

High Resolution Hurricane Test at AOML

----Lessons we learned from 69 forecast cases

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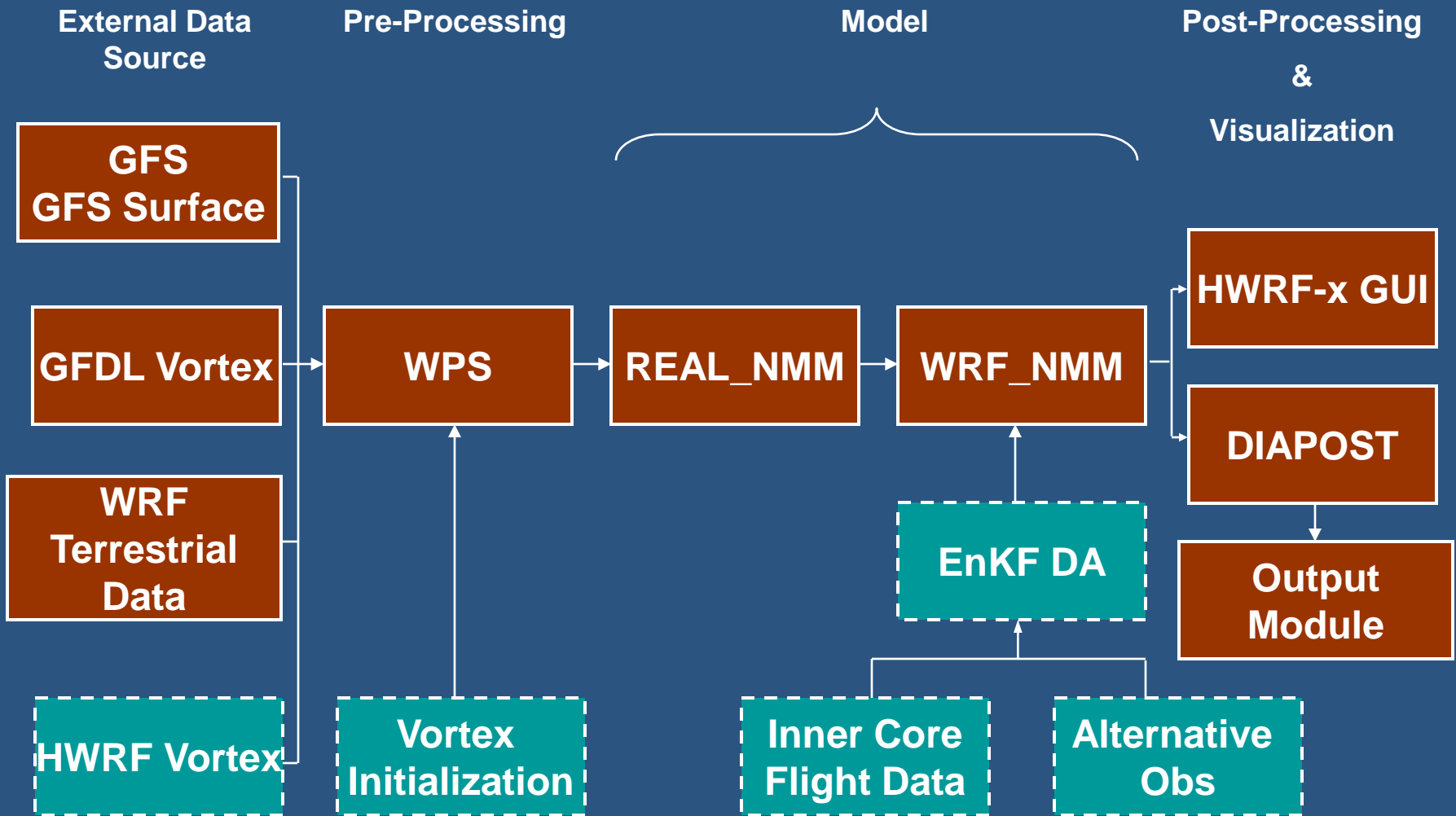
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Tim Marchok (GFDL), Louisa Nance (NCAR/DTC)

ESRL/GSD/HPCS, NCAR/DTC

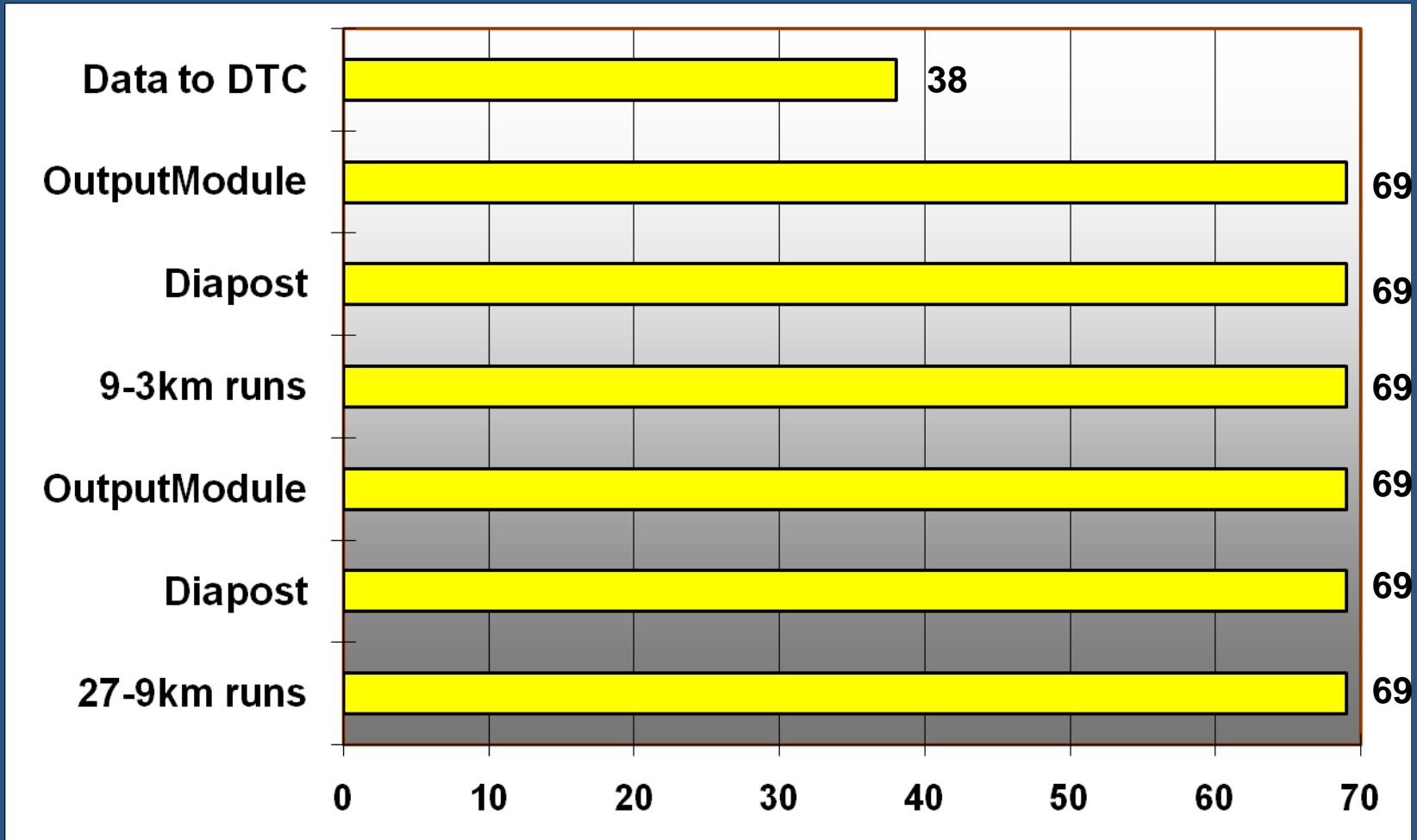
HWRF-x model system



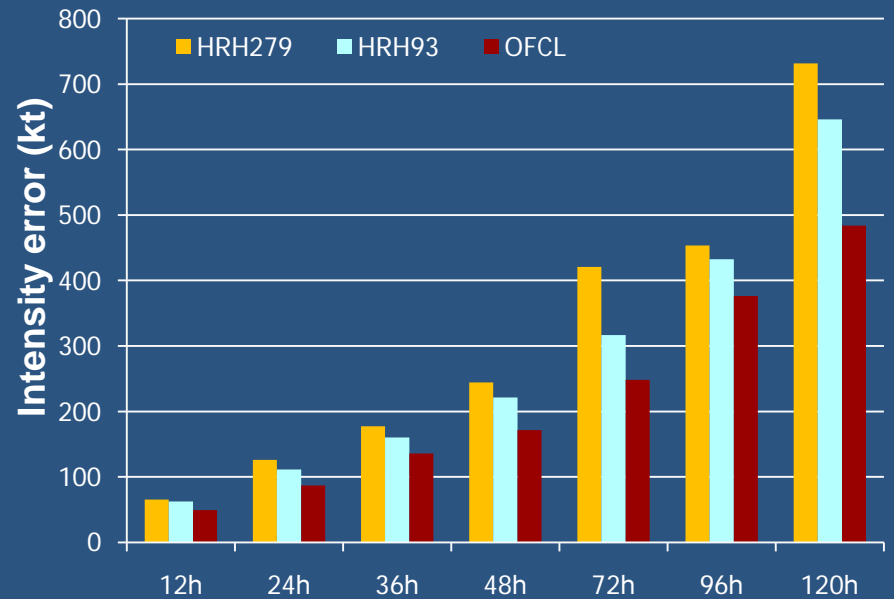
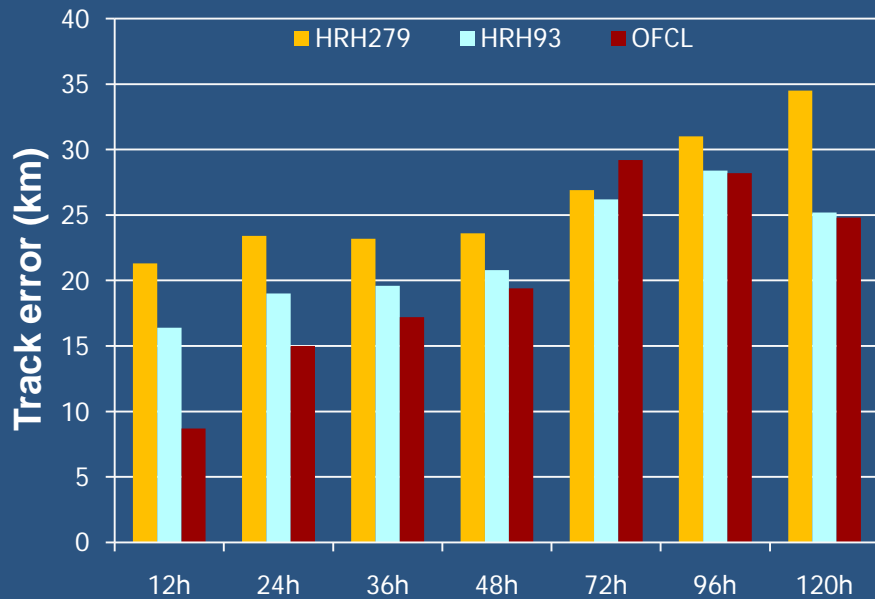
Model Configuration

- WRF NMM 3.0
- Domains
 - Horizontal
 - 27KM ($\sim 55^\circ \times 55^\circ$)/9KM ($\sim 5^\circ \times 5^\circ$)
 - 9KM ($\sim 55^\circ \times 55^\circ$)/3KM ($\sim 5^\circ \times 5^\circ$)
 - Vertical
 - 42 full levels with model top at 50 mb
- Physics
 - Cumulus: Simplified Arakawa-Schubert (27KM and 9KM domains)
 - Microphysics: Ferrier
 - PBL: GFS scheme
 - Surface Layer: GFDL surface scheme
 - Land Surface: NCEP LSM
 - Radiation: RRTM (LW) /Dudhia (SW)
- Ocean
 - Constant SST from GFDL
- Lateral Boundary Conditions
 - GFS forecast (v2007)
- Initial conditions
 - GFDL initial condition for SST and atmosphere
 - GFS initial condition for land surface model

HRH Test Run Status



HRH Test Tracks and Intensities



Forecast Time:	12h	24h	36h	48h	72h	96h	120h
# Cases:	63	62	60	57	49	39	28

Resource Used for running HRH test

	Output Frequency			Disk Space			CPU resource	
	D01	D02	Precip	WPS	ATMOS	DIAPOST	Model	DIAPOST
27-9km	3hr	30min	3min	6.5Gb	16.1Gb	16.5Gb	128CPUs ~2hr	~10min
9-3km	3hr	30min	3min	24.1Gb	80.2Gb	47.7Gb	256CPUs ~6hour	1.5hr

Total Disk Space: ~191 GB per case X 69 = ~13.2 Tb

Total CPU hour: ~1800 CPU hours X 69 = 124,200 CPU hours

Model Output Data: ~76.6 Gb X 69 = 5.3 Tb

Diagnostic Post-processor (DIAPOST)

■ Post-processing

■ Motivation

- Process hi-res model output with sufficient efficiency
- Analyze model performance on native grids to minimize the interpolation

■ Function

- Output model data at original σ - p levels on rotated lat-lon grid for model performance analysis
- Produce data at pressure/height levels on rotated/standard lat-lon grid
- Generate special data sets for evaluation & verification (ATCF track verification, DTC hi-res hurricane test data...)
- Produce special hurricane diagrams for demonstration (Multiple tracks, wind swath, rain swath ...)
- Generate GrADS environment for analysis and display

■ Diagnostic package

■ Vortex-scale analysis and diagnosis

- symmetric structure of tangential, radial, vertical wind
- radial distribution
- vertical structure
- time evolution

■ Convective-scale analysis and diagnosis

- statistics of vertical motion, mass flux
- time-height vertical profiles
- vertical structure of distributions
- time evolution of distributions

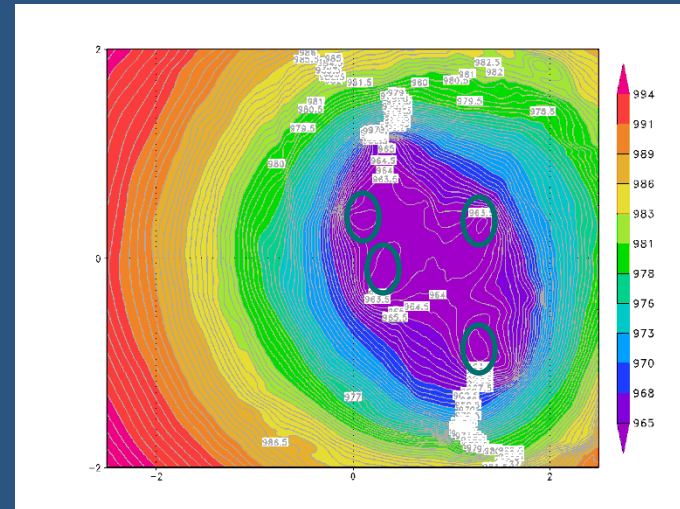
Implementation of moving nest algorithm

■ Motivation

- Multiple vortices within storm eye
 - Multiple low centers due to terrain interaction
 - Multiple vortices due to high resolution
- Disorganized storms
 - Invest cases
 - Storms during/after passing land (Island or Peninsula)

■ Solution

- Centroid Method

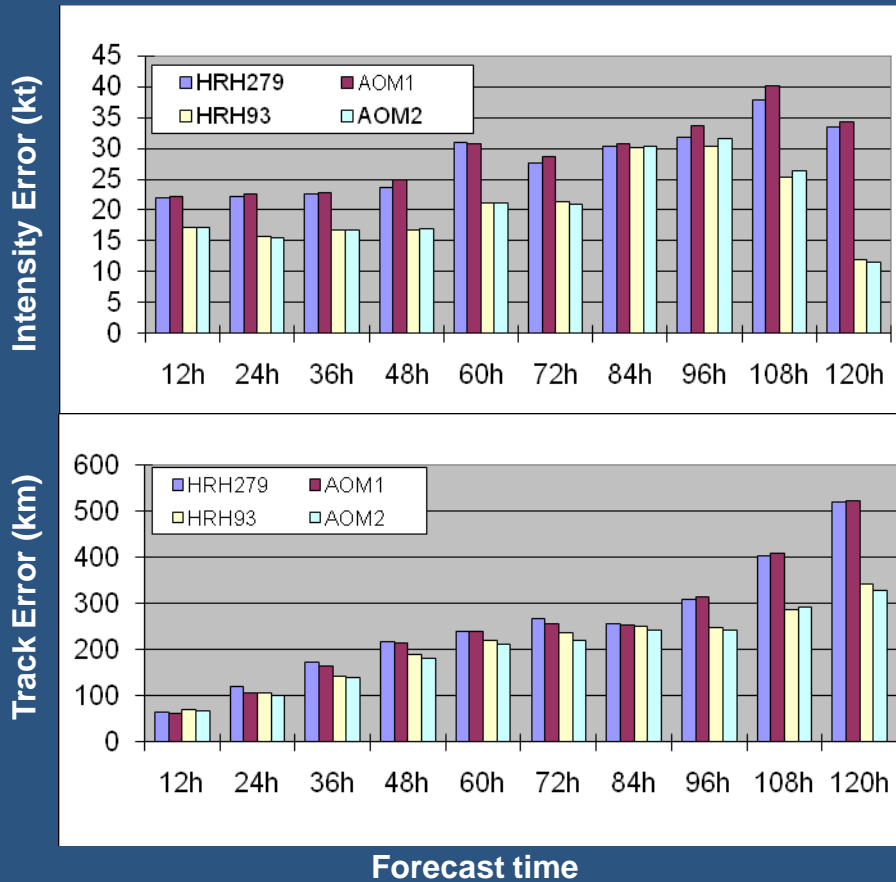


Multiple Vortices

• Issue

- Very weak and disorganized storm
- Topography issue

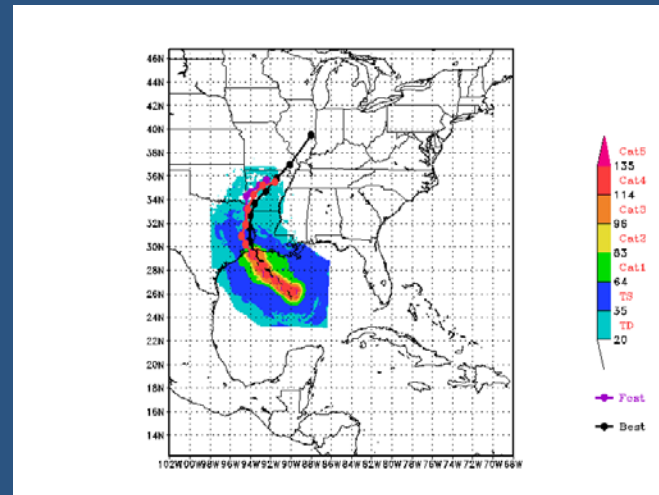
Tracker Comparisons



Some large differences

RITA [2005092300](#)

HR93 10. 24. 44. 100. 179. 342. 9999. 9999. 9999. 9999.
 AOM2 10. 24. 51. 100. 115. 214. 9999. 9999. 9999. 9999.



Summary:

- Tracker developed at AOML is consistent to GFDL/DTC tracker
- Tracker has more uncertainty over land

Physics Issues in HWRF-x

- Radiation
 - Moving nest radiation over land is the main issue
- Land surface
 - Land surface issue is related to radiation as well as land surface model itself

Summary

- HRH test is a collective effort
- Moving nest algorithm and its implementation are still at the test stage but it has shown improvement
- Physics implementation within moving nest should be upgraded and improved
- Tracker should be improved
- Initialization within HWRF-x system should be implemented