Research to Operations (R20) Activities at HRD

SUNDARARAMAN GOPALAKRISHNAN (GOPAL)
HFIP DEVELOPMENTAL MANAGER
NOAA/AOML/HURRICANE RESEARCH DIVISION, MIAMI, FL, USA

ACKNOWLEDGEMENTS: VIJAY TALLAPRAGADA, FRANK MARKS, TIMOTHY SCHNEIDER, FRED TOEPFER, ROBERT ATLAS

Presented at the TCORF/IHC Meeting, March 15-17 Miami
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
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.

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

NOAA-HFIP Jet computers
(about 30,000 processors)

Joaquin, 2015
40-member multi-model ensembles

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

Our HFP is synchronized with our operational DA needs!
Basin Scale HWRF: HFIP Stream 2 Demo System

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

“Our Operational Needs Push the Envelope of NOAA Research”

http://hwrf.aoml.noaa.gov
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)

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!

HWRF as a unique tropical cyclone model with global coverage
Run in real-time for all global tropical cyclones in support of NHC, JTWC and other international operational agencies across the Asia Pacific and North Indian Ocean regions

• With support from NOAA HFIP, HWRF model has now evolved as a unique high-resolution tropical cyclone forecast tool for all tropical oceanic basins, expanding the scope and reach to international TC research and forecast community
  • 2012: For the first time, real-time support to JTWC for North West Pacific typhoon forecasts from HWRF. Collaborations with MD, India and CWB/TTFR, Taiwan
  • 2013: Continued real-time support to JTWC for North West Pacific and North Indian Ocean basins. Extended collaborations with Vietnam, Oman and China
  • 2014: HWRF runs for all global tropical cyclones including Southern Hemisphere. Entered into bilateral agreements with Korea.
  • First overseas HWRF Tutorial sponsored by HFIP, DTC, TTFR, CWB and NCEP in May 2014.
  • HWRF will be coupled to MPIOM/HyCOM ocean models for all oceanic basins by September 2014.

International partnerships for accelerated model development & research

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