



# The DTC and Hurricane Modeling Activities



L. Bernardet<sup>1,4</sup>, L. Nance<sup>2</sup>, S. Bao<sup>1,4</sup>, C. Harrop<sup>1,4</sup>,  
N. Surgi<sup>3</sup>, W. Kuo<sup>2</sup>, S. Koch<sup>1</sup>, and B. Brown<sup>2</sup>

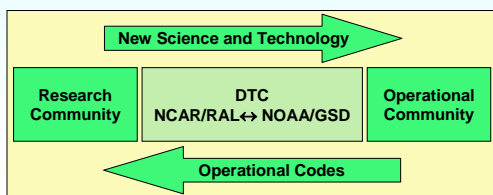
<sup>1</sup>NOAA/Earth System Research Laboratory – Boulder, CO, <sup>2</sup>National Center for Atmospheric Research – Boulder, CO,  
<sup>3</sup>NOAA/NCEP – Camp Springs, MD, <sup>4</sup>Cooperative Institute for Research in Environmental Sciences – Boulder, CO

## The Developmental Testbed Center (DTC) Mission

To serve as a bridge between research and operations to facilitate the activities of the Numerical Weather Prediction (NWP) Community.

### Relevance to NOAA

Supports NOAA objective of "Increase ... transition of advanced science and technology to operations and services" (NOAA Strategic Plan 2008 - 2014)



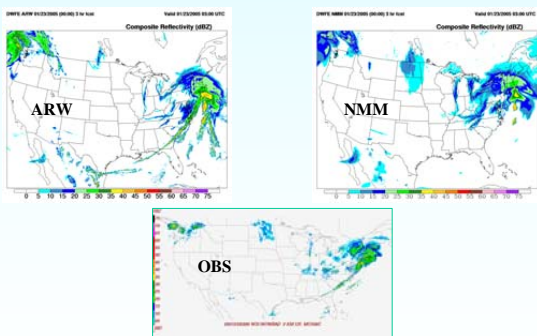
## Examples of DTC Impact on NWS WRF Test Plan (2004)

Tested and evaluated forecast skill of configurations of the Weather Research and Forecasting (WRF) Model.  
**Outcome:** Initial Operational Capability of WRF Model configurations running at NCEP.

## Winter Forecasting Experiment (2005)

Tested and evaluated high-resolution convection-permitting WRF configurations.

**Outcome:** Good representation of mesoscale features led to NCEP upgrading High-Resolution Window (HRW) runs to 5 km grid spacing using explicit microphysics.



## WRF Dynamic Core Tests (2006 - 2008)

Performed controlled comparisons of Advanced Research WRF (ARW) and Non-Hydrostatic Mesoscale Model (NMM) dynamic cores of the WRF Model.

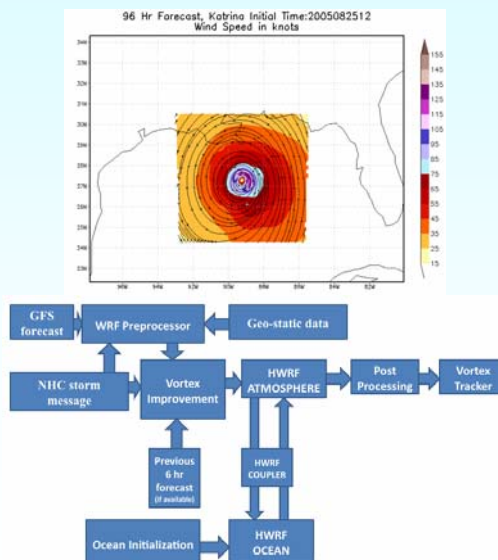
**Outcome:** NCEP decision to adopt ARW as the dynamic core for the Rapid Refresh Model (implementation in 2010).

## HWRP – the NOAA Hurricane Model

DTC is participating in the NOAA Hurricane Forecast Improvement Project (HFIP) to help improve operational numerical guidance.

HFIP goals are to reduce track and intensity error by 50% in first five days of forecast. Much work is needed in physics, initialization etc.

DTC is creating an infrastructure to run the NCEP operational hurricane model (HWRP) for developmental testing. HWRP components are:



The DTC is collaborating with NCEP to:

- Have research community and NCEP operations share code base
- Release and support HWRP to the community
- Host Hurricane Science Workshop and HWRP Tutorial in 2010
- Test new developments for implementation

## Hurricane Forecasting Testing and Evaluation Suite

Used for the HFIP High-Resolution Hurricane (HRH) Test and HWRP.

- GFDL vortex tracker
- NOAA NHC verification system
- Estimation of significance based on distribution of errors
- Rapid Intensification/Weakening verification
- DTC Forecast consistency verification

## References

Bernardet, L., L. Nance, M. Demirtas, S. Koch, A. Loughe, J. L. Mahoney, H.-Y. Chuang, M. Pyle and R. Gall, 2008: The Developmental Testbed Center and its Winter Forecasting Experiment. *Bull. Amer. Meteor. Soc.*, **89**, 611-627.

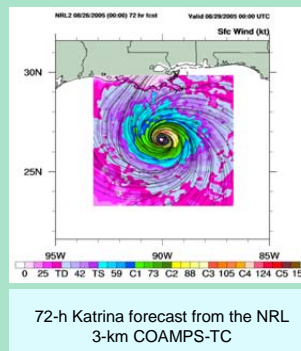
Contact: Ligia Bernardet - Systems Research Group  
NOAA Earth System Research Laboratory  
Email: ligia.bernardet@noaa.gov

## HRH: Benefits of High-Resolution to Forecasting

- Six model configurations from four distinct models (COAMPS, UWM-NMS, GFDL, and WRF) were evaluated.
- Each model configuration was setup for at least two resolutions.
- A total of 69 cases over 10 Atlantic storms from the 2005 and 2007 seasons were studied in this test,

### HRH Impact

- The use of higher resolution in the participating models did not lead to an overall benefit in tropical cyclone forecasting as measured by the metrics used in this study.
- Guidelines to NOAA investments: more developments needed in new physics, initialization, and ensemble techniques before benefits of high-resolution can be realized.

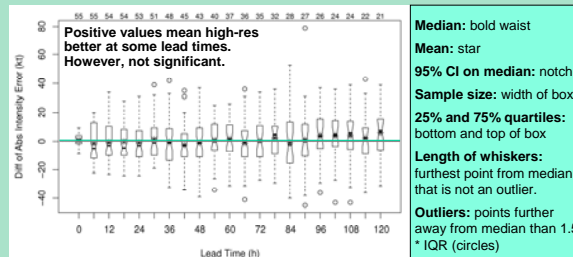


## Collaborators

The transition of HWRP to a DTC supported code has benefited greatly from a close collaboration with the HWRP group at NOAA/EMC.

The HRH Test could not have occurred without the commitment of the participating modeling groups led by Chris Davis (NCAR), Isaac Ginis (URI), S. Gopalakrishnan (NOAA AOML), Melinda Peng (NRL), Gregory Tripoli (UWM), and Fuqing Zhang (PSU).

## Boxplots of difference in absolute intensity error between low and high resolution configurations of Advanced Hurricane WRF



## DTC Provides Information to Support Decision-Making

- WRF Initial Operational Capability at NCEP.
- NCEP's implementation of explicit microphysics configuration in HRW runs.
- Choice of dynamic core for Rapid Refresh implementation at NCEP.
- NOAA investments towards improvement of hurricane forecasting