



# The Joint Hurricane Testbed

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**The Joint Hurricane Testbed is funded by the US  
Weather Research Program in NOAA/OAR's  
Office of Weather and Air Quality**

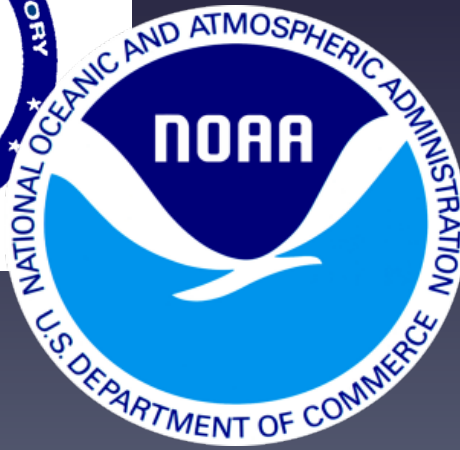
Interdepartmental Hurricane Conference, Tuesday, March 15th

# The Forecasters (Us)



How to bridge the "valley of death"?

# The Researchers (Them)



# JHT: The Process

- Call for Proposals - drafted and disseminated (bi-annually)
- Principal Investigators apply for funding through NOAA
- 7 member Steering Committee rates all proposals
- Funded projects are tested during 1 or 2 hurricane seasons in conjunction with NHC/EMC points of contact
- At the project's end, each are evaluated by NHC/EMC staff
- Implementation of successful projects are then carried out by NHC/EMC staff/PIs

# JHT: The statistics

- Number of projects supported: 89
  - 81 completed
    - 53 accepted for operational implementation
    - 19 projects completed but rejected
    - 4 projects completed, deferred pending further investigation
    - 7 projects with decisions soon forthcoming (7<sup>th</sup> round)
  - 8 new projects started 1 September 2015 (8<sup>th</sup> round)
- Implementation
  - 46 projects implemented:
    - 14 numerical modeling projects implemented by EMC/NCO
    - 32 projects implemented by NHC
  - 5 projects accepted but not yet fully implemented by NHC

# On-going JHT Activities

- **7<sup>th</sup> Round Projects**
  - 7 projects begun September 2013
  - Testing during 2014/2015 hurricane seasons
  - Projects completed 1 December, final reports all received
  - Implementation decisions to be made in spring/summer 2016
- **8<sup>th</sup> Round Projects**
  - 8 new projects began September 2015

# Improvement to the Satellite-based 37 GHz Ring Rapid Intensification Index- PI Haiyan - POCs Stacy, John, Chris L

<http://tcpf.fiu.edu/JHT/>

## Email Notification when “Yes” for a forecast for Rapid Intensification

Yongxian Pei  
Jul 14 (6 days ago)

to me, Todd.Kimberlain, john.p.cangial., Stacy.R.Stewart, john.l.beven, haiyan.jiang, kieper.research

East Pacific 37 GHz RING+ 85 GHz RI INDEX

DOLORES EP05 2015 07/15/15 00 UTC

TMI,SSMI,SSMIS,AMSR2 and WINDSAT Total Overpass Orbits: 5

DETAILED RI FORECAST FROM OVERPASS #5:

East Pacific 37 GHz RING+ 85 GHz RI INDEX

SSMIS-F17 DOLORES EP052015 07/15/15 0136 UTC

=====RI FORECAST BY THE 37 GHz only and 37+85 GHz RI INDICES=====

37 GHz Only Forecast:

FUTURE 24-HOUR INTENSITY INCREASE  $\geq$  30 KT (RI)? : YES

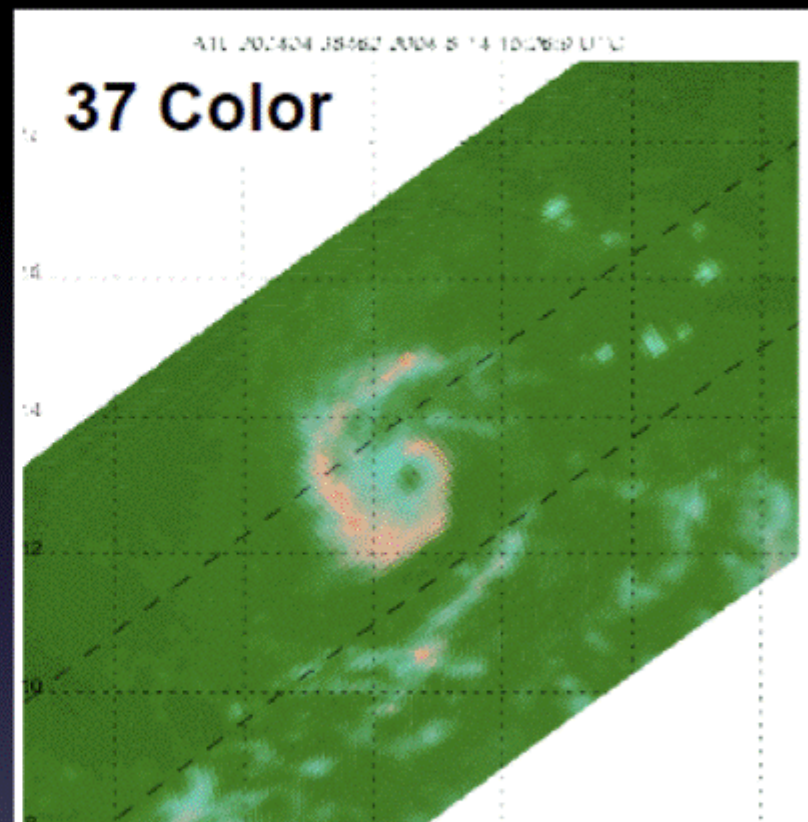
37 GHz Ring+85 GHz Forecast:

37GHz RING+85GHz RI PROBABILITIES AT SATELLITE OVERPASS TIME

PROB OF RI FOR 25 KT RI THRESHOLD= 90%

PROB OF RI FOR 30 KT RI THRESHOLD= 80%

PROB OF RI FOR 35 KT RI THRESHOLD= 13%



The Kieper “Cyan Ring”



# A Visualization Application for Distributed ADCIRC-based Coastal Storm Surge, Inundation, and Wave Modeling - Pls Brian Blanton, Rick Luettich - POCs Jamie, Jessica, Robbie, Chris L

<http://renci-unc.github.io/StormSurgeViz/>

## Community Onboarding Process

### StormSurgeViz

A MATLAB-based tool for visualization and analysis of UGRID-compliant model output

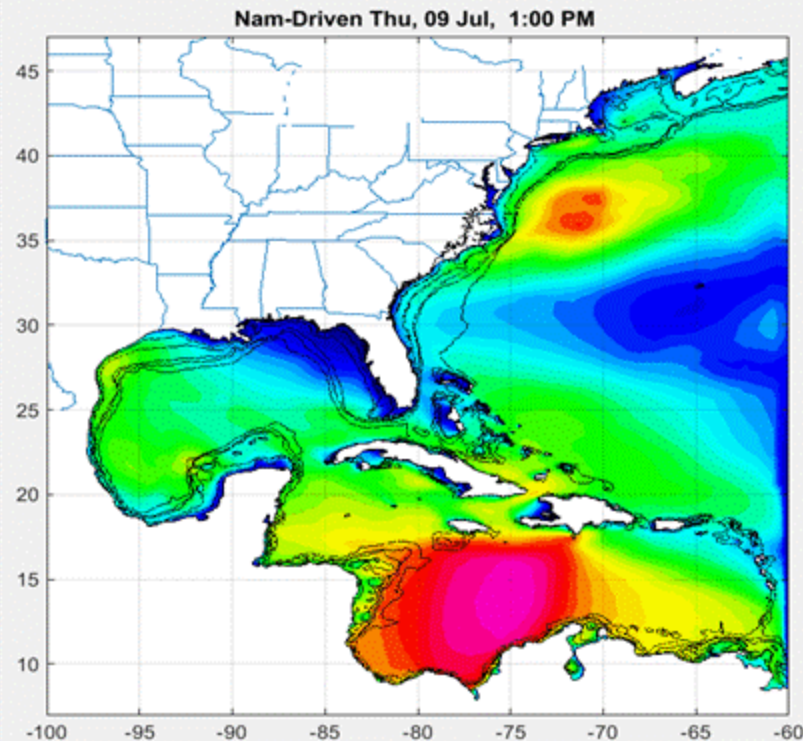
Download .zip

Download .tar.gz

View on GitHub

#### Welcome to the StormSurgeViz Home Page

StormSurgeViz is a MATLAB-based tool for visualization and analysis of CF/UGRID-compliant model output funded by NOAA's Joint Hurricane Testbed (2013) Program (<http://www.nhc.noaa.gov/jht/>).



#### Ensemble Members

namforecast

#### Scalar Variables

- Max Water Level
- Water Level
- Max Water Speed
- Sig Wave Height
- Max Sig Wave ...
- Mean Abs Wave...
- Mean Wave Dir
- Max Wind Speed
- Atmos Press (...)
- Grid Elevation

#### Vector Variables

- Water Velocity
- Wind Velocity
- Wind Velocity...

#### Scalar Snapshot List

Thu, 09 Jul, 1:...

#### Vector Snapshot List

Thu, 09 Jul, 1:...

- Keep in Sync
- Overlay Vec...
- Display as ...

#### Background Maps

##### Map Type

Transparency

Figure Renderer

zbuffer

#### Print

Current Axes

Current GUI

Print

#### ShapeFiles

Export

Filename

Shape File Name

Status : Done.

URL :

<http://opendap.renci.org:1935/thredds/dodsC/ASGS/nam/2015070912/nc6b/hatteras.renci.org/renci>

renci

UNC  
INSTITUTE OF  
MARINE SCIENCES

#### Information

Instance = rencidaily  
Model = PADCSWAN  
Storm Number/Name = 00/Nam-Driven  
Advisory Number = N/A  
Model Grid = nc6b  
# Elements = 575512  
# Nodes = 295328  
Units = feet  
Time Offset from UTC = 0  
[Show Catalog](#)

#### Controls

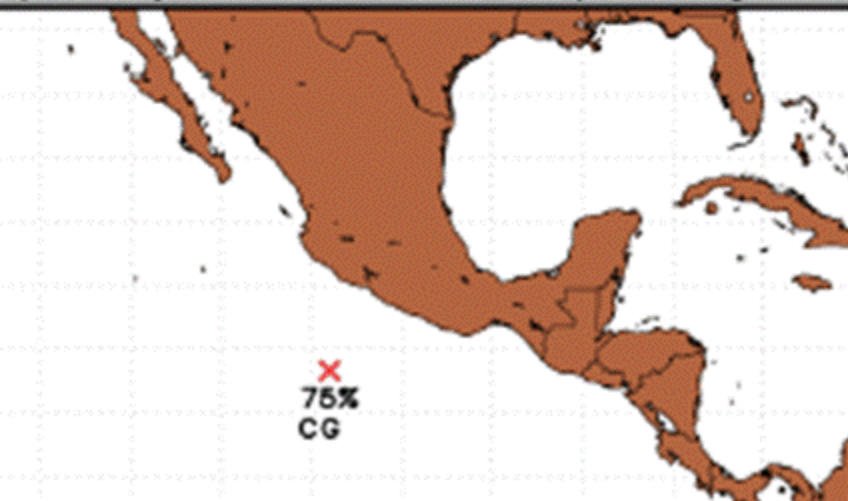
Set Colormap : noaa\_...  Flip CMap  
Number of Colors : 32  
Color Minimum : 0.00  
Color Maximum : 6.25  
Depth Contours : 10 50 100 500 1000 3000  
Axis Limits : -100 -60 7 47  
[Show Maximum in View](#) [Show Roads/Counties](#)  
[Show Minimum in View](#) [Get Field Values](#)  
[No Track to Show](#) [Reset Axes](#)  
[Show Elements](#) [Show Full Domain](#)  
[Show Water Level As ...](#) [Plot Hydrographs](#)

# A Probabilistic TC Genesis Forecast Tool Utilizing an Ensemble of Global Models – PIs Bob Hart, Henry Fuelberg – POCs Richard, Craig, Todd, Eric B, Chris L

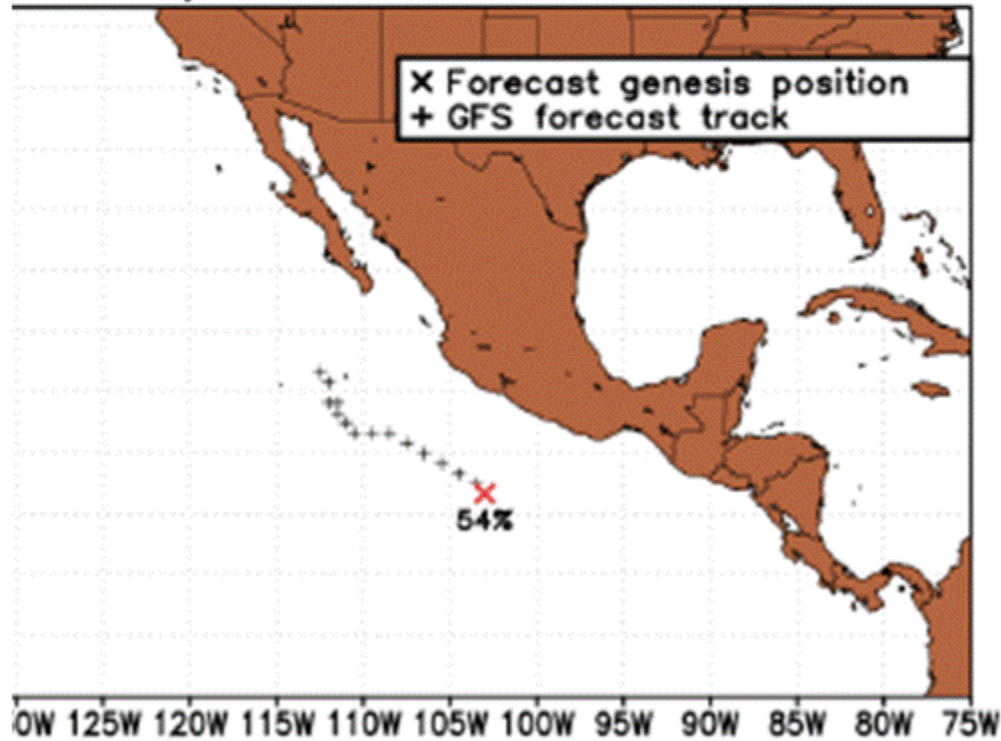
<http://moe.met.fsu.edu/modelgen/>

Experimental Probability of TC Genesis  
at Anytime Within 120 Hours  
GFS Model Output Initialized on 20140922 00Z

Legend for models in current run cycle:  
C (C) GFS (G) UKMET (U)  
Probability indicate the models that predicted genesis



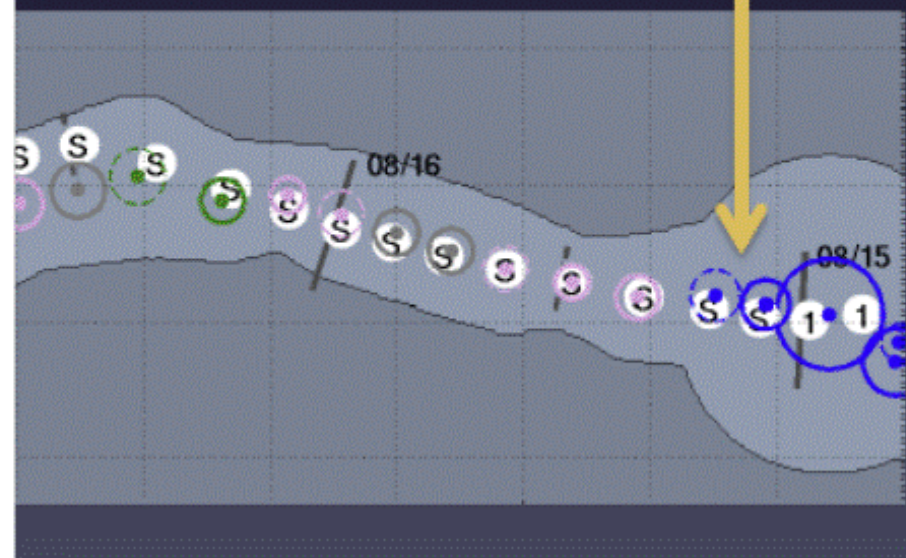
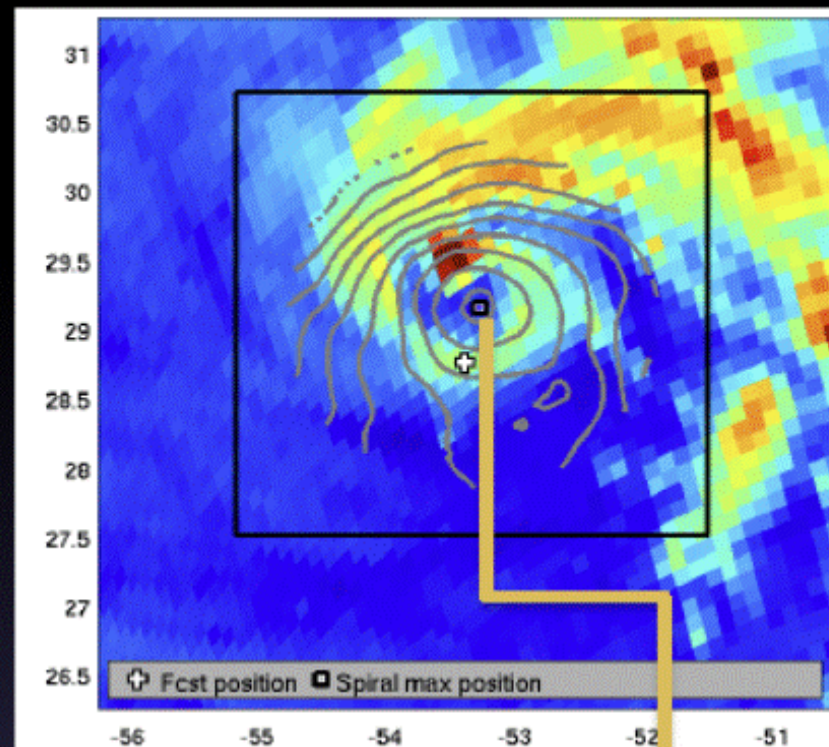
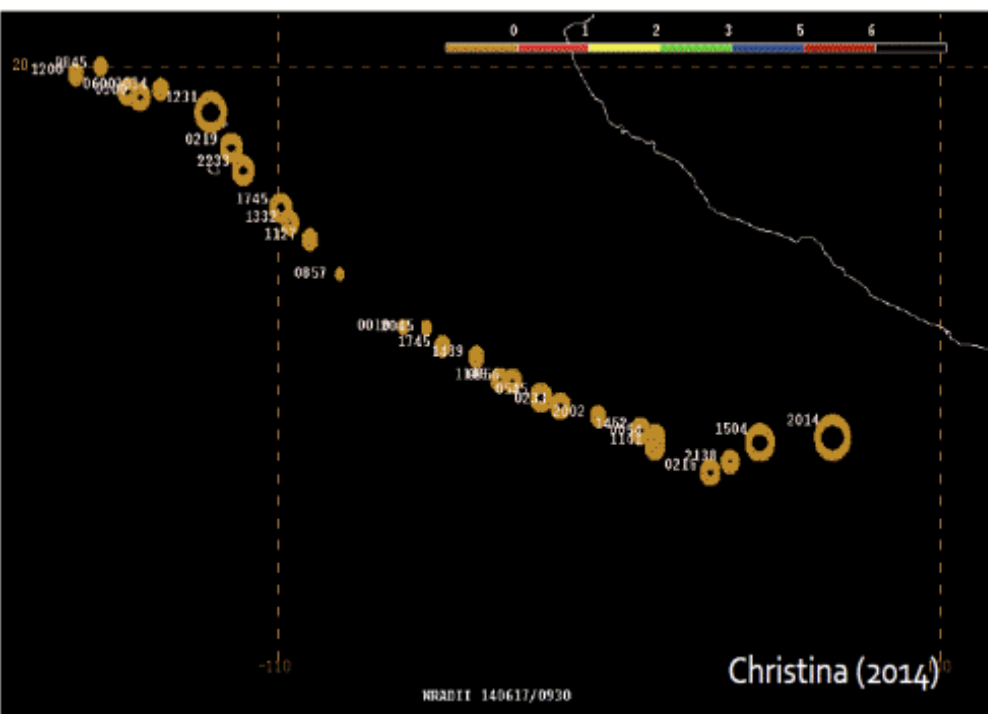
Experimental Probability of TC Genesis  
at Anytime Within 120 Hours  
GFS Model Output Initialized on 20140922 00Z





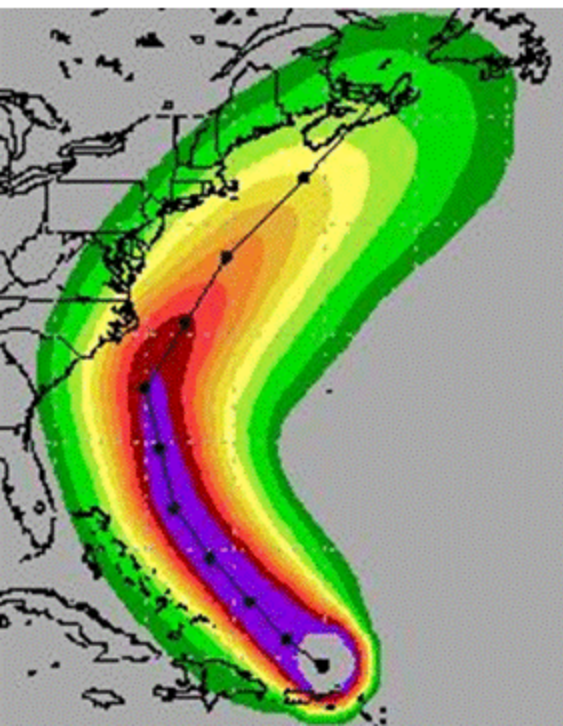
# Integration of an Objective, Automated TC Center-fixing Algorithm Based on Multispectral Satellite Imagery into NHC/TAFB Operations – PIs Wimmers and Velden – POCs Jack, Dan M, Chris L

<http://tropic.ssec.wisc.edu/real-time/archerOnline/web/index.shtml>

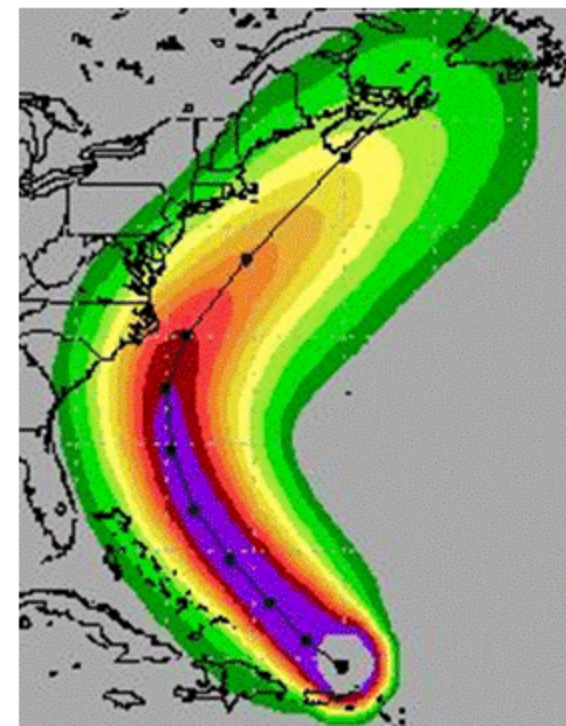


# Upgrades to the Operational Monte Carlo Wind Speed Probability Program – PI Schumacher – POCs Dan B, Mike B, Craig, Chris L

- Replaced linear interpolation with spline (Implemented in 2015 operational WSPs)
- Sampling from track and intensity forecast error statistics identical to those used for NHC official verification (Experimental)
- Radii bias correction (Experimental)
  - Uses radii-CLIPER, which does not represent exceptionally small or large TCs well
  - Bias-correct radii-CLIPER estimates based on OFCL radii forecasts, when available
- Developed time-averaged integrated GPCE parameter (Experimental)



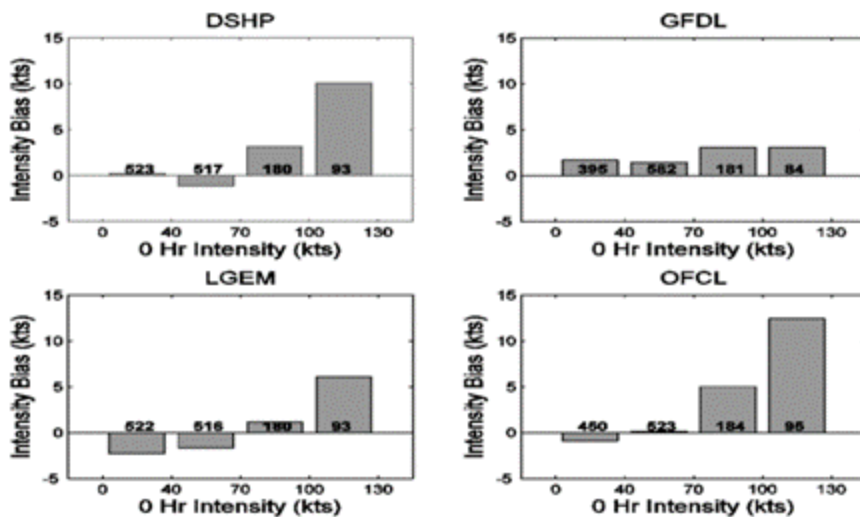
- Spline interpolation creates smoother, more realistic-looking track realizations
- Can have significant impact for recurving systems (e.g., Earl 2010)



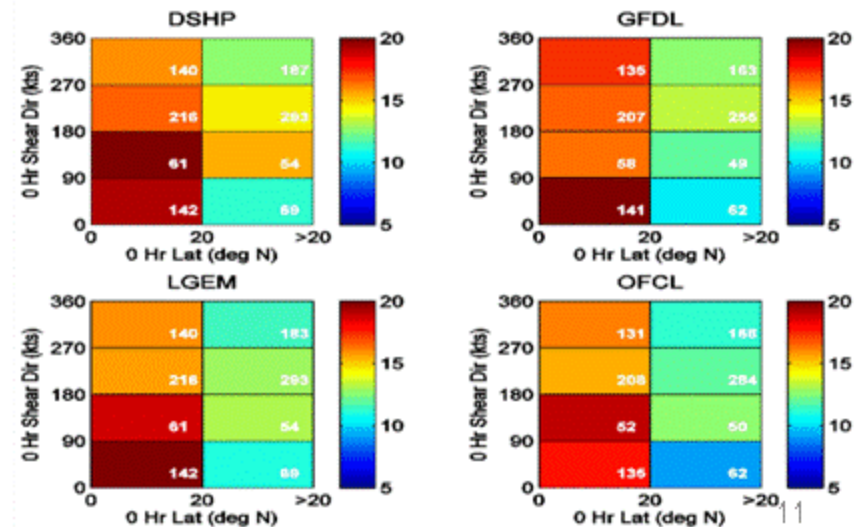
# Guidance on Intensity Guidance - PIs Nolan, Schumacher - POCs - Lixion, Dave R, Eric B, Chris L

- Bhatia and Nolan (2013) showed that intensity forecast error is often related to the nature of the particular storm and surrounding atmospheric environment.
- Parameters representing initial condition error and atmospheric stability (“proxies”) are also linked to forecast error.
- These proxies and environmental conditions can serve as independent variables in multiple linear regression formula to predict absolute error and bias.
- Prediction of Intensity Model Error (PRIME) for Atlantic Basin Tropical Cyclones applied to four ‘early models’: DSHP, LGEM, HWFI, GHMI.
- PRIME developed with 2007-2014 Real-Time runs and R-PRIME (Retrospective PRIME) used 2008-2104 Retrospective runs.

24-hour Bias vs. 0-hour Intensity

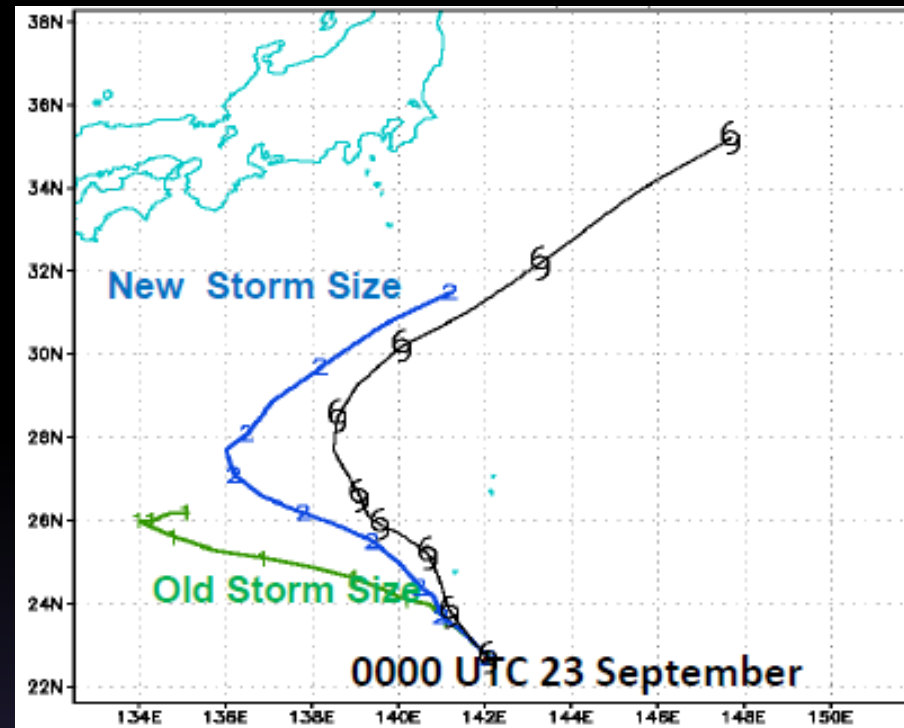


48-hour MAE vs. 0-hour Latitude and 0-hour Shear Direction

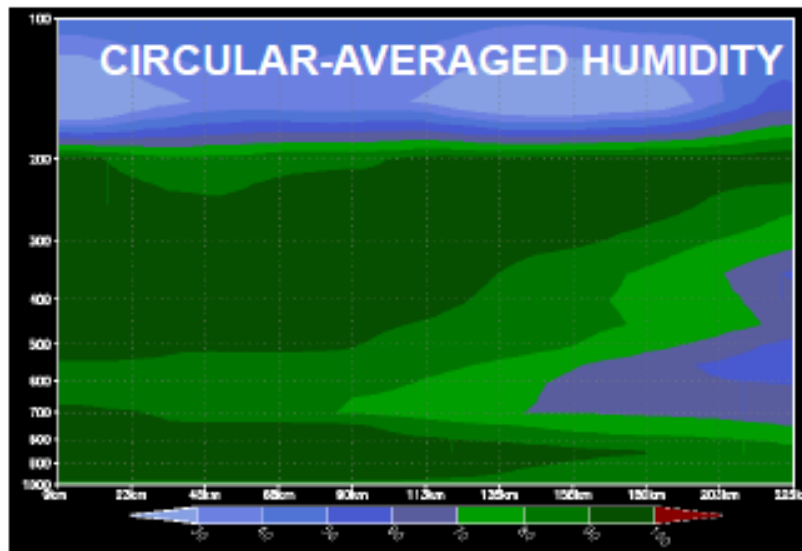




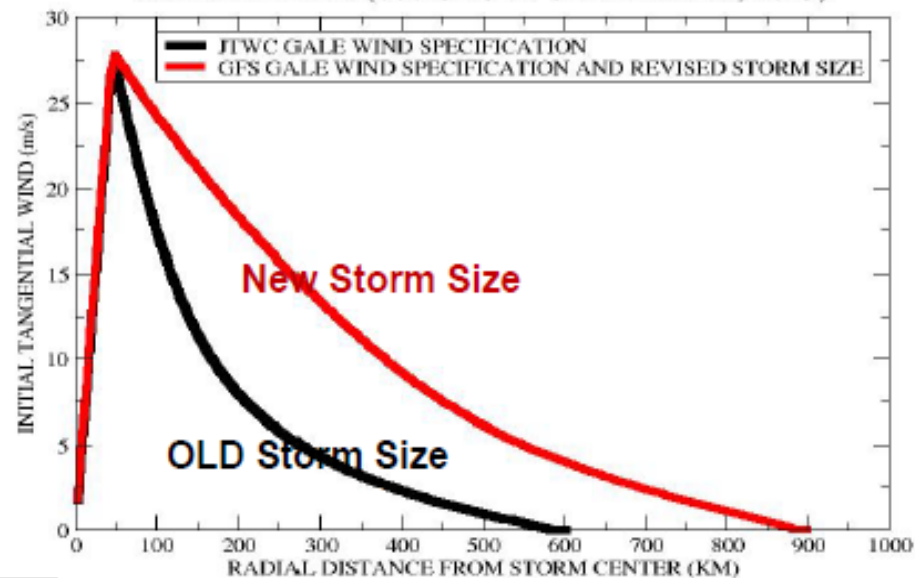
Improving the GFDL/GFDN Operational Tropical Cyclone Models at NOAA/NCEP and Navy/FNMOC- PIs Isaac Ginis, Morris Bender - POCs Richard, Craig, Vijay, Chris L



## NEW MOISTURE INITIALIZATION



## TYPHOON PABUK (19W) INITIAL TIME: (000 UTC 22 SEPTEMBER, 2013)





# Factors Considered in NHC Decisions on Operational Implementation

- **Forecast or Analysis Benefit:** expected improvement in operational forecast and/or analysis accuracy
- **Efficiency:** adherence to forecaster time constraints and ease of use needs
- **Compatibility:** IT compatibility with operational hardware, software, data, communications, etc.
- **Sustainability:** availability of resources to operate, upgrade, and/or provide support

# 8<sup>th</sup> Round Timetable

- August 2014
  - Announcement of Opportunity released
- October 2014
  - 35 Letters of Intent reviewed by Steering Committee
- February 2015
  - 20 Full Proposals reviewed by Steering Committee
- September 2015
  - 8 new projects began

Review criteria and their maximum points are:

- (1) Importance/relevance and applicability of proposal to the program goals (30 points),
- (2) Technical merit (50 points),
- (3) Overall qualifications of applicants (10 points),
- (4) Project Costs (10 points), and
- (5) Outreach and education (0 points)

# 8<sup>th</sup> Round JHT Projects - 2015 to 2017

Project Title	Principal Investigator(s)	NHC Point of Contact
Passive Microwave Data Exploitation via the NRL Tropical Cyclone Webpage	Josh Cossuth (NRL)	Avila, Blake, Roberts, Landsea
Improvements in Operational Statistical Tropical Cyclone Intensity Forecast Models	Andrea Schumacher (CSU/CIRA)	Brown, Avila, Landsea
Improvements to the Tropical Cyclone Genesis Index (TCGI)	Jason Dunion (U of Miami/CIMAS/AOML)	Pasch, Kimberlain, Blake, Evans (CPHC), Landsea
Improvement and Implementation of the Probability-based Microwave Ring Rapid Intensification Index for NHC/JTWC Forecast Basins	Haiyan Jiang (Florida Intl Univ.)	Stewart, Cangialosi, DeCicco (JTWC), Landsea
Guidance on Observational Undersampling over the Tropical Cyclone Lifecycle	Dave Nolan (U of Miami/RSMAS)	Brennan, Stewart, Landsea
Probabilistic Prediction of Tropical Cyclone Rapid Intensification Using Satellite Passive Microwave Imagery	Chris Rozoff and Chris Velden (U of Wisc/CIMSS)	Beven, Brown, Roberts, Landsea
Improved Eyewall Replacement Cycle Forecasting Using a Modified Microwave-Based Algorithm (ARCHER)	Tony Wimmers (U of Wisc./CIMSS) and Jim Kossin (NOAA/NCDC)	Pasch, Beven, Landsea
Transition of the Coastal and Estuarine Storm Tide Model to an Operational Model for Forecasting Storm Surges	Keqi Zhang (FIU)	Brennan, Berg, Rhome, Taylor (MDL), Landsea

# Joint Hurricane Testbed Steering Committee

- John Gamache - Co-chair - Hurricane Research Division, AOML
- Jeff Hawkins - Naval Research Laboratory
- Sharan Majumdar – University of Miami
- Ed Rappaport - Co-chair - National Hurricane Center
- Brian Strahl - Joint Typhoon Warning Center
- Vijay Tallapragada - Environmental Modeling Center, NCEP
- Hugh Willoughby - Florida International University



# The Joint Hurricane Testbed

The screenshot shows the website interface with a navigation menu on the left and a main content area. The URL [www.nhc.noaa.gov/jht](http://www.nhc.noaa.gov/jht) is displayed at the top. The page title is "National Hurricane Center". The main content area features a banner for the "Joint Hurricane Testbed" with the USWRP logo. Below the banner, the "JHT Overview" section includes links for "Overview", "Current Projects", "Past Projects", "Admin Presentations", "Highlights", "Staff", and "Committee". The "Mission Statement" section states: "The mission of the Joint Hurricane Testbed is to transfer more rapidly technology, research results, and observational advances of the United Program (USWRP), its sponsoring agencies, the academic community, improved tropical cyclone analysis and prediction at operational centers." The "News" section lists three items: "20 March 2012: 2012 IHC presentations posted for 2011-2013 projects", "1 November 2011: Press Release on new 2011 funded JHT projects", and "30 September 2011: New JHT projects (Round 6, FY11-13) announced". The "Main Activities" section lists three bullet points: "Identify new techniques, models, observing systems, etc. with potential via an announcement of opportunity and a proposal, review, and funding", "Establish and maintain an infrastructure to facilitate the modification and integration of new tools, techniques, and data into the operational computing, communication, and display environment", and "Complete tests in a quasi-operational environment of tools, techniques, and data, with metrics for scientific performance, ease-of-use, and support". The "Our Organization" section lists links for "About NHC", "Mission", "Staff", "Visitors", "Virtual Tour", "Library Branch", "NCEP", and "Newsletter". The "Contact Us" section includes "Comments" and social media links for Facebook and Twitter.

Rappaport et. al., 2012 - *BAMS*

## THE JOINT HURRICANE TEST BED

Its First Decade of Tropical Cyclone  
Research-To-Operations Activities Reviewed

BY EDWARD N. RAPPAPORT, JIANN-GWO JIING, CHRISTOPHER W. LANDSEA,  
SHIRLEY T. MURILLO, AND JAMES L. FRANKLIN

Collaboration between researchers, forecasters and technology specialists facilitated the development and implementation of numerous projects benefitting forecast operations.

# 7<sup>th</sup> Round JHT Projects - 2013 to 2015

Project Title	Principal Investigator(s)	NHC Point of Contact
A Visualization Application for Distributed ADCIRC-based Coastal Storm Surge, Inundation, and Wave Modeling	Brian Blanton, Rick Luettich (Univ. of N Carolina)	Feyen (NOS), Rhome, Berg, Schauer, Landsea
Improving the GFDL/GFDN Operational Tropical Cyclone Models at NOAA/NCEP and Navy/FNMOC	Isaac Ginis (Univ. of Rhode Island), Morris Bender (NOAA/GFDL)	Pasch, Mattocks, Tallapragada (EMC), Landsea
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# 7<sup>th</sup> Round Timetable

- **August 2012**
  - Announcement of Opportunity released
- **October 2012**
  - 36 Letters of Intent reviewed by Steering Committee
- **December 2012 - January 2013**
  - 22 Full proposals reviewed by Steering Committee
- **February - April 2013**
  - Rank and select 7 proposals for funding
  - Point-of-contacts established among NHC/EMC staff
  - Work with PIs to setup timelines for their projects
- **September 2013 – May 2014**
  - PIs begin projects in coordination with points-of-contact
- **March 2014**
  - Present progress at Interdepartmental Hurricane Conf.

# 7<sup>th</sup> Round Timetable (continued)

- April 2014
  - Mid-year report and renewal proposal due
- May-June 2014
  - Steering Committee reviews progress and renewal proposals - all 7 projects are renewed for year two
- June – November 2014
  - Begin real-time testing during hurricane season
- December 2014 – April 2015
  - PI refine their projects and interact with points-of-contact
- March 2015
  - Present progress at Interdepartmental Hurricane Conf.
- June – November 2015
  - Continued real-time testing during hurricane season



# 7<sup>th</sup> Round Timetable (continued)

- **December 2015**
  - PI provide their final report
- **March 2016**
  - Operational implementation decisions made by NHC/EMC
- **March-August 2016**
  - Implementation of accepted projects by NHC/EMC

# 7<sup>th</sup> Round Timetable (continued)

- December 2015
  - PI provide their final report
- March 2016
  - Operational implementation decisions made by NHC/EMC
- March 2016-May 2018
  - Implementation of accepted projects by NHC/EMC

**FOUR-SIX YEARS FROM ANNOUNCEMENT TO  
IMPLEMENTATION**

# Top 5 Priorities for New Funding

- NHC-1/JTWC-1. Guidance for tropical cyclone intensity change, especially for the onset, duration, and magnitude of **rapid intensification** events, as well as for over-water rapid weakening events.
- NHC-2/JTWC-2. Improved capability to **observe the tropical cyclone and its environment** to support forecaster analysis and model initialization.
- NHC-3/JTWC-8. Statistically based real-time **guidance on guidance** to assist in the determination of official track and intensity forecasts. This could include multi-model consensus approaches, provided in probabilistic and other formats.
- NHC-4/JTWC-9. Enhancements to the **operational environment** (e.g., ATCF, AWIPS-II) to increase forecaster efficiency, by expediting analysis, forecast, coordination, and/or communication activities.
- NHC-5/JTWC-11. Techniques or products to support **pre-genesis** disturbance track, intensity, size, and wind speed probability forecasts.

# Joint Hurricane Testbed (JHT)

- Bridge hurricane research and operations
- Began in 2001 under the USWRP
- **Our Mission:** successfully transfer new technology, research results & observational advances from research groups to operational centers
- Testing is done at National Hurricane Center or Environmental Modeling center