

NOAA HFIP High-Resolution Hurricane Test

Developmental Testbed Center

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HRH Test – Mar 08 – June 09

■ Goals

- Evaluate the effect of increasing horizontal resolution *within a given model* on hurricane intensity forecasts
- Provide a data set to explore the potential value of a multi-model ensemble for improving hurricane forecasts

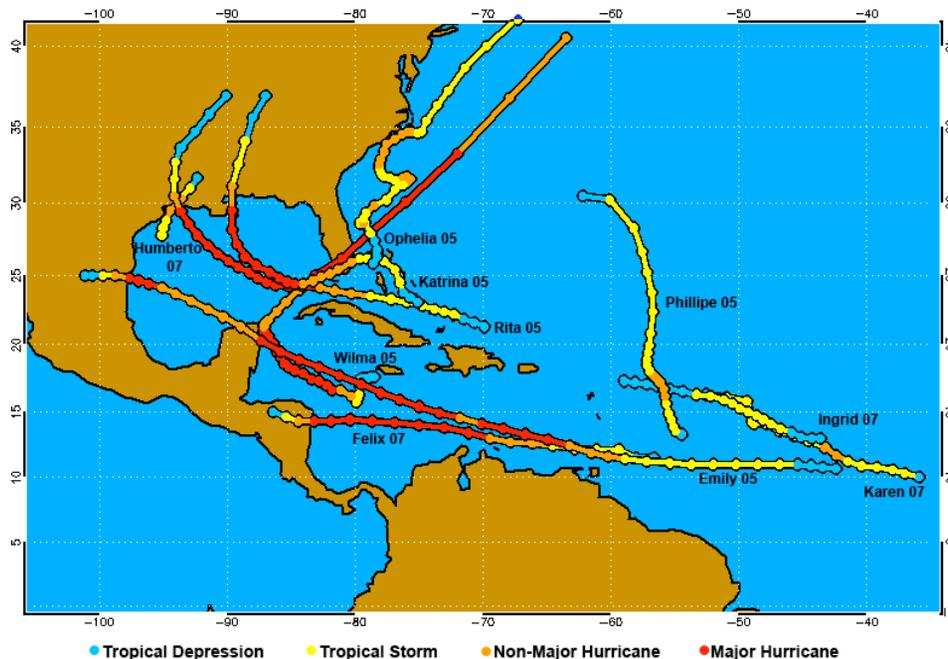
■ Participants:

- WRF Developmental Testbed Center (DTC)
- National Hurricane Center (NHC)
- NOAA GFDL

Group	NOAA AOML	NCAR MMM	NRL	PSU	URI	UWM
Model	WRF-NMM	WRF-ARW	COAMPS	WRF-ARW	GFDL	UW Non- hydro Model System

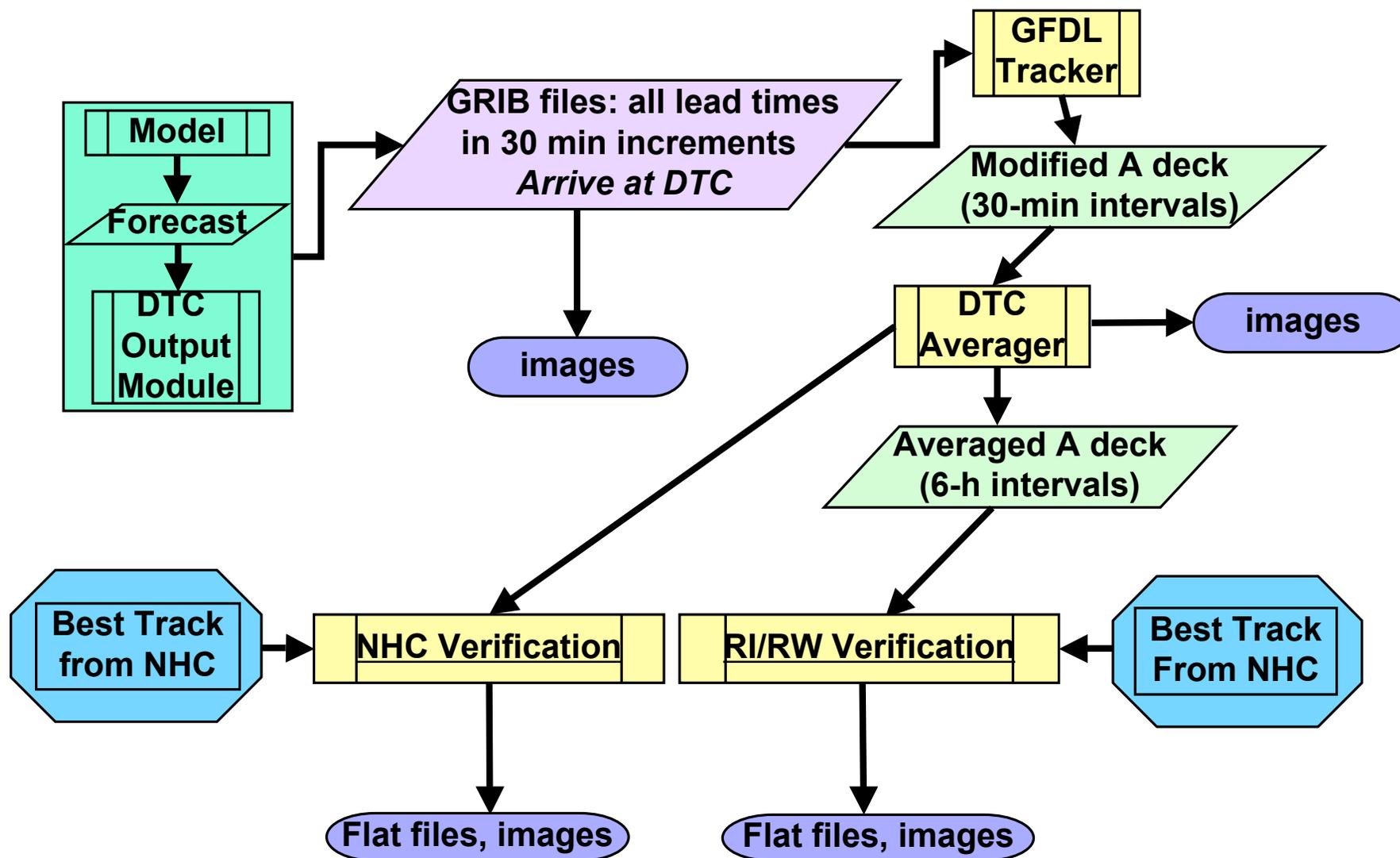
HRH Test Cases

- **Criteria:** Diverse set of storms and time periods for each storm
- **Storms:** Ten storms from the 2005 and 2007 hurricane seasons
- **Number of cases:** 69



This presentation: GFDL only		
	Date	Cases
Wilma	10/05	11
Philippe	09/05	5
Felix	09/07	7
Rita	09/05	6
Karen	09/07	4
Katrina	08/05	6
Emily	07/05	9
Ophelia	09/05	10
Total		58

DTC Evaluation System for HRH





GFDL Vortex Tracker

■ Upgrades for HRH (by GFDL's T. Marchok)

- Ability to read in moving nests
- Ability to read in forecast lead time in minutes
- Ability to track high-resolution forecasts through alterations on parameters for Barnes analysis and for min/max search
- Increased ability to deal with regions of missing data

■ Outstanding issues

- Track is lost when storm is disorganized
- Fix is sometimes incorrect due to high-resolution nest being very small

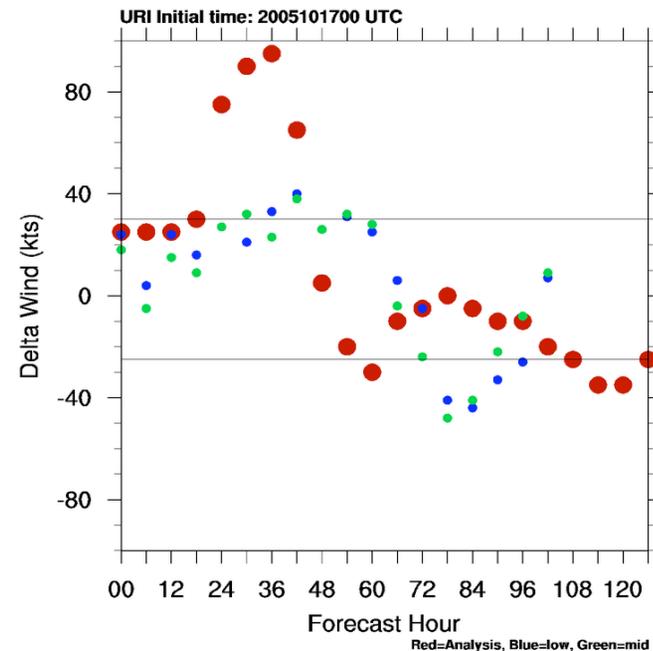


NHC Verification System

- Ingests Best Track and forecast track
- Track verification: MAE and bias for magnitude and vector
- Intensity Verification: MAE and bias of difference in maximum winds between forecast and best track
- Verification of wind radii
- This presentation: track MAE, intensity MAE and bias for all GFDL cases available by 04/24

DTC RI / RW Verification

- RI – increase 30 kt in 24 h
- RW – decrease 25 kt in 24 h over water
- Events are identified in Best Track and forecast track
- A RI or RW match occurs when event happens at the same time in forecast and best track
- Future development: more sophisticated and informative match



Contingency Table for RI/RW

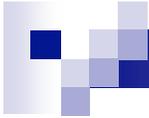
		O	
		Y	N
F	Y	a	b
	N	c	d

$$HR = (a+d)/n$$

$$POD = a/(a+c)$$

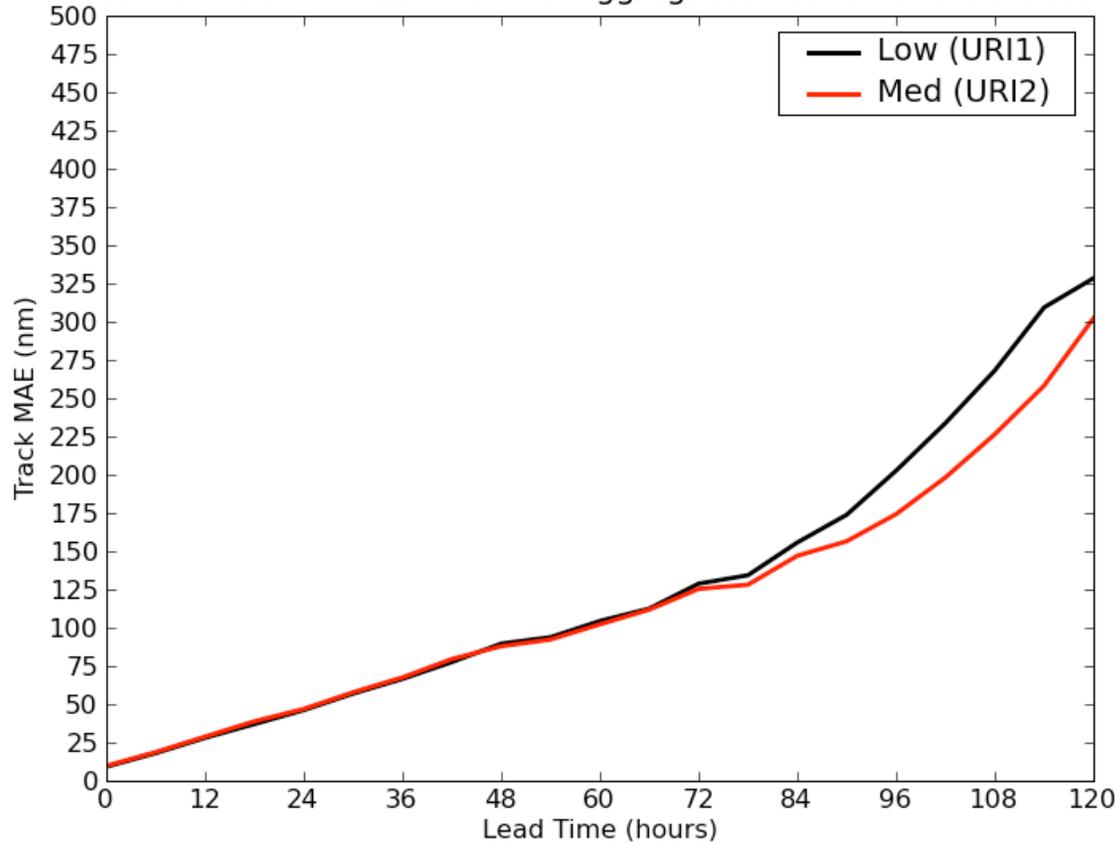
$$CSI = a/(a+b+c)$$

$$FAR = b/(a+b)$$



Track MAE for GFDL Model

Model: URI Storm: ALL InitTime: Aggregated over all available storms



Low and Medium resolutions:

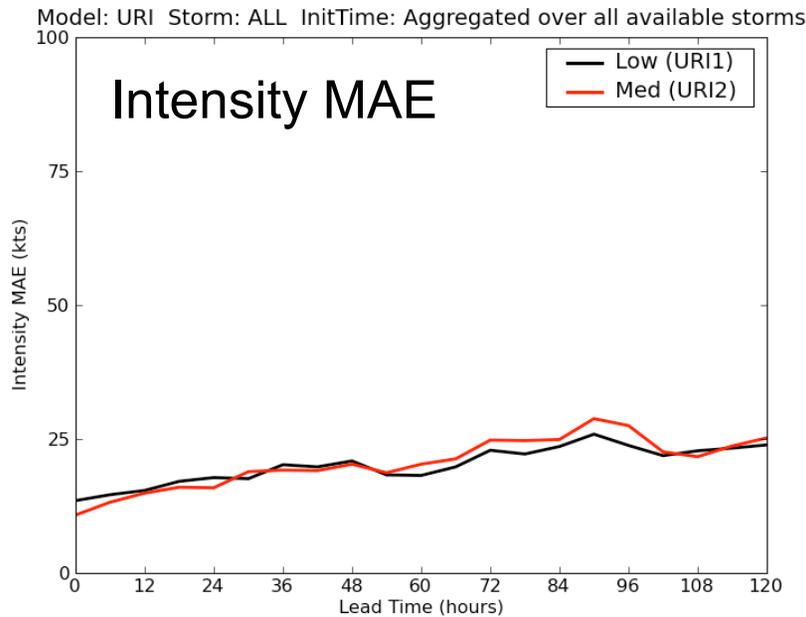
- Low: 1/12 deg
- Medium: 1/18 deg

Low and Medium resolutions:

- Days 1-3 Errors grow linearly
- Days 4-5 Errors grow faster
- Days 1-3 – No difference
- Days 4-5 – Medium less error

# URI1	58	57	54	52	49	42	36	32	28	25	22
# URI2	58	57	56	53	50	43	37	33	28	25	22

Intensity error for GFDL Model

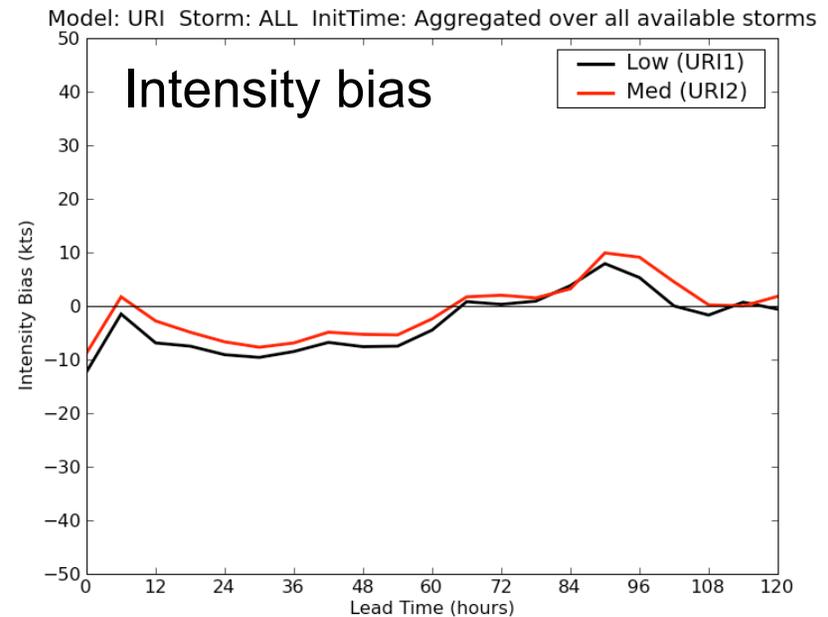


Low and Medium res intensity MAE:

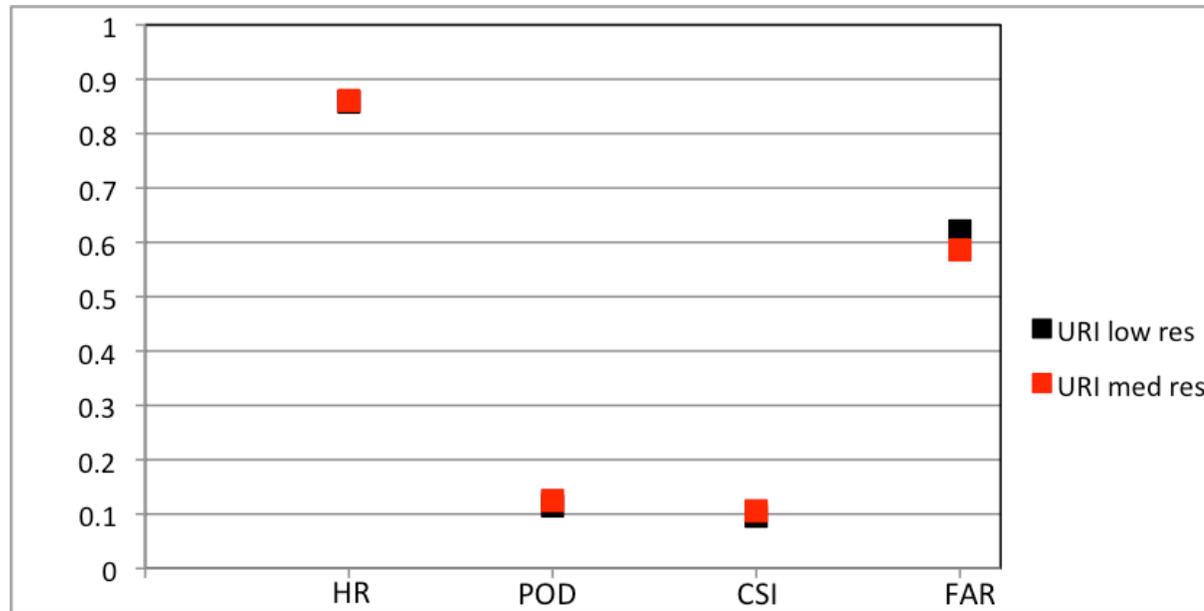
- Day 1 – Medium less error
- Day 2 – No difference
- Day 3-4 – Medium more error
- Day 5 – No difference

Low and Medium res intensity bias:

- Days 1-3 – too weak
- Days 4 – 4.5 – too strong
- Days 1-3 – Medium less bias
- Days 4-5 – Medium more bias



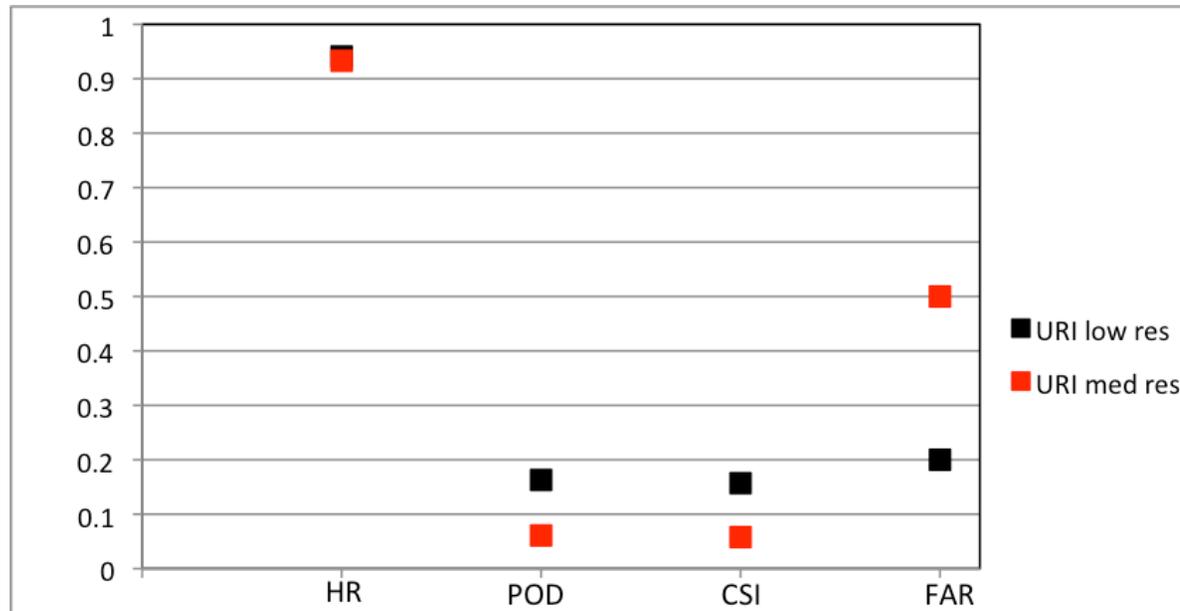
RI Verification for GFDL Model



		Observed	
		Yes	No
Low res	Yes	11	18
	No	85	613
Med res	Yes	12	17
	No	84	614

	HR	POD	CSI	FAR
Low res	0.858	0.115	0.096	0.621
Med res	0.861	0.125	0.106	0.586

RW Verification for GFDL Model



		Observed	
		Yes	No
Low res	Yes	8	2
	No	41	676
Med res	Yes	3	3
	No	46	675

	HR	POD	CSI	FAR
Low res	0.941	0.163	0.157	0.2
Med res	0.933	0.061	0.058	0.5



Conclusions

- DTC has developed system for hurricane verification – available for HFIP
- GFDL model
 - Increase in resolution led to better track on days 4-5
 - Intensity is too low on days 1-3 and too strong on day 4
 - Increase in resolution improves intensity on days 1-3
 - RI forecast is similar for low and medium resolution
 - RW forecast is degraded with increased resolution

Future Work

- Analyze all cases submitted by each participating modeling group
- Assess whether small difference among results of different resolutions is statistically significant
- Provide final conclusions on impact of resolution on forecasting