Joint Hurricane Testbed (JHT) 2010 Update

Transition from Research to Operations

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Joint Hurricane Testbed Mission Statement

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

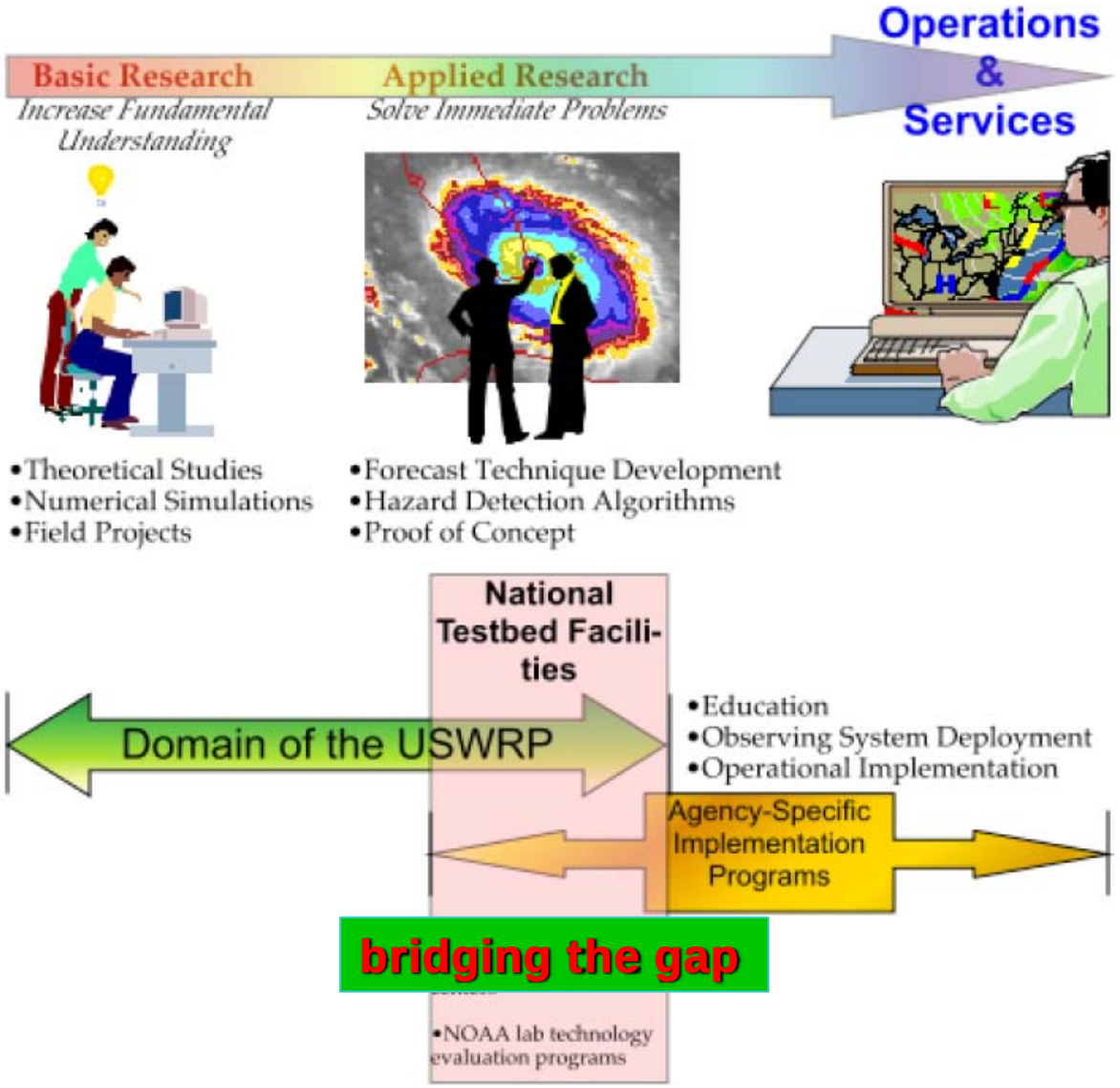


Fig. 1. Schematic of the relationship of the USWRP to the continuum from basic research to operations and services and to agency-specific technology-infusion programs. Within the region of overlap in applied research responsibilities are the national testbed facilities. Research ideas and technology will be evaluated at these facilities in the context of operational environments.

JHT Process

- **Principal Investigators apply for funding through NOAA**
- **A seven member Steering Committee rates all proposals**
- **Funded projects are tested during one or two hurricane seasons in conjunction with NHC/ Environmental Modeling Center points of contact**
- **At the project's end, each is evaluated by NHC/EMC staff**
- **Implementation of successful projects are then carried out by NHC/EMC/NCO staff/PIs**

Summary of JHT projects 2001-2010

- **1) Number of projects supported: 62**
  - 50 completed, 32.5 accepted for operational implementation
  - Number of projects rejected: 5
  - Number of projects completed but pending further investigation (decisions deferred): 2.5
  - Number of projects in process: 22

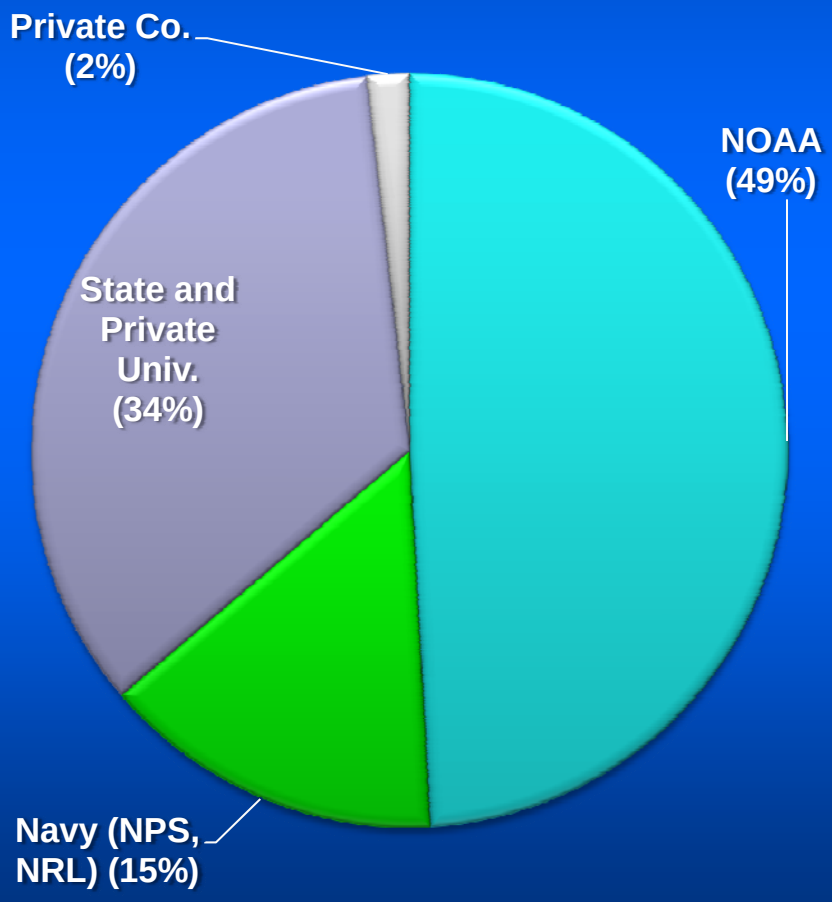
- **2) Implementation**
  - Number of projects implemented: 30.5
    - Number of numerical modeling related projects implemented by EMC/NCO: 9
    - Number of projects implemented by NHC: 21.5
  - Number of projects accepted but not yet fully implemented by NHC: 2

Note:

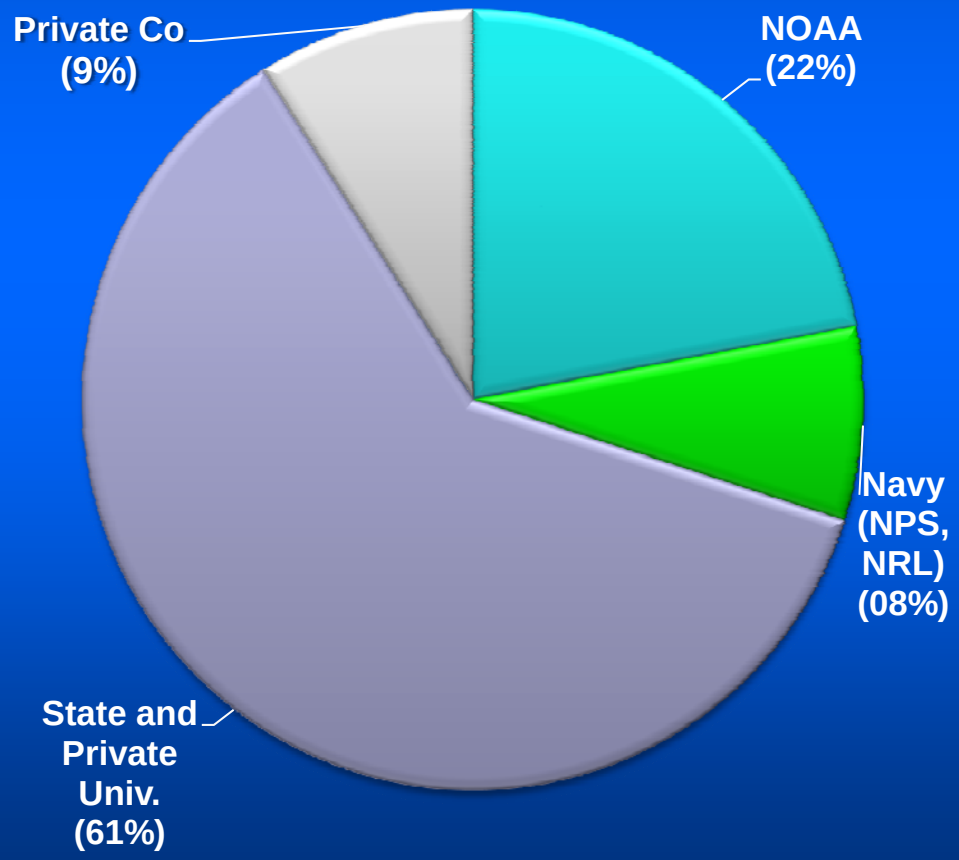
- 1) Implementation is defined when a project is completed, accepted, and the technique installed on NCEP/NCO or NHC operational systems and runs on operational time frame.
- Some techniques were “implemented” on JHT platform for testing.

2003-2010 Changes: Funding Distribution

Second Round (2003-2005)
$1.35M



Fifth Round (2009-2011)
$1.15M



2003-2010 Changes: Forecaster Priorities

Second Round (03-05)

1. Intensity change, rapid intensification
2. “Guidance on guidance” for track, intensity and precipitation – probabilistic
3. Precipitation amount and distribution
4. Reduce the occurrence of guidance and official track outliers
5. Implement improved observational systems in the storm and its environment

Fifth Round (09-11)

1. intensity change, rapid intensification
2. Improved observational systems in the storm and its environment
3. Guidance on guidance for track, intensity and precipitation
4. Enhancements to the operational environment to increase forecaster efficiency
5. Additional operational guidance on coastal inundation (e.g., storm surge and waves)

2003-2010 Changes: Modeling Priorities

(Provided by EMC)

Second Round (03-05)

1. Improved model development to advance track and intensity forecasts
2. Improved boundary layer representation for coupled air/sea/land models-hurricane rainfall and inland flooding problem
3. Improved targeting strategies
4. Transforming results from field programs, e.g., CBLAST, into tangible results for NWP models.
5. Diagnostic studies of storm scale structure changes from high resolution models

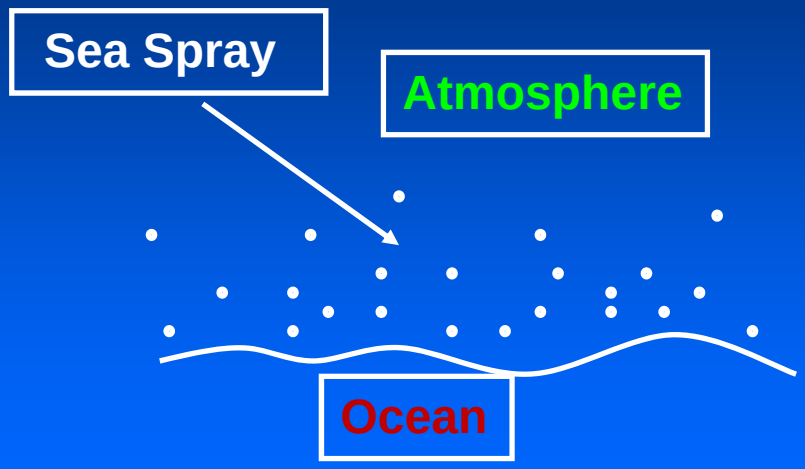
Fifth Round (09-11)

1. General model improvements to advance track and intensity forecasts
2. Improved parameterizations of microphysics, radiation and oceanic-atmosphere boundary layer for coupled atmosphere/ ocean/wave hurricane model
3. Model validation techniques suitable for three dimensional high resolution verification
4. Diagnostic techniques to further increase the utility of global models (e.g., NCEP, UKMO, NOGAPS) in forecasting tropical cyclone genesis

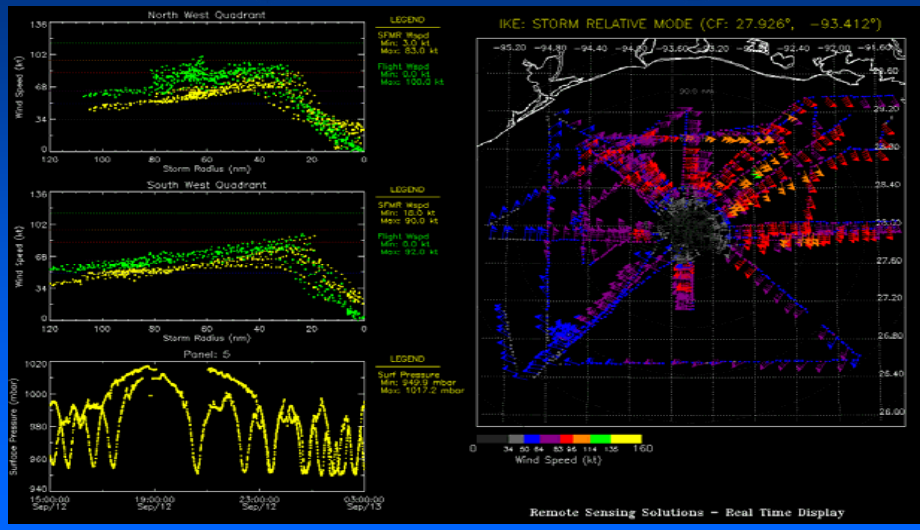
2009-Present Major Activities :

- Test and Complete the 4th Round (07-09) Projects
  - Second year for nine 4th round projects – August 2008-July 2009
  - Testing of 4th round projects
    - Collaboration with PI
    - Programming
    - Establishing data flow
    - Generating output for forecaster use/evaluation
  - Final Reports from Principal Investigators – August 2009-February 2010
    - Feedback from NHC and EMC points of contact

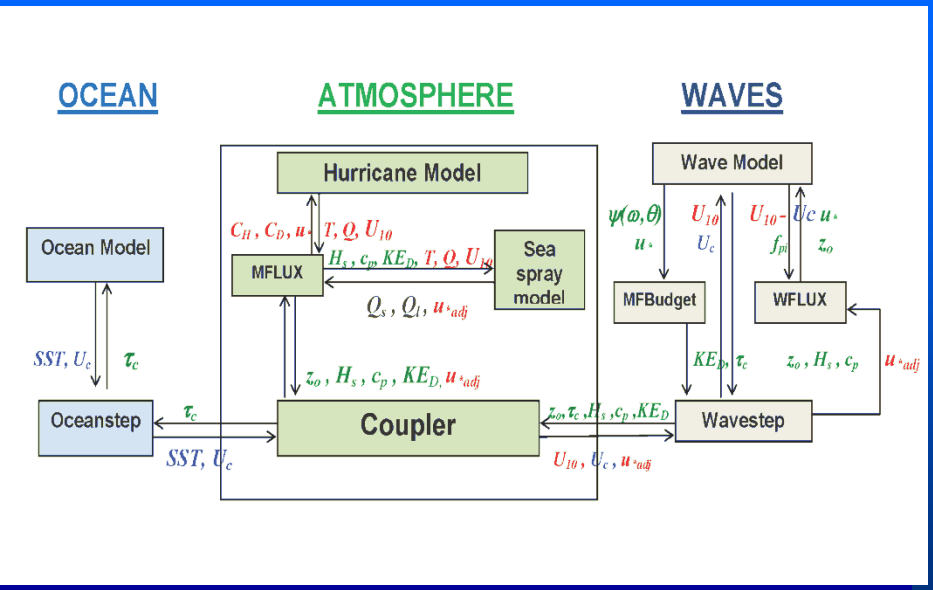
Highlights of 4th Round Completed Projects



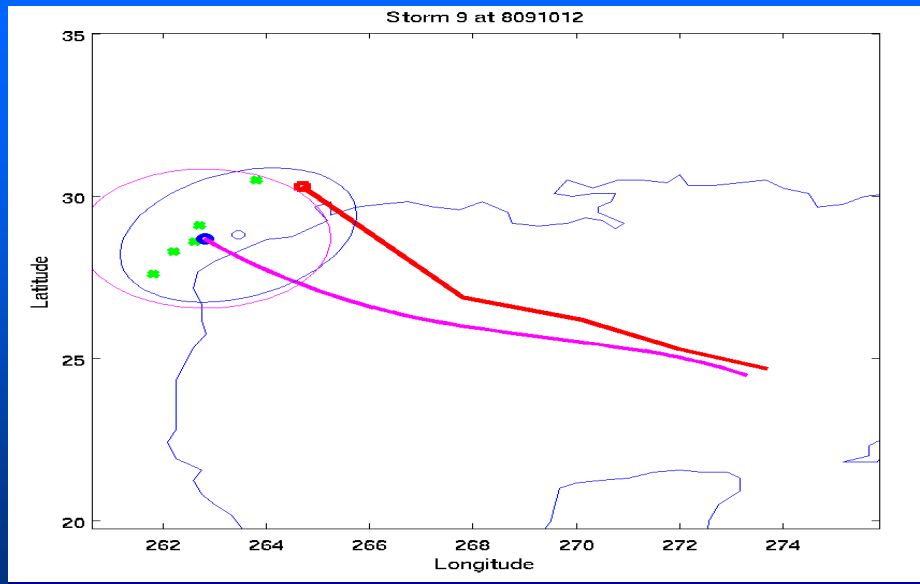
Sea Spray Parameterization – Bao/Fairall



Visualization Tool & SFMR – Carswell/Uhlhorn

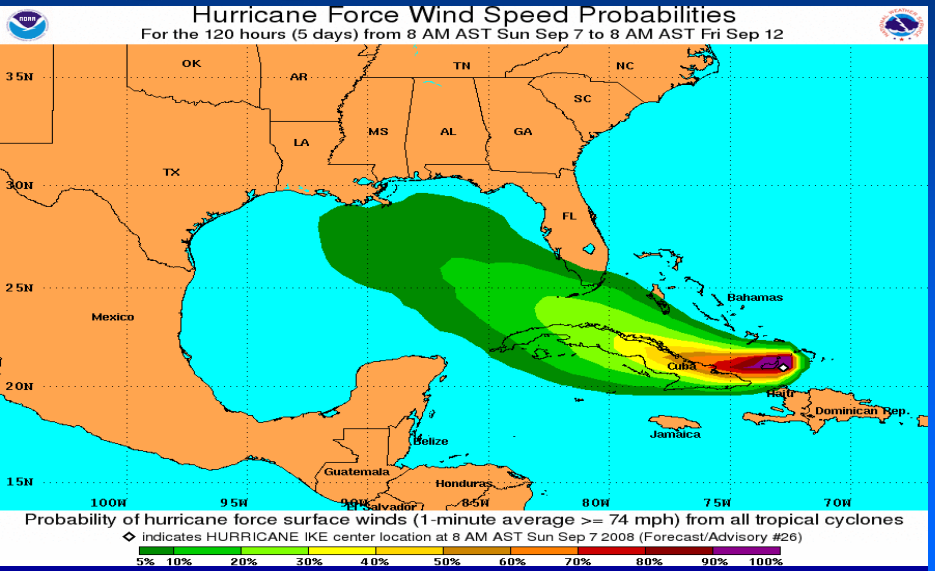


Coupled TC-Wave-Ocean - Ginis

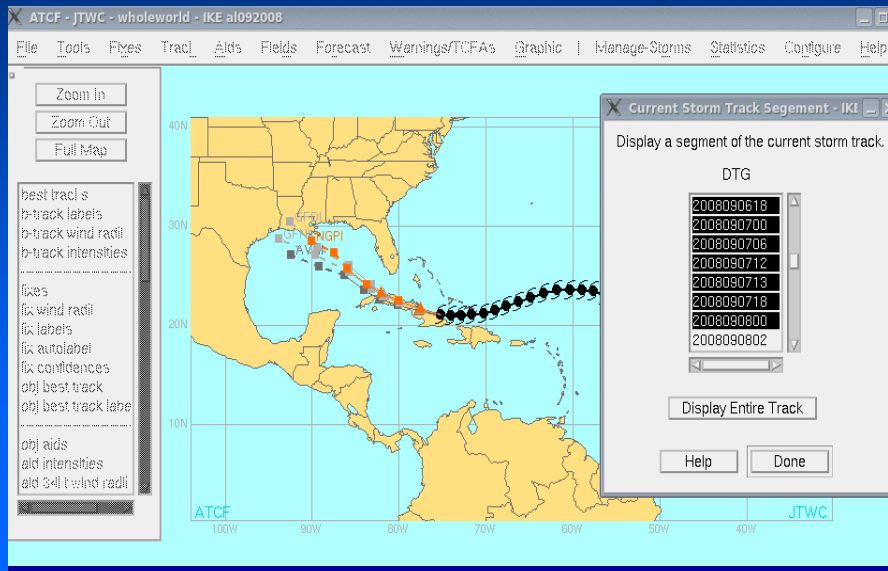


TC Dressing – Hansen

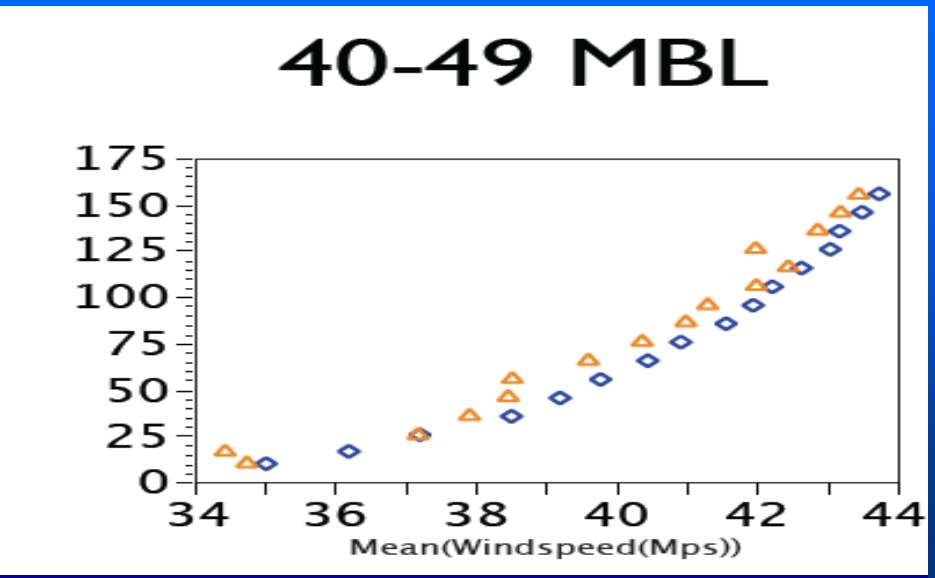
Highlights of 4th Round Completed Projects



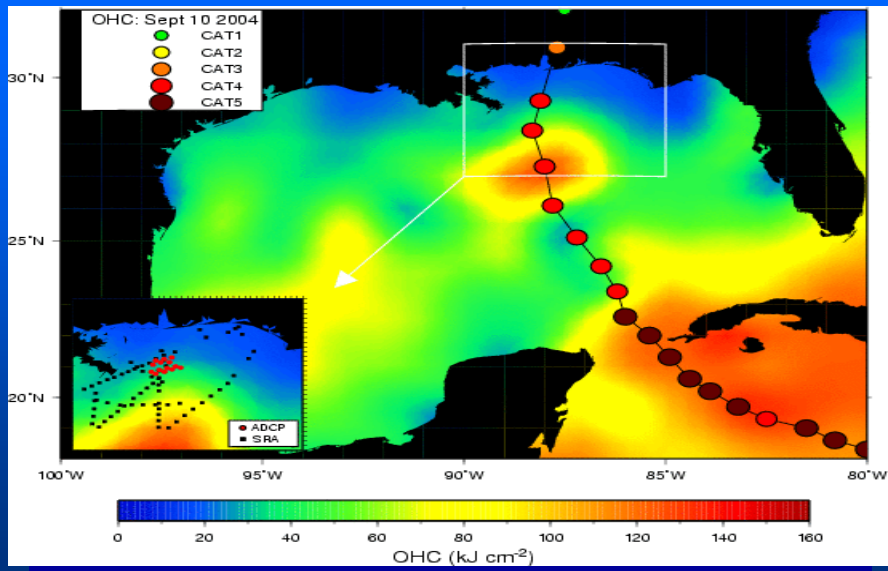
Improved Wind Probabilities – DeMaria/Knaff



Enhanced ATCF - Sampson

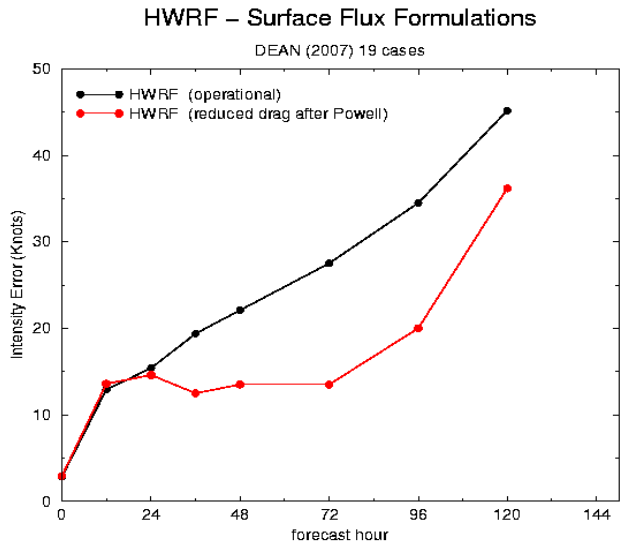


Drag Coefficient in Shallow Water - Powell

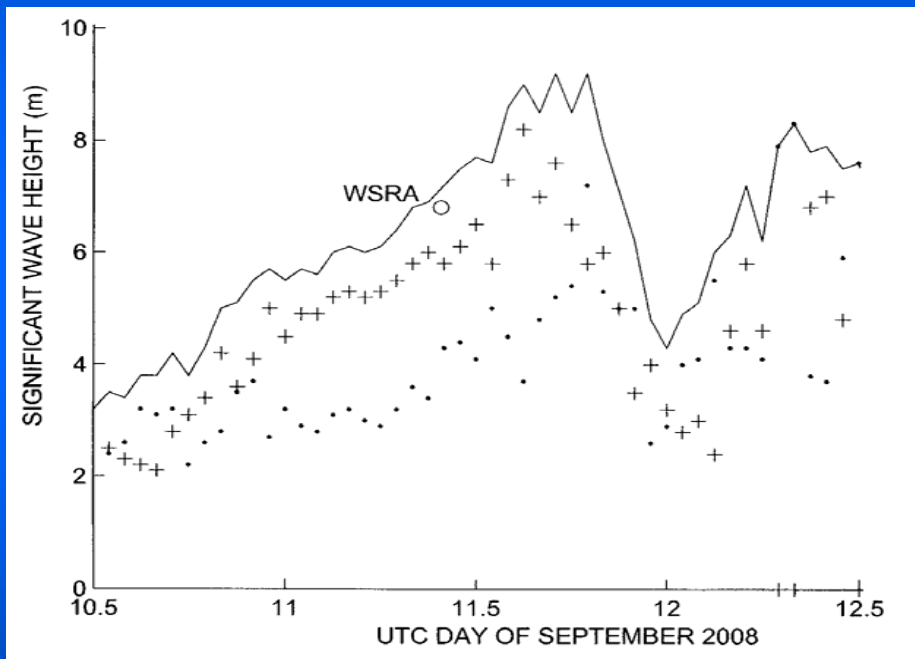


Ocean Model Parameterizations - Shay

Highlights of 4th Round Completed Projects



HWRF Transition - Tuleya



Waves from Aircraft - Walsh

Cont.

2009-Present Major Activities :
Factors in Final Evaluation

- **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

2009-Present Major Activities : *Cont.*

- Fund and Test 5th Round (09-11) Projects
  - Send recommendations on top ranked proposals to USWRP
  - Provide details on funded projects to NHC/EMC staff
  - Identify POC (NHC/EMC)
  - Work with PIs and POCs to define timelines
  - Facilitate testing during the 2009 hurricane season
- Start preparing for the 6th Round of Funding

Current (5th Round) Project Focus Areas

Primary Area of Focus	# of Projects
Improvements to dynamical models (for track, intensity, and precipitation forecasts)	5
Statistical intensity forecast guidance	3
Enhancements to observed data, assimilation	1
Tropical cyclone structure/wind/wave distribution	2
Enhancements to operational environment	1
Total	**12**

Challenges for 2010

- Implement newly accepted projects (NHC)
  - JHT final review/reports to NHC Director
  - NHC Director makes implementation decision
  - Staff at NHC works to implement accepted projects
- Test and evaluation (with NHC & EMC)
  - Prepare real-time testing & evaluation for 5th round projects
  - Set up necessary software code and data flow

Challenges for 2010 – cont.

- Preparation for 6th round projects
  - Draft Federal Funding Opportunity (FFO) (April 2010)
    - Centers (NHC/JTWC/EMC) priorities
    - Evaluation criteria
  - FFO published (July)
  - SC Review of Pre-applications (September)
  - PIs submitting full proposals (November)
  - SC Review of full proposals (January 2011)
  - Projects selected for funding (March 2011)
  - Projects begin (August 2011)

Acknowledgements

- JHT Steering Committee
- NHC and EMC forecaster and points of contact
- NHC adm & Technical Support Branch staff
- JHT principal investigators and other funded participants
- John Gaynor/Roger Pierce (USWRP)
- OFCM

JHT Website

http://www.nhc.noaa.gov/jht/index.shtml

Thank you

Supplemental Slides

NHC Contributions to JHT

Logistics

- **Dedicated physical space in operations, offices**

Personnel

- **NHC dedicating about 1.5 FTE spread across ~12 people**
  - **0.5 FTE reimbursed by USWRP for quarter-time JHT Director and one quarter-time JHT administrative assistant**
  - **NHC contributing 1.0 FTE, including NHC member on JHT Steering Committee, forecasters, and technical support staff**
- **Forecaster and technical points of contact (POC)**
- **Programming, system administration, and network support**
- **Administrative support**

Computing Resources

- **Network connectivity**
- **Operational data flow**

JHT Infrastructure

Personnel

- Quarter-time Director (NOAA FTE)
- 7-member Steering Committee
  - Three from NOAA (one TPC), two from DOD, and two from the academic community
  - TPC member serves as co-Chair
- Two quarter-time administrative assistants (NOAA FTE)
- One IT Facilitator (meteorologist/programmer)

Computing Resources

- Server and workstations
- Software

TPC/ NHC Priority[1]	JTWC Priority[1]	Operational Need[1]	Linkage to Research Needs
1	**1**	Guidance for tropical cyclone intensity change, with highest priority on the onset, duration, and magnitude of rapid intensification events. Similar guidance is also needed on when rapid over-water weakening (such as had been observed in recent Gulf of Mexico hurricanes) will occur.	A1a-f, B1, B2, B3a-e, B6, B7
2	**2**	Improved capability to observe the tropical cyclone and its environment to support forecaster analysis and model initialization.	B1, C1-C3
3	**5**	Statistically-based real-time guidance on guidance for track, intensity and precipitation (e.g., multi-model consensus approaches), provided to forecasters in probabilistic and other formats.	B5,B6
4	**6**	Enhancements to the operational environment to increase forecaster efficiency, by expediting analysis, forecast, coordination, and/or communication activities.	C1c
5	**7**	Additional operational guidance on coastal inundation (e.g., storm surge and waves).	A4, A5, B2, B3, B6
6	**8**	Improved and extended track guidance. Identification, and then reduction of, the occurrence of guidance and official track outliers, focusing on both large speed errors (e.g., accelerating recurvers and stalling storms) and large direction errors (e.g., loops), and on specific forecast problems, including interactions between upper-level troughs and tropical cyclones, track forecasts near mountainous areas, and extratropical transition.	A2, B1-B3, B5-B6
7	**3**	Guidance for tropical cyclone genesis that exhibits a high probability of detection and a low false alarm rate, and/or provides probability of genesis.	A3, B1-B3, B5-B7
8	**9**	Operational analysis of the surface wind field (including maximum sustained winds) in tropical cyclones. This also includes methods for forecasting the wind field over elevated terrain and high-rise buildings.	B1, B2, C1-C3
9	**4**	Guidance for changes in tropical cyclone size/wind structure and related parameters, including combined sea heights.	A1a-g, B1-B7
10	**10**	Guidance on the operational utility and relative merits of high-resolution model output compared to lower resolution ensemble model output.	B6, B7
11	**11**	Guidance for tropical cyclone precipitation amount and distribution.	A4, B1-B7
12	**12**	Improved utility of microwave satellite and radar data in tropical cyclone analysis.	B1, C1c
13	**13**	Improved techniques for estimating the intensity of tropical cyclones passing over and north of sea-surface temperature gradients (e.g., in the eastern North Pacific Ocean and the Atlantic Gulf Stream).	C1
14	**14**	Quantitative guidance tools for seasonal tropical cyclone forecasts for the Atlantic and North Pacific basins, using statistical and/or dynamical methodologies.	A6,B2, B6

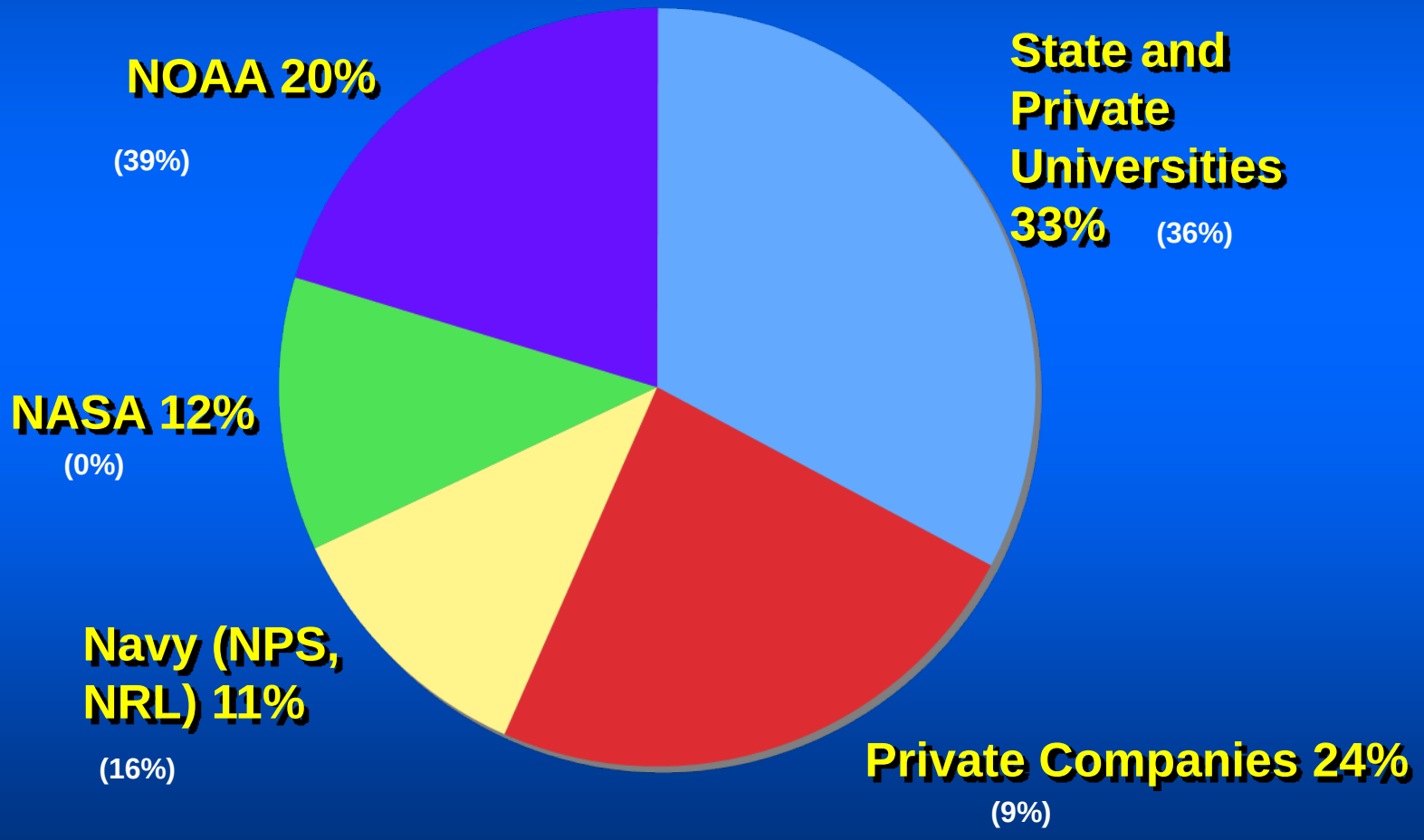
2008-present Major Activities *Cont.*

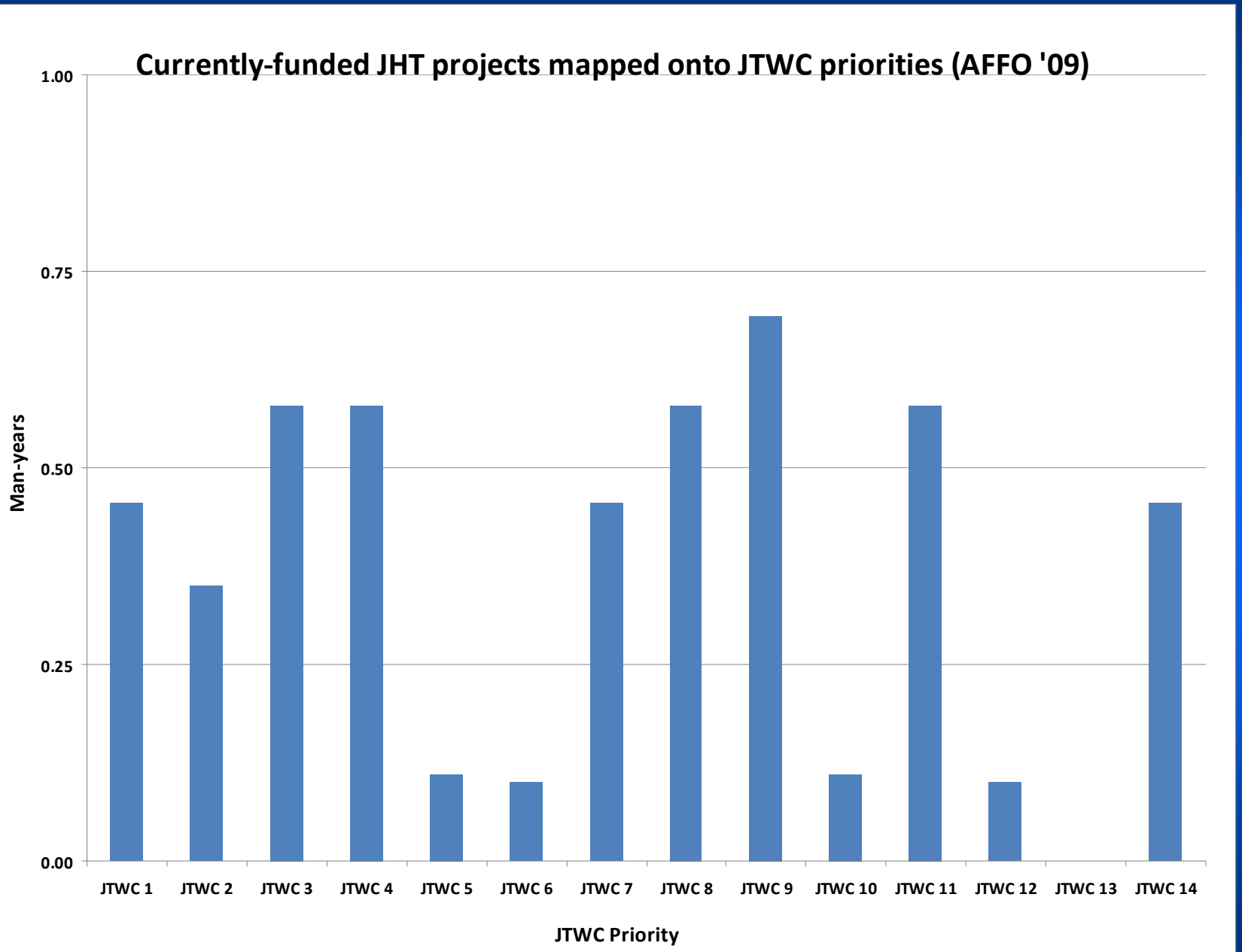
4th Round Project Focus Areas

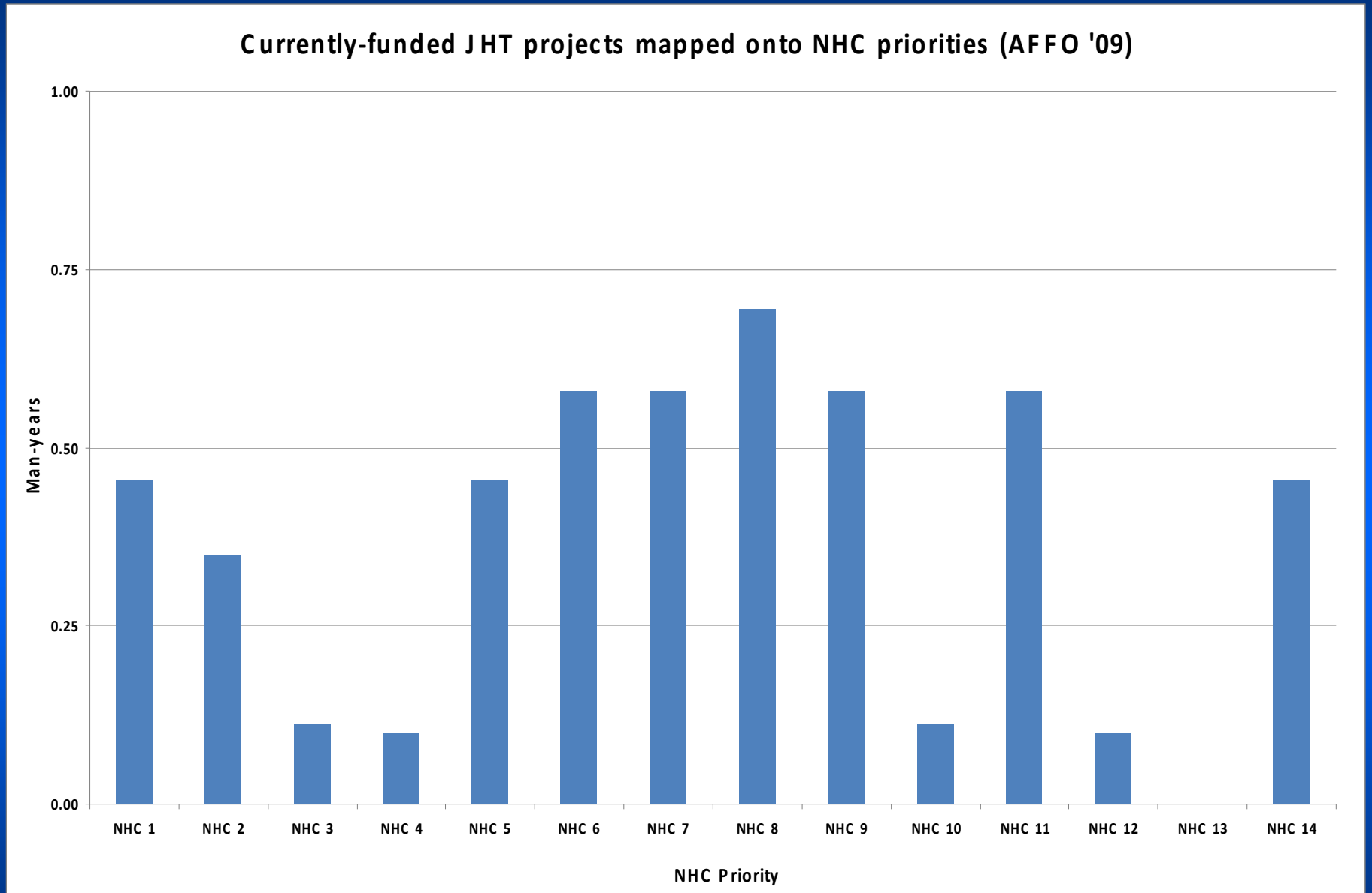
Primary Area of Focus	# of Projects
Improvements to dynamical models (for track, intensity, and precipitation forecasts)	5
Statistical intensity forecast guidance	1
Enhancements to observed data, assimilation	0
Tropical cyclone structure/wind/wave distribution	2
Track forecast guidance	1
Enhancements to operational environment	1
Total	**10**

4th Round (FY07-08) Recommended Funding Distribution

Total $1.04M ($1.5M announced)




Currently-funded JHT projects mapped onto JTWC priorities (AFFO '09)
1.00
0.75
0.50
0.25
0.00
Man-years
JTWC 1
JTWC 2
JTWC 3
JTWC 4
JTWC 5
JTWC 6
JTWC 7
JTWC 8
JTWC 9
JTWC 10
JTWC 11
JTWC 12
JTWC 13
JTWC 14
JTWC Priority


Currently-funded JHT projects mapped onto NHC priorities (AFFO '09)
1.00
0.75
0.50
0.25
0.00
Man-years
NHC 1
NHC 2
NHC 3
NHC 4
NHC 5
NHC 6
NHC 7
NHC 8
NHC 9
NHC 10
NHC 11
NHC 12
NHC 13
NHC 14
NHC Priority

Currently-funded JHT projects mapped onto TC research needs