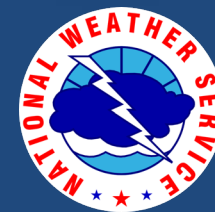


Hurricane and Ocean Testbed (HOT): Update

Wallace Hogsett – NOAA/NWS/NCEP/National Hurricane Center
Jason Sippel – NOAA/OAR/AOML Hurricane Research Division

**77th Interdepartmental Hurricane Conference
March 2023**

The HOT is funded by the US Weather Research Program in NOAA/OAR's Weather Program Office

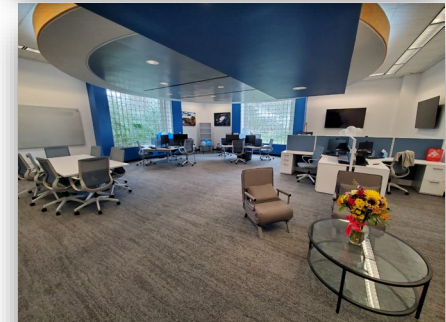


Agenda

- Hurricane and Ocean Testbed (HOT):
 - Overview
 - First Year Review
- Ongoing JHT & JTTI Projects
- Operational Transition Decisions: Metrics & Process
- Looking ahead to 2023

The Hurricane and Ocean Testbed (HOT)

- The William Lapenta Laboratory at NHC, Home of the HOT:
 - A **physical** , collaborative environment to consider all aspects of the forecast continuum - from observations to actions
 - A **virtual** technology ecosystem to test hurricane and ocean R&D in a quasi-operational environment
- HOT is a home for all projects, innovations, etc. across the value chain that require NHC T&E
 - Establishes efficient pathways to rapidly progress Readiness Levels (RLs) of hurricane and ocean innovations



The William Lapenta Laboratory at NHC:
Home of the Hurricane and Ocean Testbed (HOT)

Isolated Virtual
AWIPS Cloud
Environment

Whiteboard
and Video Wall

AV Demonstrations

Experiment
Workstations

Development
Workstations

Collaboration Area



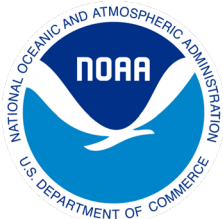
HOT: The First Year

- Dec 2021: Dr. William Lapenta Laboratory ribbon cutting
- Feb 2022: NHC began development work on Tropical Cloud AWIPS instance (w/ NOAA/GSL)
- Mar 2022: Executed Wind Hazard Recommender experiment
- May 2022: Ensemble sensitivity fields demonstrated in Cloud AWIPS (JHT Project, FY19-22)
- June-Sep 2022:
 - FY19 JHT Projects demonstrated @ NHC
 - Four new HOT projects (FY23 -25) announced
 - GSL executed a real -time demo of Hazard Services for storm surge in Cloud AWIPS (JTTI Project, FY20-22)
 - Developed new & enhanced aircraft observations in Cloud AWIPS
- Nov 2022: Executed Real -time Technical Hackathon (Obs -focused)
- March 2023: HOT-TC3 Workshop - WSP2.0 Implementation Planning (JTTI Project)

2022 Real-Time Technical Hackathon



- **Objective:** Gather diverse research and operational stakeholders in the Lapenta Laboratory at NHC for a real-time workshop to accelerate integration of observational datasets into operational workflows.
- **Ideal real -time scenario:** NOAA P-3s flying, no watches or warnings (especially CONUS), late afternoon/evening
 - Executed on **Tue Nov 1** during NOAA P-3 flight into Tropical Storm Lisa
 - Outcomes: two new “operations-ready” innovations & hardened tech environment



NWS/NHC
OAR/ AOML/HRD
OAR/GSL
NESDIS/StAR





HOT Staff & Funding

- Staff
 - **Wallace Hogsett** : HOT Co-Director, NHC Science and Operations Officer
 - **Jason Sippel** : HOT Co-Director and HRD Meteorologist
 - **Alan Brammer** : HOT R2O Facilitator/Programmer
 - **NHC Technology & Science Branch (TSB) Chief:** HOT Transition Manager
- FY22 Funding
 - ½ time support for HOT Facilitator/Programmer
 - 0.2 FTE support and HRD for admin support
 - 30K for JTTI project support (real-time demonstration and evaluation)



JTTI - Current Projects

- FY20: 2 Projects in HOT Evaluation
 - Taylor Trogon & Nate Hardin: Generating Storm Surge Hazards using Hazard Services
 - Galina Chirokova: Use of Ocean Stability Data and Machine Learning to Improve Tropical Cyclone Situational Awareness and NHC Statistical-Dynamical Intensity Guidance
- FY21: 2 Projects in HOT Evaluation
 - Kate Musgrave: Integration of Model Large-Scale Environmental Diagnostics for Tropical Cyclones into the MET-TC Verification Package
 - Andrea Schumacher: Unification and Improvements to Guidance for National Weather Service Tropical Cyclone Wind and Storm Surge Hazard Products
- FY22: 1 Project in HOT Evaluation
 - Dan Halperin: Effectively Communicating Uncertainty in Tropical Cyclone Intensity Forecasts



JHT/HOT Project Overview - 2015-23

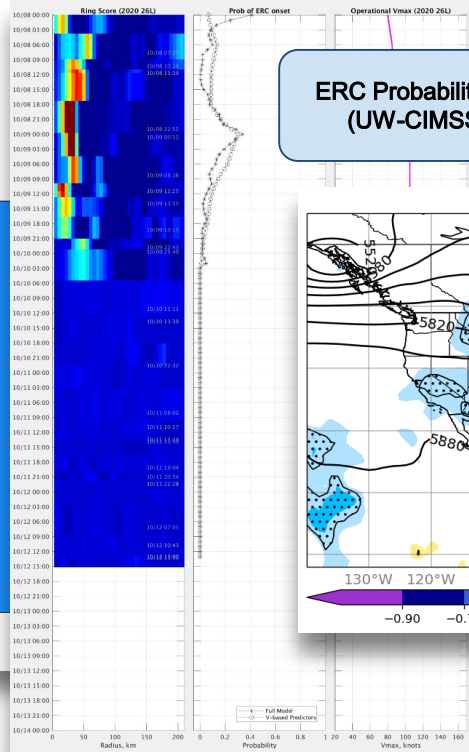
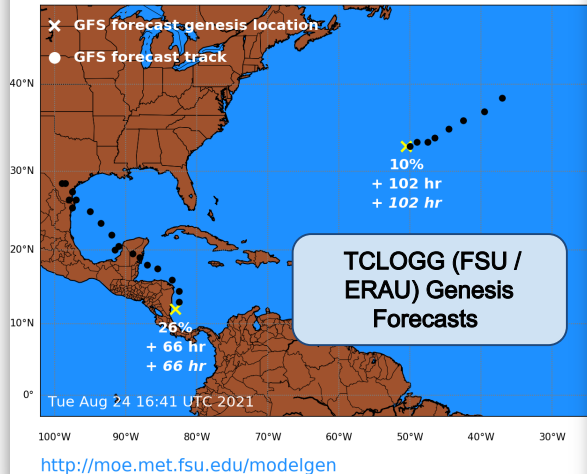


- **Round 8 (FY15 -17):** 8 projects completed
 - 5 accepted for operational implementation
 - 1 deferred until additional evaluation can be conducted
 - 2 not accepted for operational implementation
- **Round 9 (FY17 -19):** 6 projects completed
 - 2 accepted for operational implementation
 - 4 not accepted for operational implementation
- **Round 10 (FY19 -22):** 2 projects completed, 1 ends 6/30/2023
 - Transition decisions later this year
- **Round 11 (FY22 -24):** 4 new HOT projects

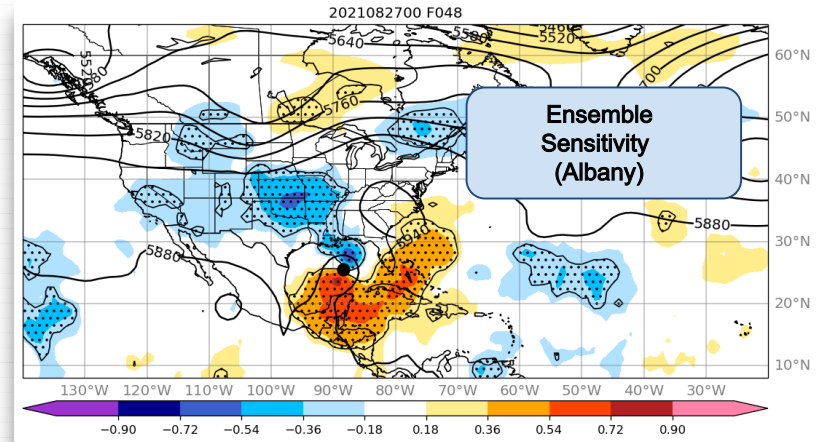


JHT - 2019-2022 Projects

Experimental 0-48 h TC genesis probability
GFS model output initialized 2021-08-24 12Z



ERC Probabilities
(UW-CIMSS)





New HOT Projects

WPO-Funded HOT Projects (2022 -2025)	PIs	Start Date	End Date
Forecaster Support Products for Analysis of Tropical Cyclone Intensity and Structure from Aircraft Reconnaissance Observations	Vigh / Bell / Zhang	8/1/22	7/31/25
A Machine Learning Model for Estimating Tropical Cyclone Track and Intensity Forecast Uncertainty	DeMaria	8/1/22	7/31/25
Expansion of Ensemble -based Sensitivity to TC Hazard Forecasts	Torn	8/1/22	7/31/25
The Impact of Targeted Synoptic Dropsondes on Tropical Cyclone Forecasts in HAFS	Ditchek	8/1/22	7/31/25

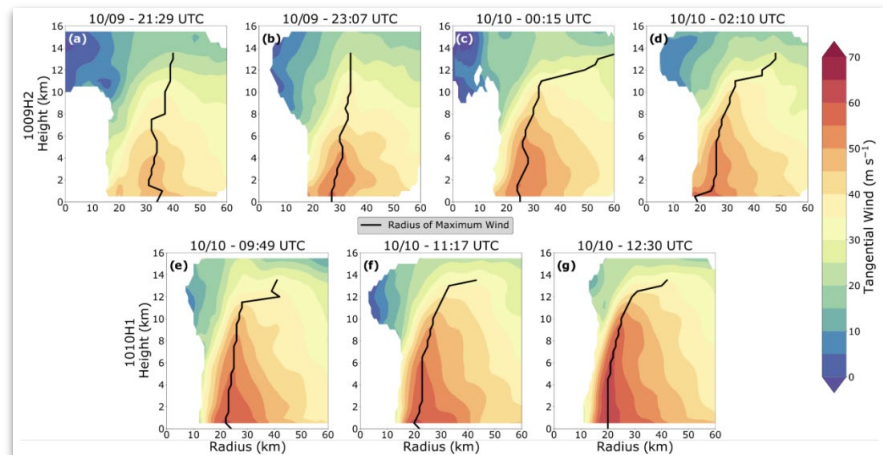
Forecaster Support Products for Analysis of TC Intensity and Structure from Aircraft Reconnaissance Observations



PI: Vigh (NCAR)

Expected Outcome:

- Real-time suite of observational analysis products that provide high-quality spatial and temporal analysis of the TC wind field from 0-3 km in height, graphical and tabular outputs of the estimated VMAX, RMW, and wind radii information along with the uncertainty.



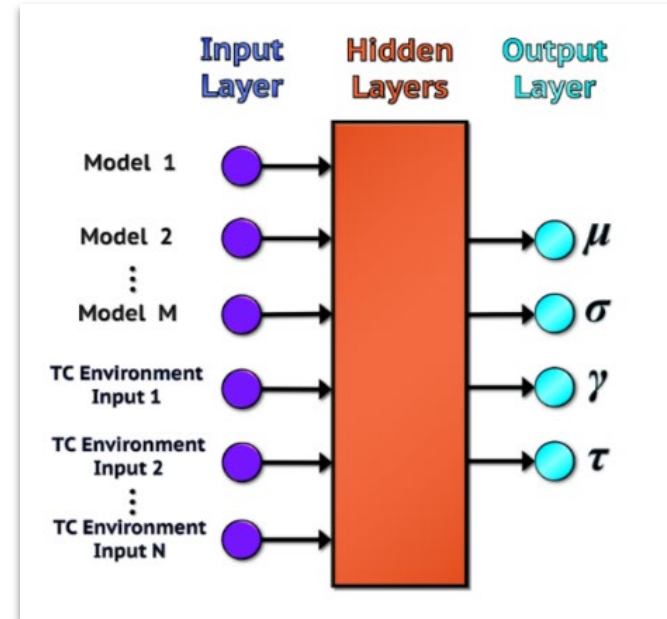


A Machine Learning Model for Estimating Tropical Cyclone Track and Intensity Forecast Uncertainty

PI: DeMaria (CIRA)

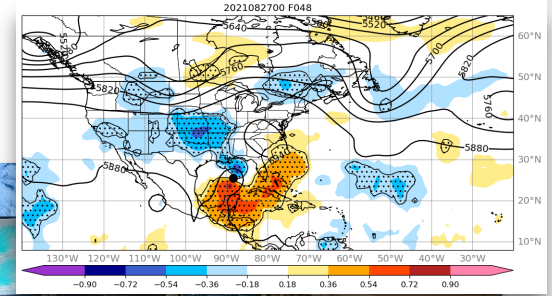
Expected Outcome:

- A guidance model to produce track and intensity forecasts and measures of uncertainty based on conditional distributions predicted by neural networks



Expected Outcome:

-

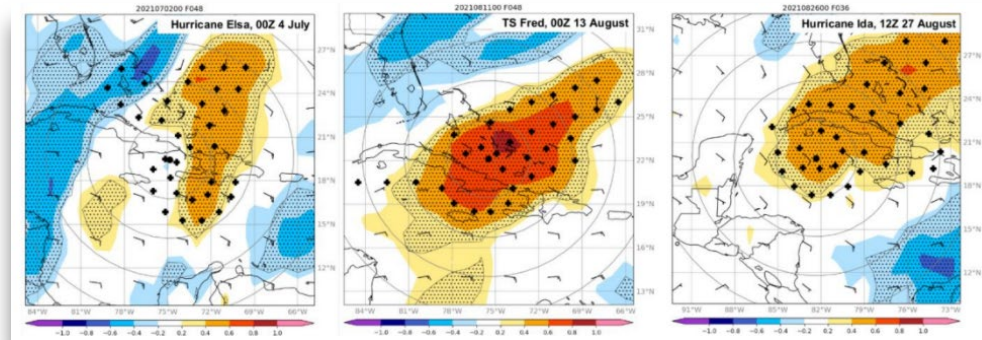
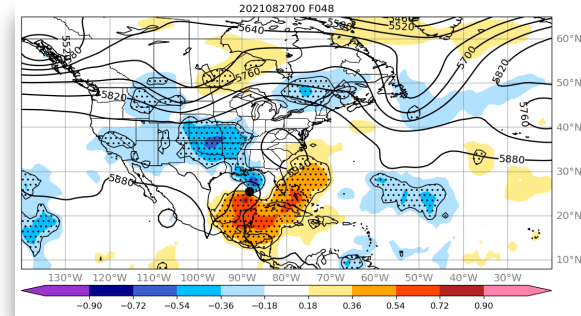


The Impact of Targeted Synoptic Dropsondes on Tropical Cyclone Forecasts in HAFS

PI: Ditchek (CIMAS)

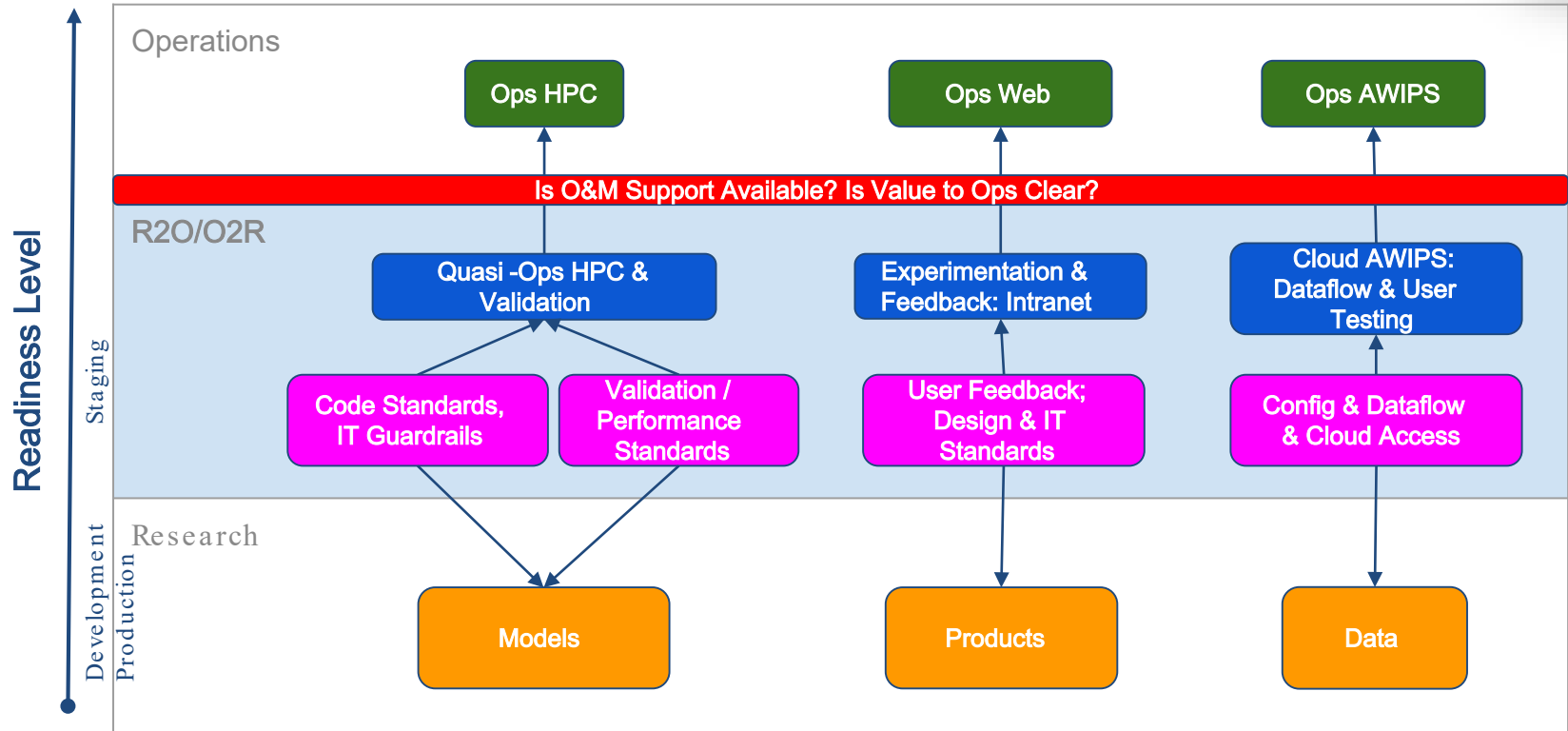
Expected Outcome:

- Provide NHC with guidance for optimizing future flight-track strategies for dropsonde deployment





Roles of the HOT





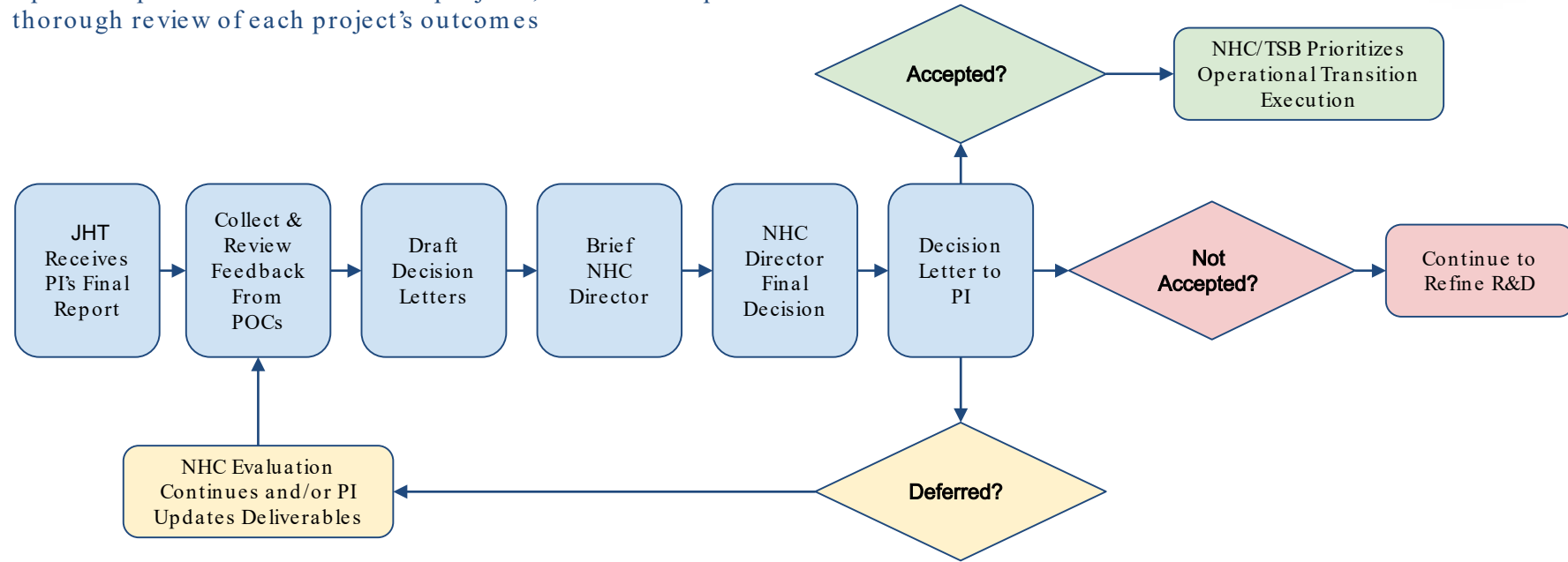
Operational Implementation Metrics

- **Forecast or Analysis Benefit** : expected improvement operational forecasts and/or analysis benefit
- **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 (O&M)



NHC Transition Decision Process

Upon completion of each round of projects, JHT leadership conducts a thorough review of each project's outcomes





JHT/HOT Implementation Summary

- 102 projects supported in 11 funding rounds since 2001
 - 63 accepted for operational implementation
 - 31 not accepted
 - 1 deferred
 - 3 projects nearing completion or recently completed
 - 4 new projects
- 66% of completed JHT projects have been accepted for operational implementation



Looking ahead to 2023+

2022 was the first full year of the HOT (formerly JHT), and we're building a strong foundation for the future

In 2023+, continue to design & build components of an O2R2O machine:

- Cloud-based, non -operational staging systems (e.g., AWIPS, HPC?, storage? Dataflow?)
- Code management to make dev →staging→ops transitions simpler
- Pipeline to integrate R2O with NHC operational workflows
- Provide IT requirements for PIs

Continue to “exercise” HOT Lab infrastructure for R2O transition activities (HOT, JTTI, HFIP, etc.) via workshops, hackathons, etc.



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