Improving Forecast Guidance through the Joint Hurricane Testbed

Shirley Murillo – NOAA/OAR/AOML Hurricane Research Division

Chris Landsea – NOAA/NWS/NCEP/National Hurricane Center

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

98th AMS Annual Meeting - Eighth Conference on Transition of Research to Operations - January 10, 2018

Joint Hurricane Testbed (JHT)

- Bridges hurricane research & 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 the National Hurricane Center, Central Pacific Hurricane Center or at their institutions

JHT: By the numbers

- Number of projects supported: 95
  - 82 completed
    - 54 implemented into operations at NHC/EMC/other
    - 21 not accepted
    - 5 deferred
    - 2 unable to be implemented
  - 8 projects started 1 Sep. 2015 (FY15-17: 8th round, 1 complete)
  - 6 projects started 1 July. 2017 (FY17-19: 9th round)

Metrics for Operational Implementation

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

Our process

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

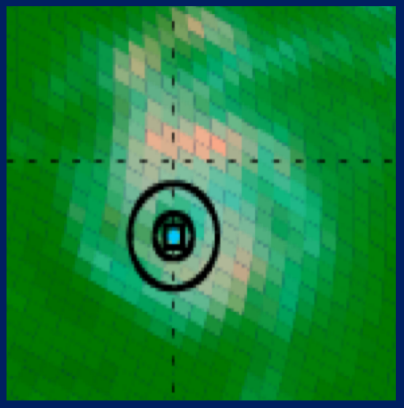
Current Project Highlights - FY15-17: 8th round

Tropical Cyclone Genesis Index: Dunion

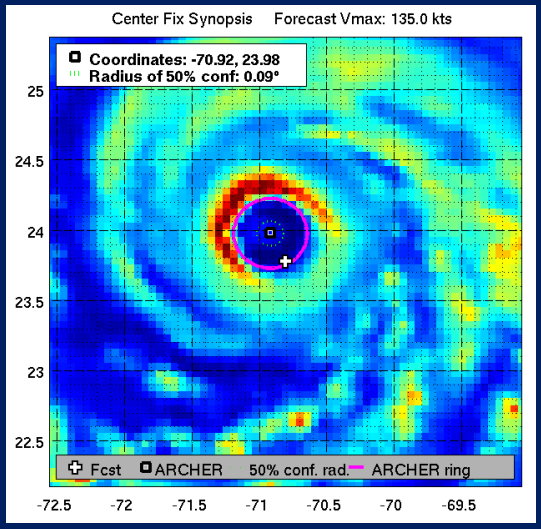
ATLANTIC TC GENESIS INDEX
AL972013 10/01/13 18 UTC

TIME (hr)	0	6	12	18	24	36	48	60	72	84	96	108	120
TCGI (%)							45.1						65.0
HDIV (x10-7s-1)	-3.0	-4.0	-1.0	-3.0	-5.0	0.0	-6.0	1.0	-5.0	0.0	-4.0	0.0	0.0
VORT (x10-6s-1)	1.3	1.6	1.6	1.7	1.6	1.5	1.1	0.8	1.0	0.5	1.1	1.1	1.1
DV24 (x10-6s-1)	0.3	0.0	-0.1	-0.7	-0.5	-0.7	-0.1	-0.3	0.1	0.6	0.0	-0.1	-0.3
VSHD (kt)	5	9	11	9	9	17	19	19	19	26	24	28	27
MLRH (%)	67	67	64	63	67	64	68	62	64	52	54	52	54
PCCD (%)	42	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TNUM	1.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LAT (deg N)	16.8	17.2	17.8	18.5	20.3	22.9	25.0	26.3	27.6	28.3	29.2	30.1	31.4
LON (deg W)	83.0	83.5	84.4	85.1	85.8	87.0	87.4	87.5	86.8	86.5	85.5	84.4	82.9
DTL (km)	169	172	217	259	132	154	382	358	270	188	56	-5	-140
TRACK SOURCE	AVNO	AVNO	AVNO	AVNO	AVNO	AVNO	AVNO	AVNO	AVNO	AVNO	AVNO	AVNO	AVNO

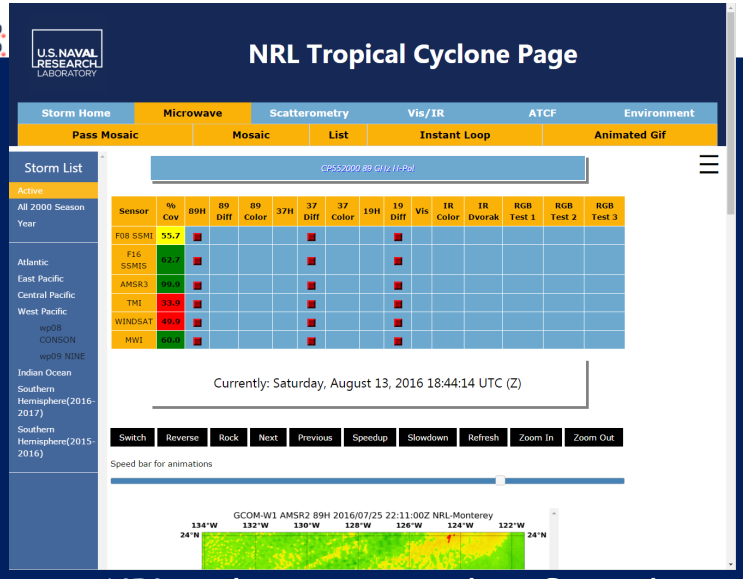
Prob
Prob



Rapid Intensity Forecasting: Jiang



Eyewall Replacement Cycle
ARCHER: Wimmers



NRL web page upgrades: Cossuth

Matrix of RI probabilities

RI (kt / h)	20/12	25/24	30/24	35/24	40/24	45/36	55/48
SHIPS-RII:	17.4%	64.3%	54.0%	37.1%	30.9%	62.9%	70.6%
Logistic:	7.1%	42.6%	43.0%	19.6%	12.3%	55.7%	56.8%
Bayesian:	0.9%	47.6%	34.5%	8.3%	3.5%	10.1%	36.4%
Consensus:	8.5%	51.5%	43.9%	21.6%	15.6%	42.9%	54.6%

RI SHIPS improvement: Rozoff

New JHT Projects - FY17-19: 9th round

Project Title	Principal Investigator(s)
Improvements to Operational Statistical Tropical Cyclone Intensity Forecast Models Using Wind Structure and Eye Predictors	Galina Chirokova (CSU/CIRA), John Kaplan (AOML/HRD)
Ensemble-based Pre-genesis Watches and Warnings for Atlantic and North Pacific Tropical Cyclones	Russ Elsberry (UC-CS)
Improvements and Extensions to an Existing Probabilistic TC Genesis Forecast Tool Using and Ensemble of Global Models	Bob Hart (FSU), Dan Halperin (Embry-Riddle)
Estimation of Tropical Cyclone Intensity Using Satellite Passive Microwave Observations	Haiyan Jiang (Florida Intl Univ.)
Transition of Machine-Learning Based Rapid Intensification Forecasts to Operations	Andrew Mercer and Kimberly Wood (MSU)
Evolutionary Programming for Probabilistic Tropical Cyclone Intensity Forecast	Paul Roebber and Clark Evans (UW-Milwaukee)

Our 2018 Plans

- Continued testing during the 2017 hurricane season of 8 projects (8th round)
- Final report provided by Principal Investigators – late 2017
- Operational implementation decision made by NHC – 2018
- New proposals funded starting 1 July 2017 (9th round)
- New PIs present project's progress at the Tropical Cyclone Operations and Research Forum (March 2018)
- Conduct testing during the 2018 hurricane season

Best Practices/Lessons Learned

- Dedicated Admin. Staff
  - JHT Director and Admin. Assistant: work closely with operatinal centers and PIs
  - IT computer programmer for JHT projects
- Process is proposal driven
  - Includes NHC/CPHC/JTWC areas of priority
  - Provide info on operational center's IT environment
- Seven member Steering Committee
  - Representatives from the Tropical Cyclone community
  - Review and rank proposals
- When projects begin, PIs are partnered with forecasters
  - Continuous interaction throughout transition process
  - PI provide semi-annual progress reports

The Joint Hurricane Testbed

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.

Improving Forecast Guidance through the Joint Hurricane Testbed

Shirley Murillo – NOAA/OAR/AOML Hurricane Research Division
Chris Landsea – NOAA/NWS/NCEP/National Hurricane Center

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

98th AMS Annual Meeting - Eighth Conference on Transition of Research to Operations - January 10, 2018