 2

NOAA HURRICANE FORECAST IMPROVEMENT PROJECT

HFIP Stream 2 Regional Modeling Activities

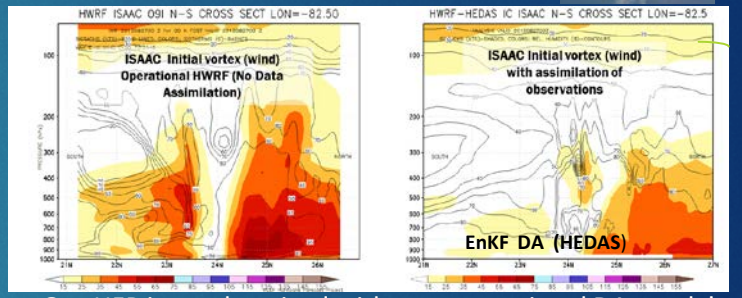
Stream 2: HFIP experimental models which test and evaluate new techniques and strategies for model forecast guidance prior to testing for possible operational implementation. Stream 2 also tests techniques that cannot be tested on current operational computers because of size and time requirements, but can be tested on HFIP computer facilities in Boulder, CO.



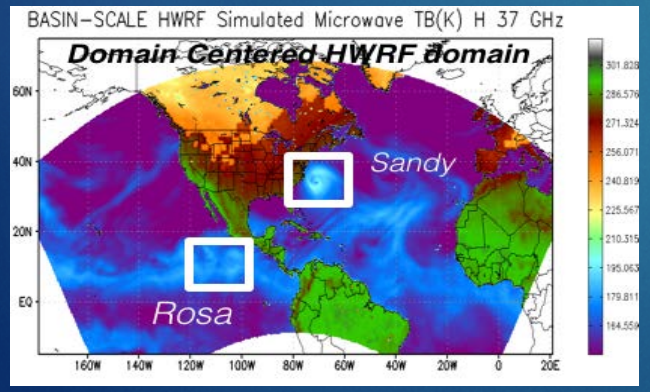
27:9:3 system- 2012 R2O

NOAA-HFIP Jet computers (about 30,00 processors)

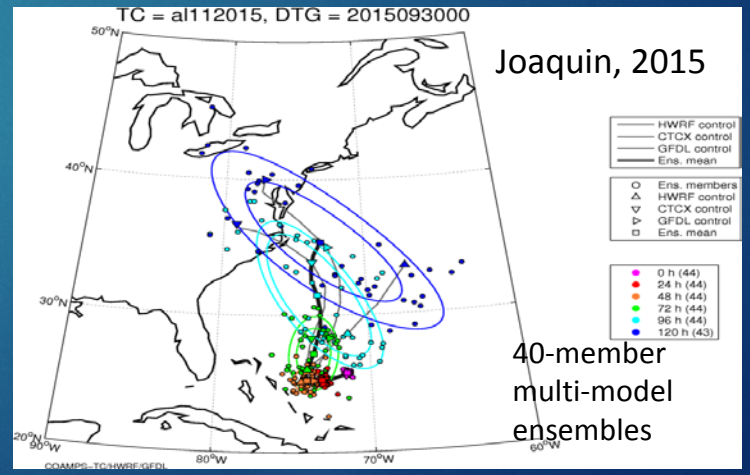
- All major HWRF transitions had their origin here!
- Mirrors all real-time data feeds for HWRF
- Lodges HWRF operational and research repositories



Our HFP is synchronized with our operational DA needs!

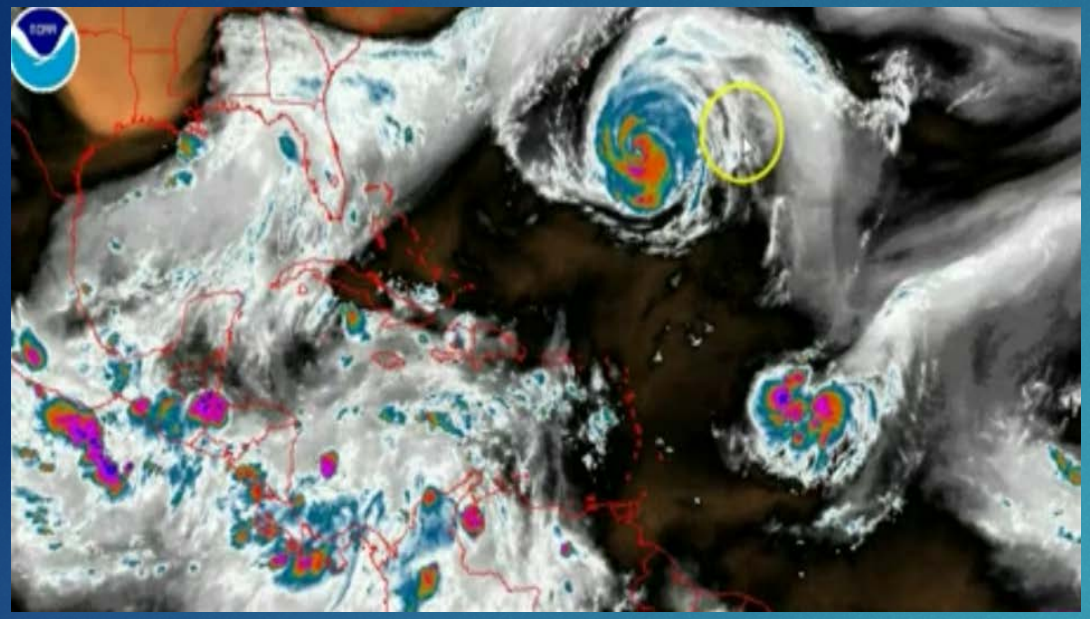


27:9:3 basin-scale HWRF 2015 system (R)

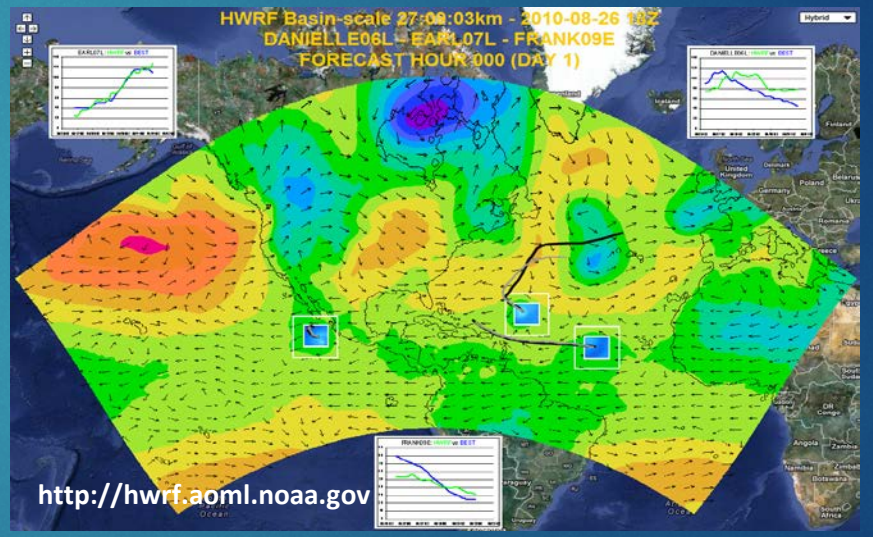


HWRF-COAMPS (TC)-GFDL Ensemble Prediction of Joaquin

Basin Scale HWRF: HFIP Stream 2 Demo System



"Our Operational Needs Push the Envelope of NOAA Research"



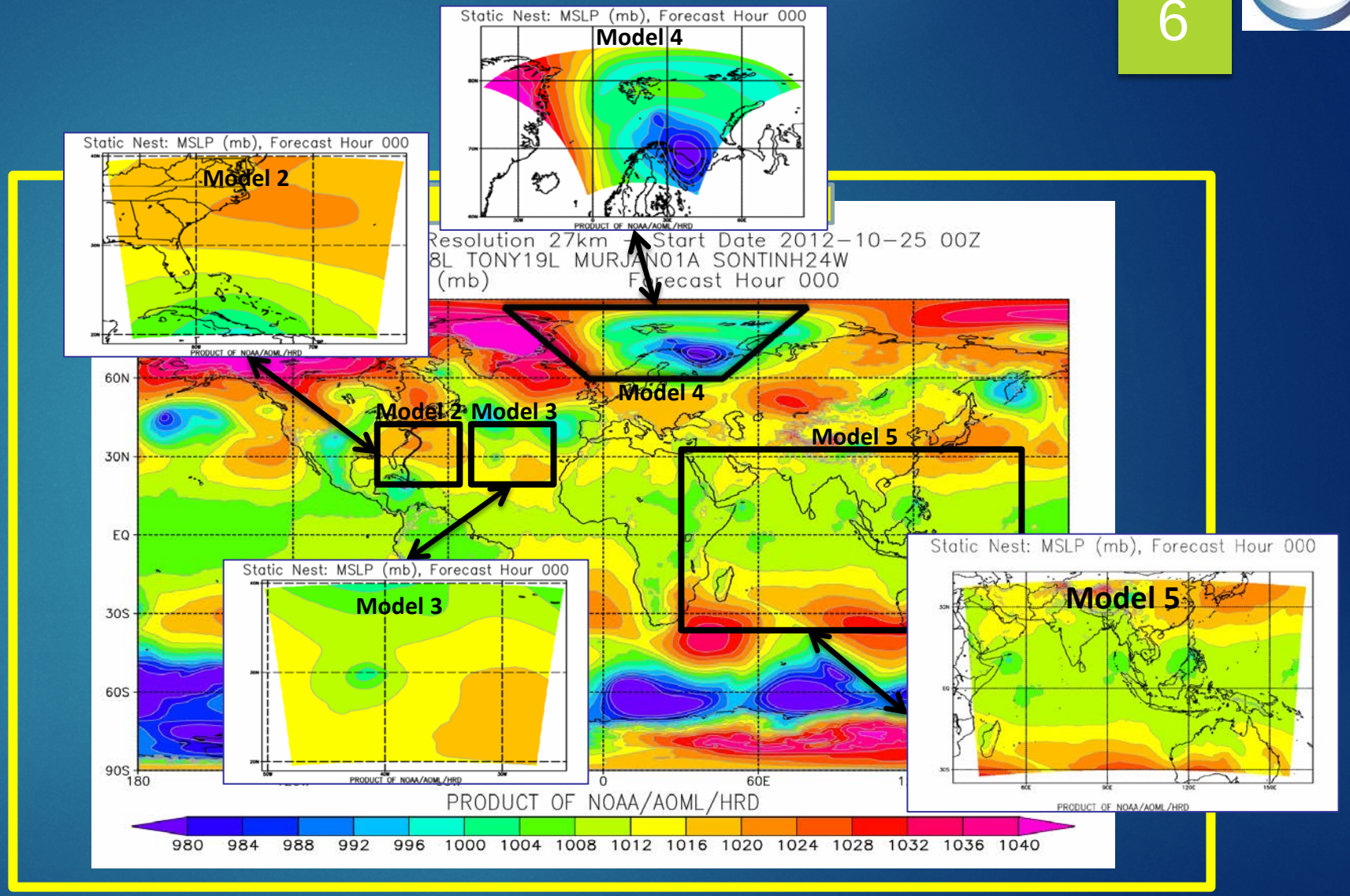
Storm Centric -VS- Domain Centric Forecasts

- Improved storm-storm & multi-Scale interactions
- Tropical predictions system (Extended predictions)
- Landfall and post landfall (storm surge & rainfall)
- Genesis
- Regional ensembles
- Data assimilation

NOAA HURRICANE FORECAST IMPROVEMENT PROJECT

Addressing Our Next-Generation TC Prediction Needs

- Next Generation Global Model is expected to run at about 8-10-km resolution within the NEMS framework.
- AOML along with other NOAA partners are building the Next Generation Nesting Framework (NGGNF) within NEMS to advance global-2-local scale modeling for hurricanes.
- NGGNF will allow multiple heterogeneous numerical models, both inside and outside of NEMS, to be coupled together into a high-resolution (1-3 km) prediction system.



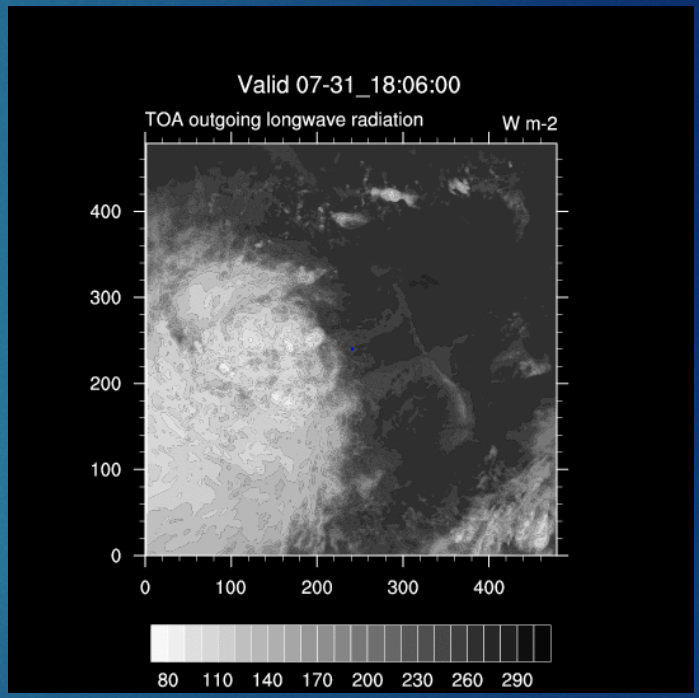
*Example of Core, Grid, and Projection Independent, dynamical (up/)downscaling using and **advancing** ESMF re-gridding*

R2O: OSSEs and OSEs

OSSEs Goals:

- Evaluate the impact of new observing systems on TC track and intensity predictions
- Optimize sampling strategies for current and future airborne/space based observing systems

Goals fall under NOAA's Quantitative Observing Systems Assessment Program (QOSAP)

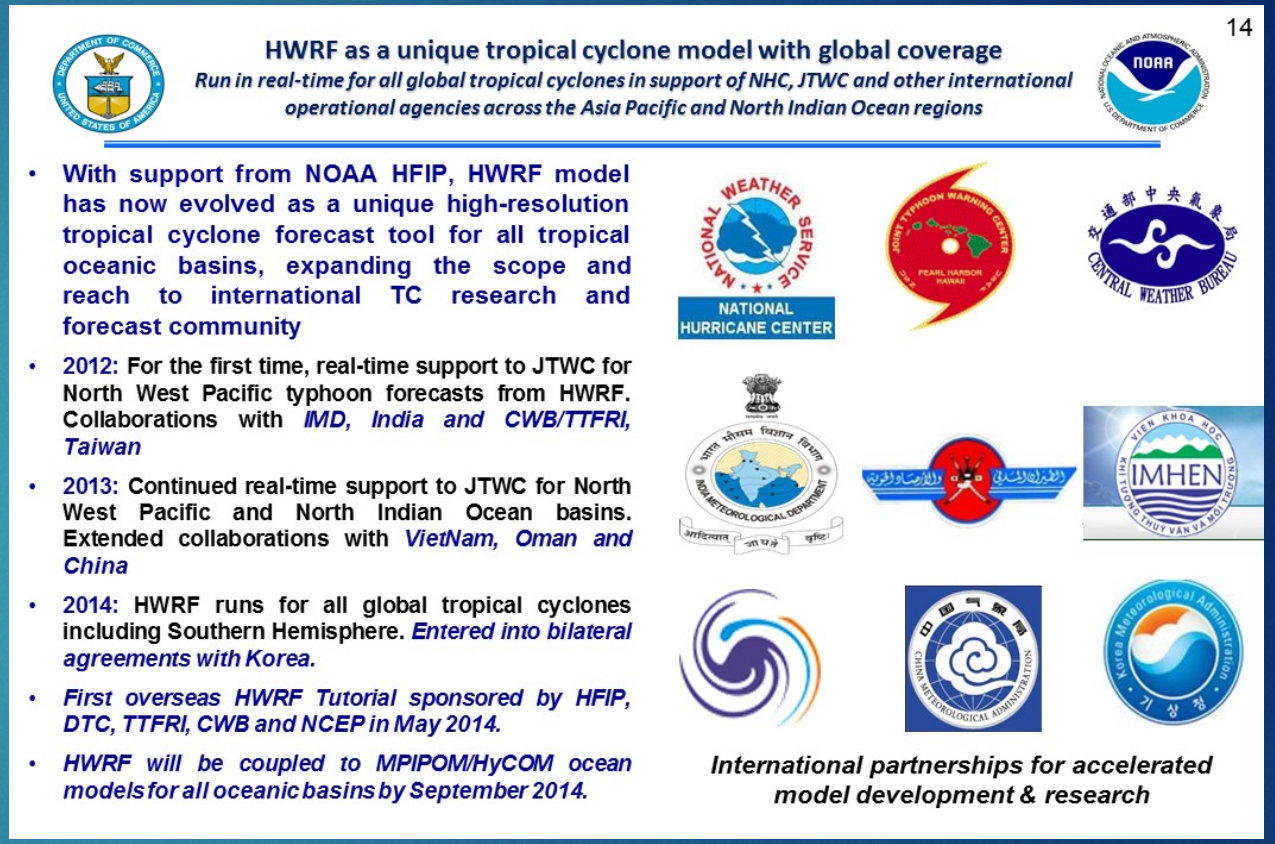


Simulated satellite data and flight track from our Nature Run

http://www.aoml.noaa.gov/qosap/

Summary

- NOAA's operational needs drives our research
- R2O success depends on various factors
- Building up a unified system for research and operations is important
- Sustained partnership between NOAA research and operations and other agencies/universities hold the key to our future success.
- Example of HWRF success says it all!

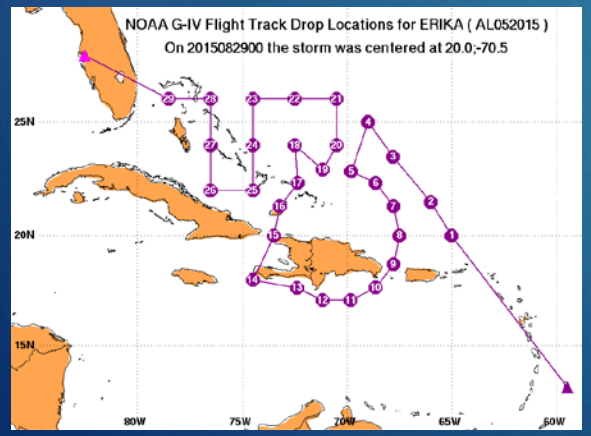


Thanks to Dr.Tallapragada

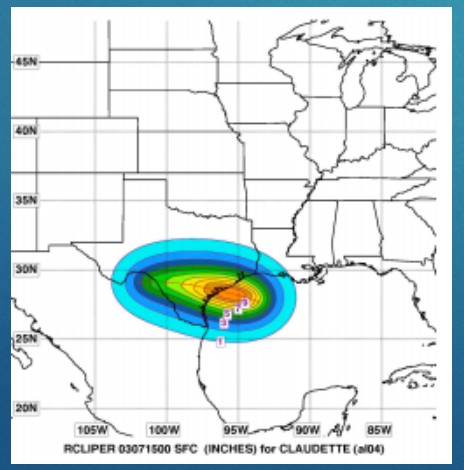
HRD and the Joint Hurricane Testbed

- Participating since 2001
  - Co-chair of Steering Committee and as PIs on projects
- 27 HRD projects funded for transition
- Past Projects include: R-CLIPER, SFMR technology, SHIPS upgrades, etc.
- Stay tuned for next session to hear about current JHT efforts

Targeting

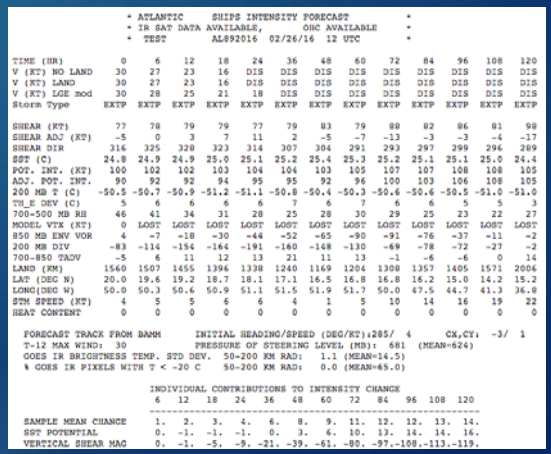


R-CLIPER



SFMR

SHIPS



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                 * ATLANTIC      SHIPS INTENSITY FORECAST          *
                 * IR SAT DATA AVAILABLE,        OHC AVAILABLE     *
                 * TEST              AL892016  02/26/16  12 UTC    *

TIME (HR)          0    6   12   18   24   36   48   60   72   84   96  108  120
V (KT) NO LAND    30   27   23   16  DIS  DIS  DIS  DIS  DIS  DIS  DIS  DIS  DIS
V (KT) LAND       30   27   23   16  DIS  DIS  DIS  DIS  DIS  DIS  DIS  DIS  DIS
V (KT) LGE mod    30   28   25   21   18  DIS  DIS  DIS  DIS  DIS  DIS  DIS  DIS
Storm Type      EXTP EXTP EXTP EXTP EXTP EXTP EXTP EXTP EXTP EXTP EXTP EXTP EXTP

SHEAR (KT)        77   78   79   79   77   79   83   79   88   82   86   81   98
SHEAR ADJ (KT)    -5    0    3    7   11    2   -5   -7  -13   -3   -3   -4  -17
SHEAR DIR        316  325  328  323  314  307  304  291  293  297  299  296  289
SST (C)         24.8 24.9 24.9 25.0 25.1 25.2 25.4 25.3 25.2 25.1 25.1 25.0 24.4
POT. INT. (KT)  100  102  102  103  104  104  103  105  107  107  108  108  105
ADJ. POT. INT.   90   92   92   94   95   95   92   96  100  103  106  108  105
200 MB T (C)  -50.5 -50.7 -50.9 -51.2 -51.1 -50.8 -50.4 -50.3 -50.6 -50.6 -50.5 -51.0 -51.0
TH_E DEV (C)      5    6    6    6    6    7    6    7    6    6    5    5    3
700-500 MB RH    46   41   34   31   28   25   28   30   29   25   23   22   27
MODEL VTX (KT)    0 LOST LOST LOST LOST LOST LOST LOST LOST LOST LOST LOST LOST
850 MB ENV VOR    4   -7  -18  -30  -44  -52  -65  -90  -91  -76  -37  -11   -2
200 MB DIV      -83 -114 -154 -164 -191 -160 -148 -130  -69  -78  -72  -27   -2
700-850 TADV      -5    6   11   12   13   21   11   13   -1   -6   -6    0   14
LAND (KM)       1560 1507 1455 1396 1338 1240 1169 1204 1308 1357 1405 1571 2006
LAT (DEG N)     20.0 19.6 19.2 18.7 18.1 17.1 16.5 16.8 16.8 16.2 15.0 14.2 15.2
LONG(DEG W)     50.0 50.3 50.6 50.9 51.1 51.5 51.9 51.7 50.0 47.5 44.7 41.3 36.8
STM SPEED (KT)    4    5    5    6    6    4    1    5   10   14   16   19   22
HEAT CONTENT      0    0    0    0    0    0    0    0    0    0    0    0    0

 FORECAST TRACK FROM BAMM      INITIAL HEADING/SPEED (DEG/KT):285/  4     CX,CY:  -3/  1
 T-12 MAX WIND: 30             PRESSURE OF STEERING LEVEL (MB):  681  (MEAN=624)
 GOES IR BRIGHTNESS TEMP. STD DEV.  50-200 KM RAD:  1.1 (MEAN=14.5)
 % GOES IR PIXELS WITH T < -20 C    50-200 KM RAD:  0.0 (MEAN=65.0)

                    INDIVIDUAL CONTRIBUTIONS TO INTENSITY CHANGE
                       6   12   18   24   36   48   60   72   84   96  108  120
 ------------------------------------------------------------------------------
 SAMPLE MEAN CHANGE    1.   2.   3.   4.   6.   8.   9.  11.  12.  12.  13.  14.
 SST POTENTIAL         0.  -1.  -1.  -1.   0.   3.   6.  10.  13.  14.  14.  16.
 VERTICAL SHEAR MAG    0.  -1.  -5.  -9. -21. -39. -61. -80. -97.-108.-113.-119.
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