Impacts of Land Effects and Improvements in Modeling Landfall Using HWRF

A Joint Hurricane Testbed (JHT) Program

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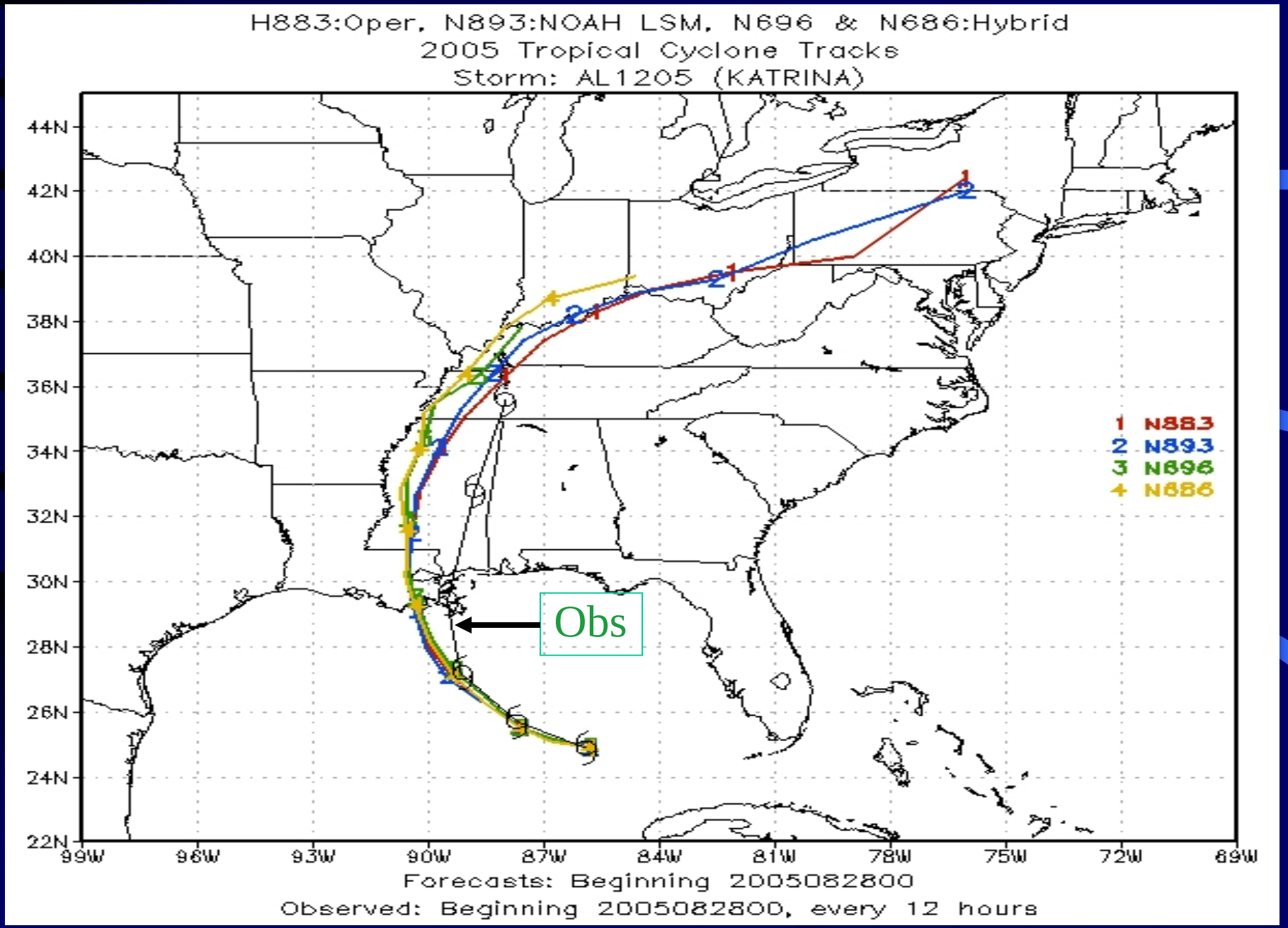
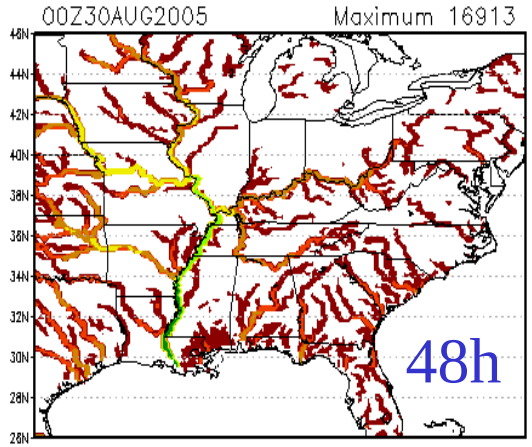
JHT project task areas

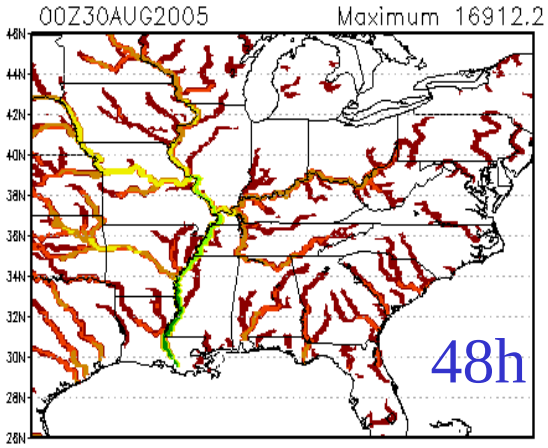
- Improve HWRF intensity forecasts
- Upgrade land model and landfall prediction
  - Transition to NOAH LSM
- Trouble shoot and diagnose HWRF problems
  - Analysis tools

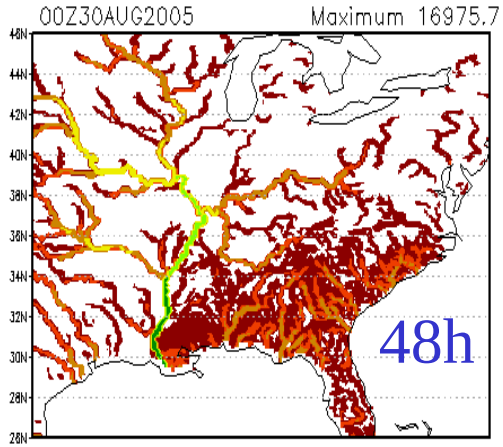
HWRF Predicted Tracks of Katrina

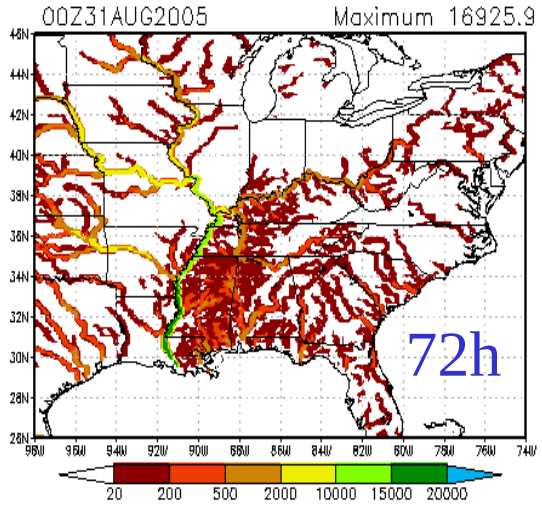


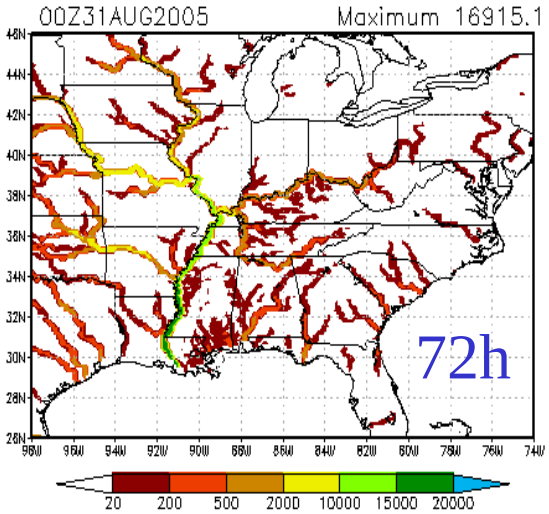
Forecasted Stream Flow ($m^3 s^{-1}$)

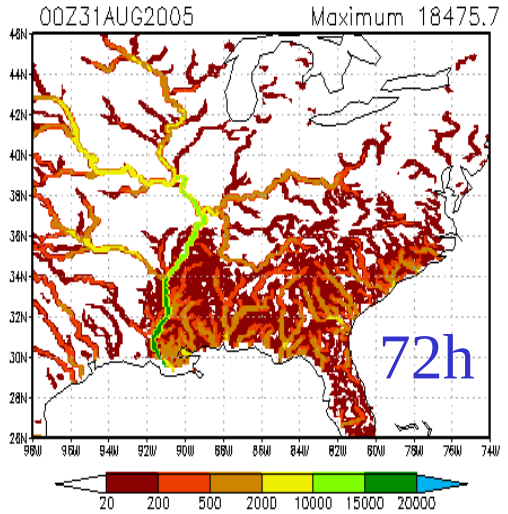










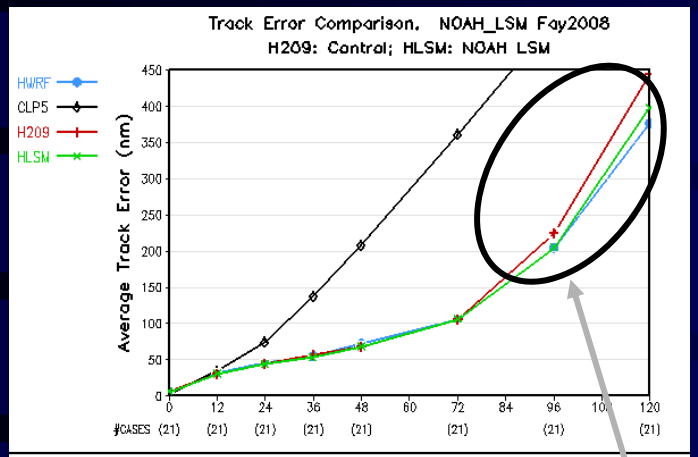


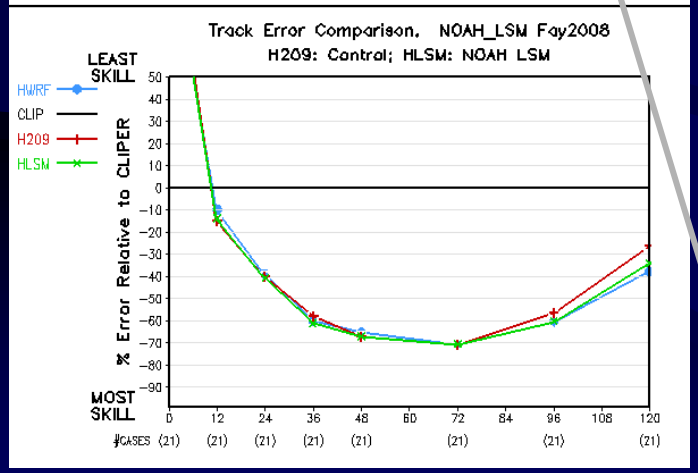
NLDAS NAM HWRF

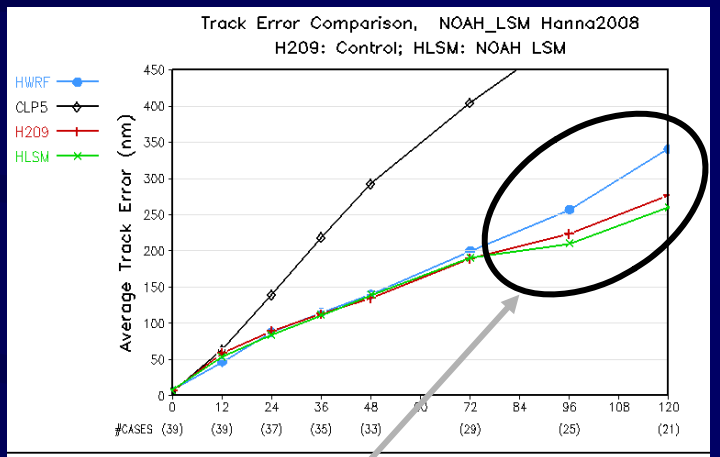
Stream flow is higher in HWRF than in NLDAS and NAM, especially in Southeast of the domain

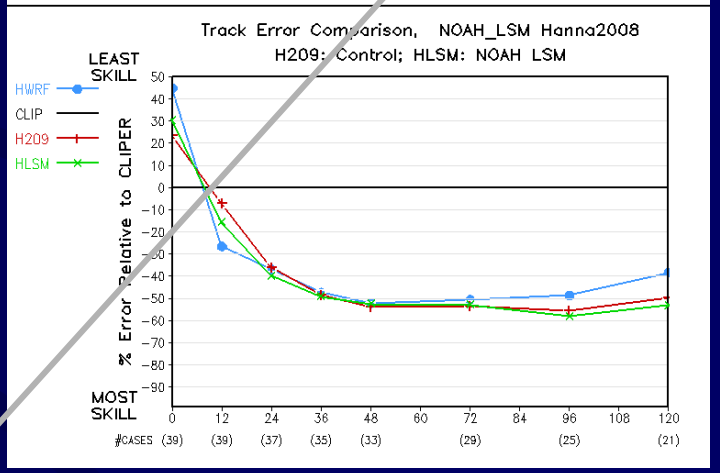
Fay

Hanna



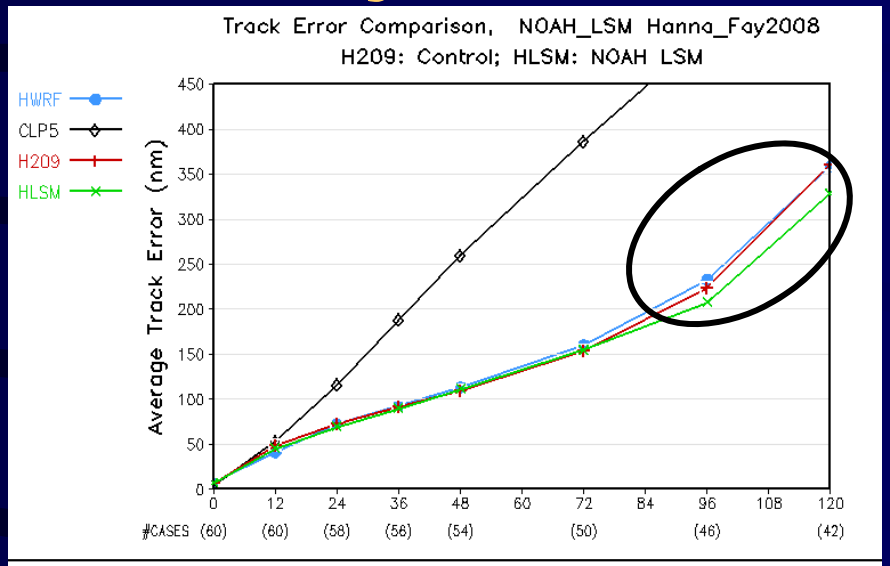


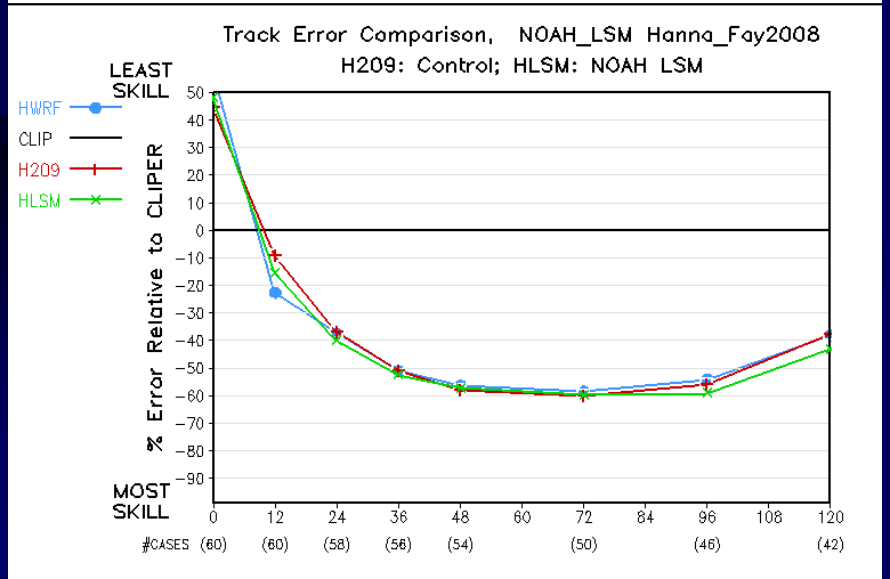




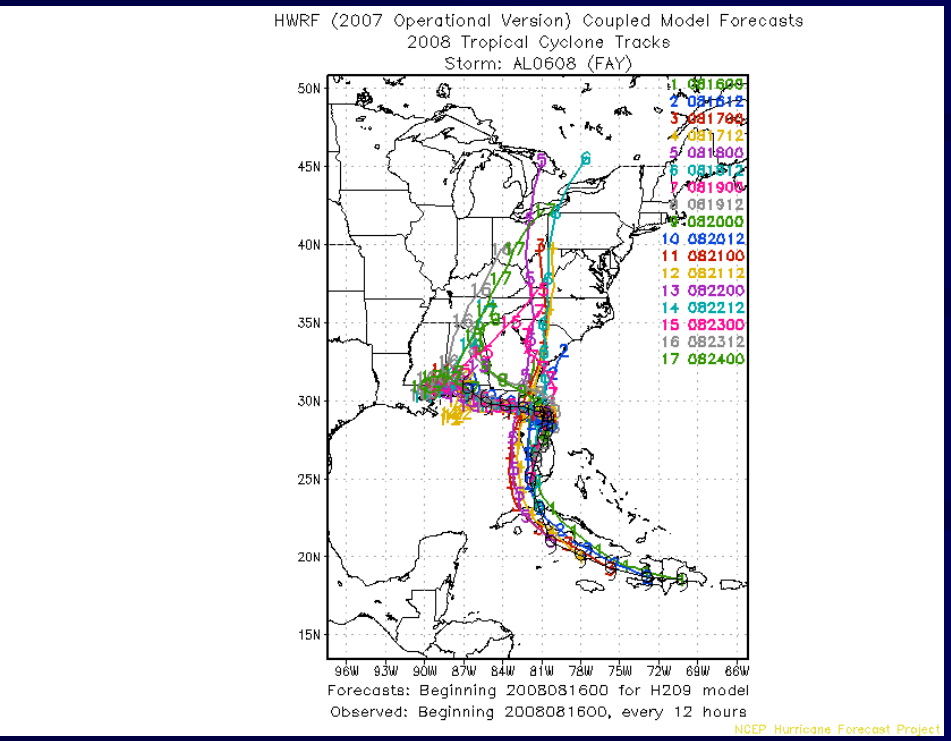
HLSM improves track errors over both HWRF(prod) and control !

Hanna & Fay combined (42)

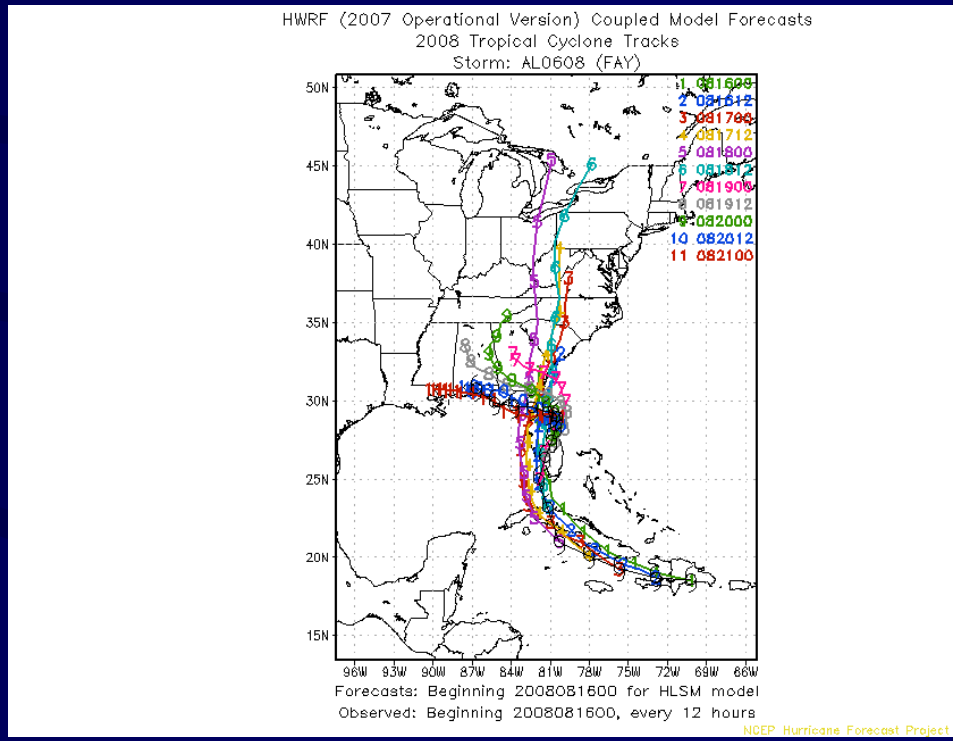




HWRF control

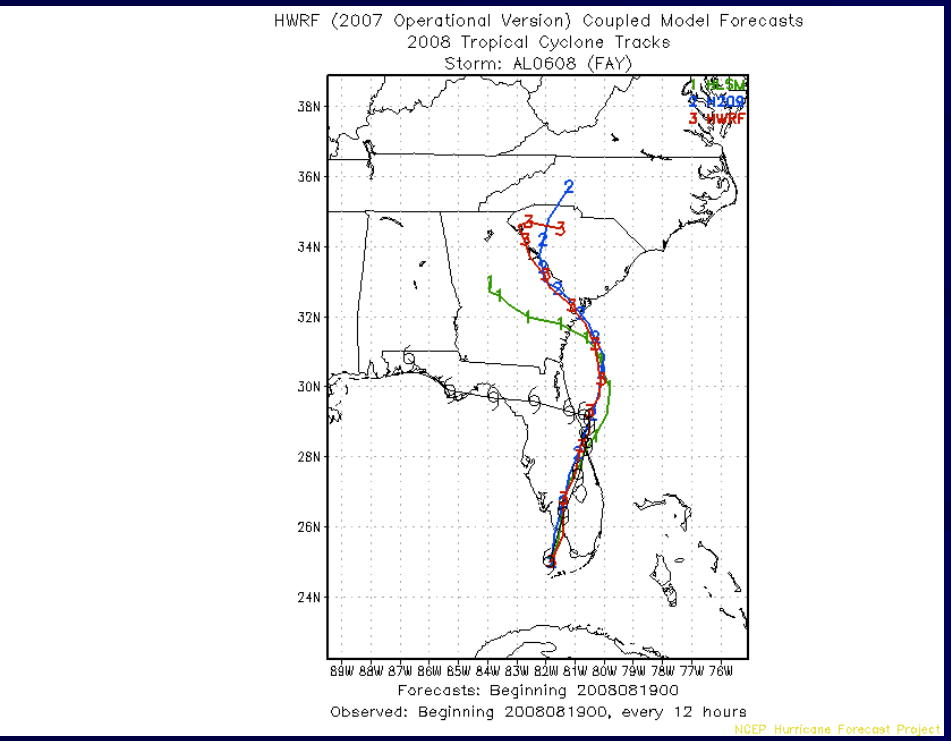


HLSM

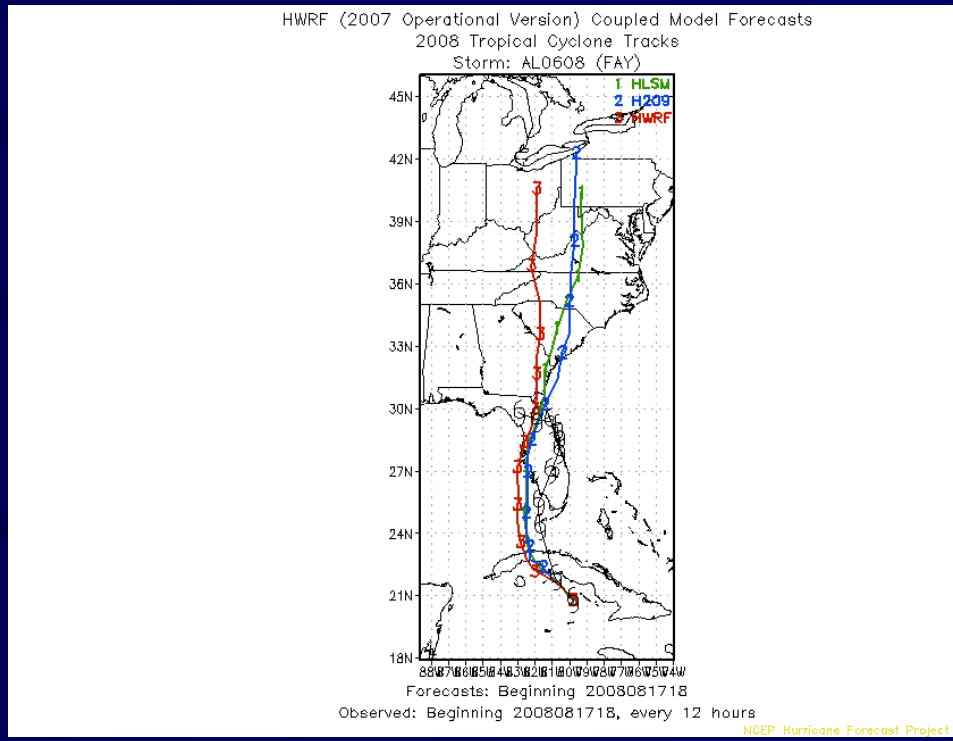


HLSM reduced problem of outliers in control model

Two cases of Fay

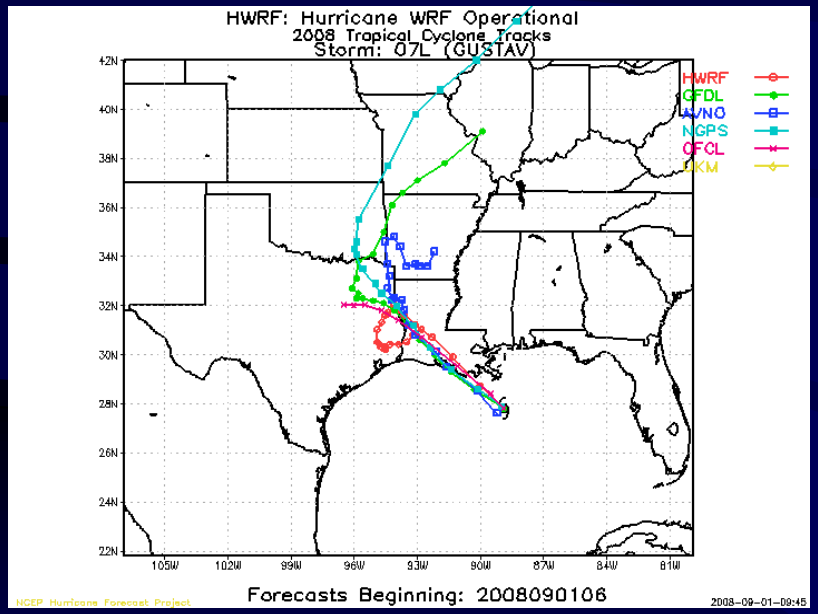


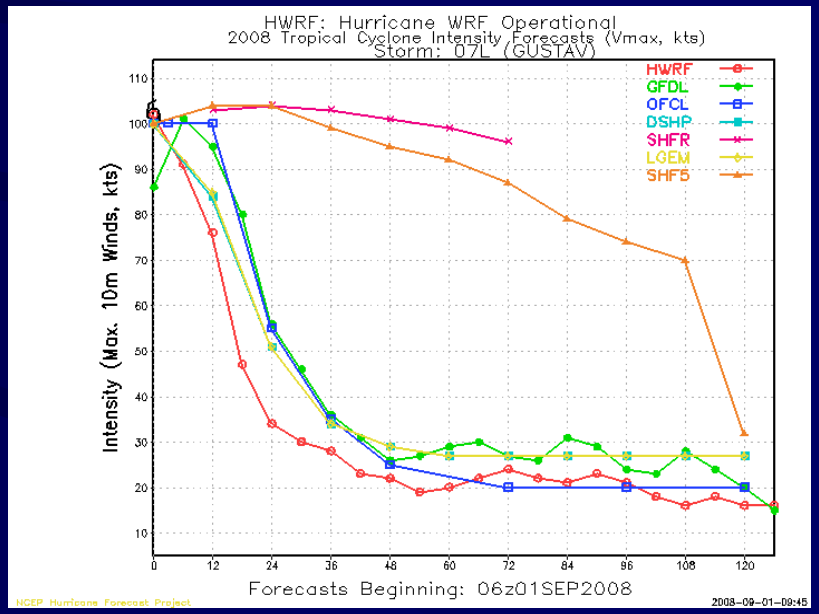
HLSM improvement



HLSM improvement
All forecasts bad!!
Effects mean stats!!

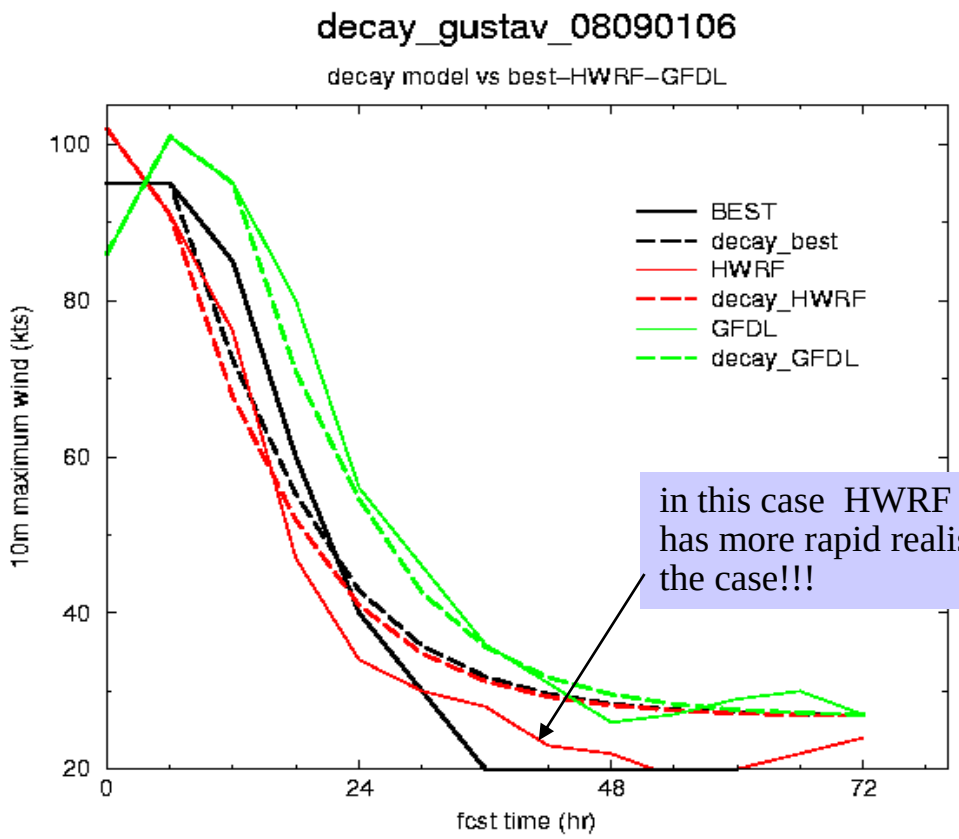
Operation models of Gustav at landfall





Compare HWRF with inland decay model

(Kaplan and DeMaria 1995, 2001 & 2006)



in this case HWRF model decay has more rapid realistic. Not always the case!!!

Summary & Future Works

- HLSM reduces track errors for significant number of cases
- To initialize HWRF with realistic initial conditions of soil moisture from NAM and NLDAS, rather than GFS.
- Make refinements to HLSM system
- To run more hurricane cases to test both HWRF and the stream flow routing scheme.
- To objectively verify landfall decay and rainfall
- To explore use of inland flooding models (e.g. from NWS Office of Hydrology or USGS)

Additional analysis tools…

- Forecast maximum intensity histogram

✓ does model forecast match observational distribution ??

✓ how does one model compare with another ?

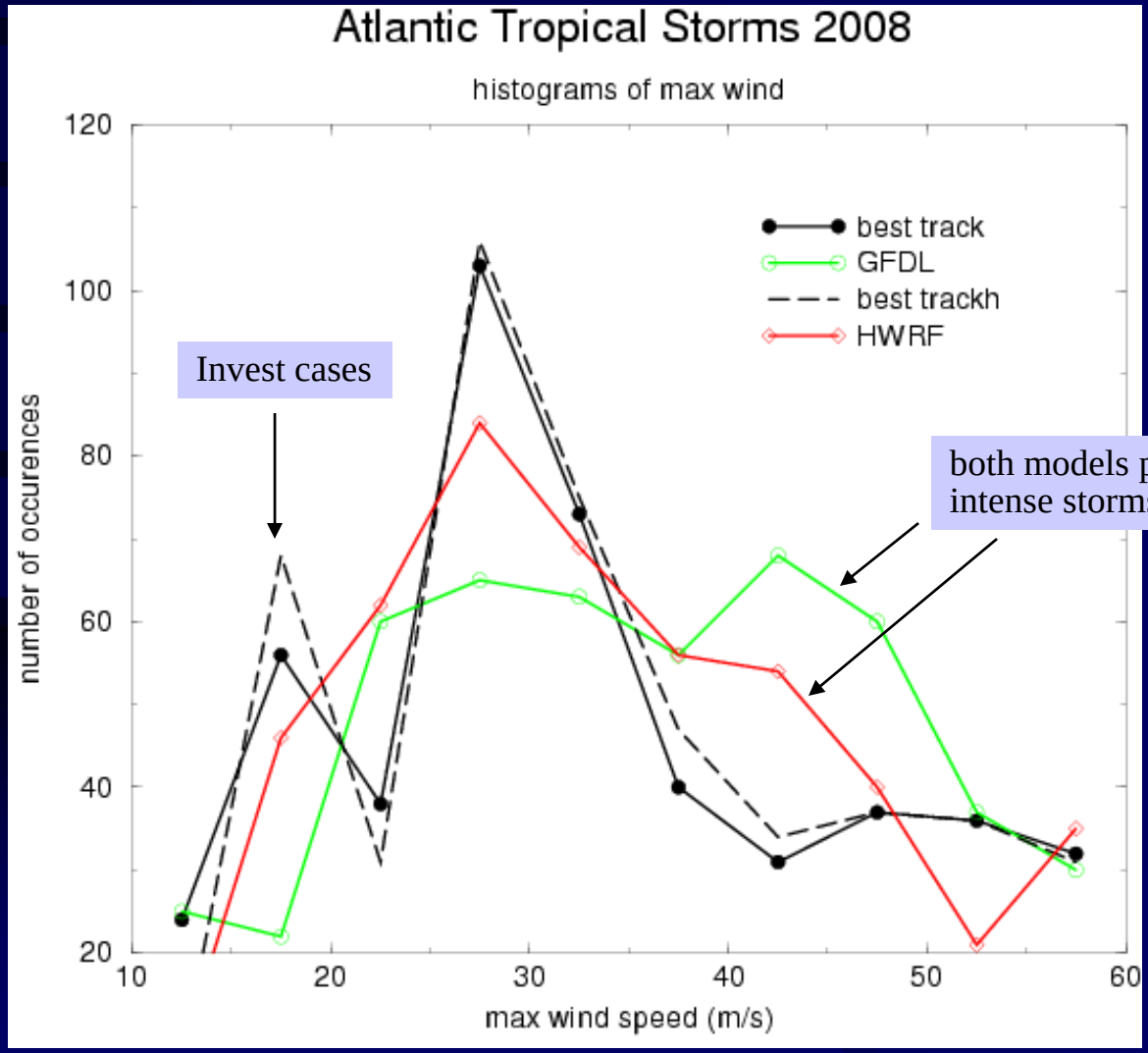
✓ utilizes modified version of NHC verification package… thanks to Tim Marchok

- HPLOT diagnostic utility refined by **VijayTallapragada**

✓ grads based utility to compare multiple models

✓ Capable of calculating derived quantities such as shear and MPI

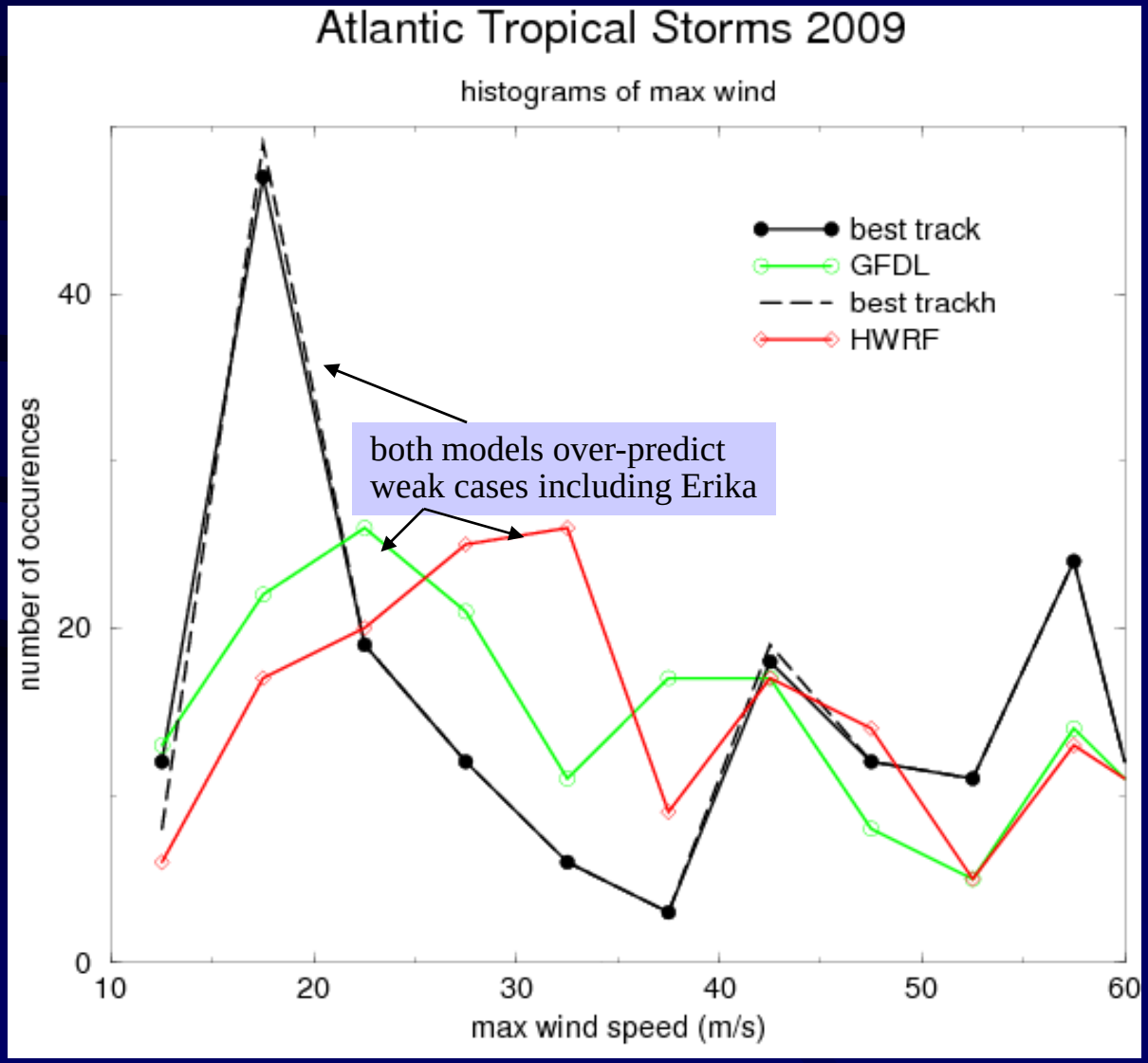
Histograms of 10m maximum wind 2008

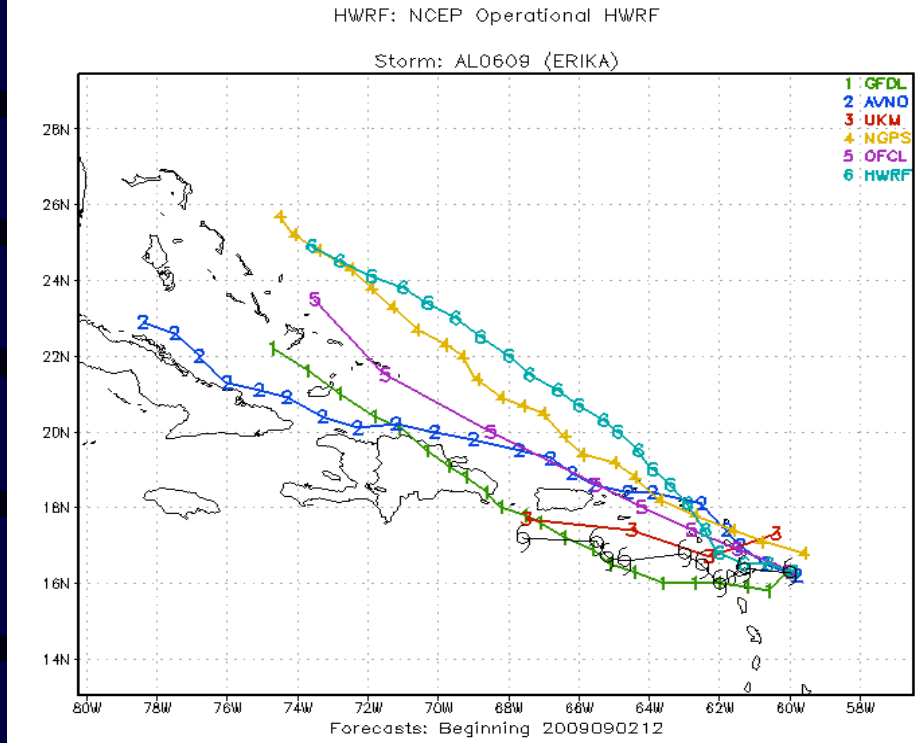


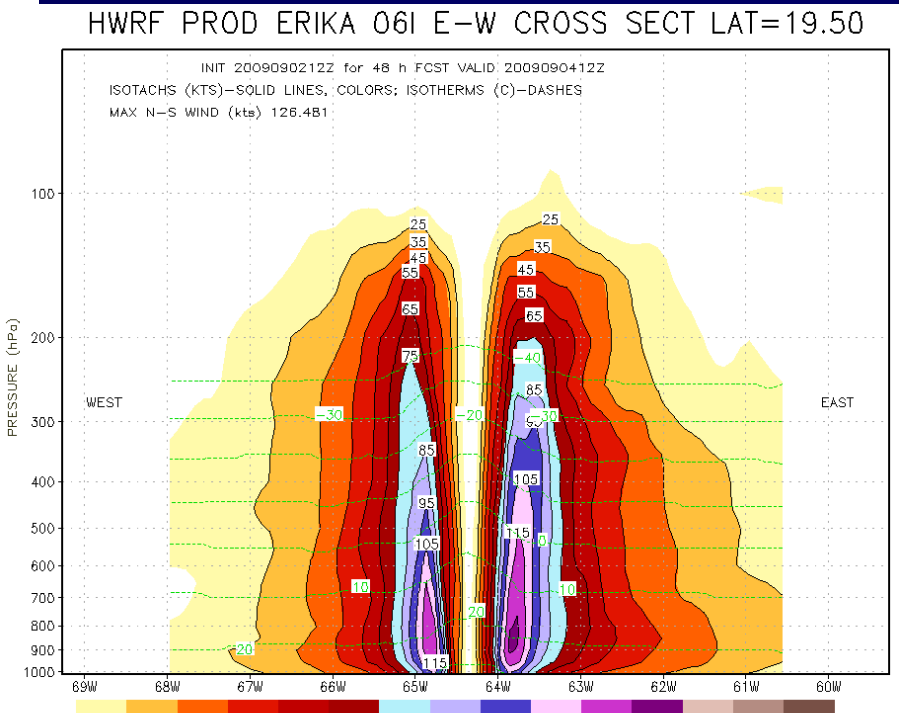
Invest cases

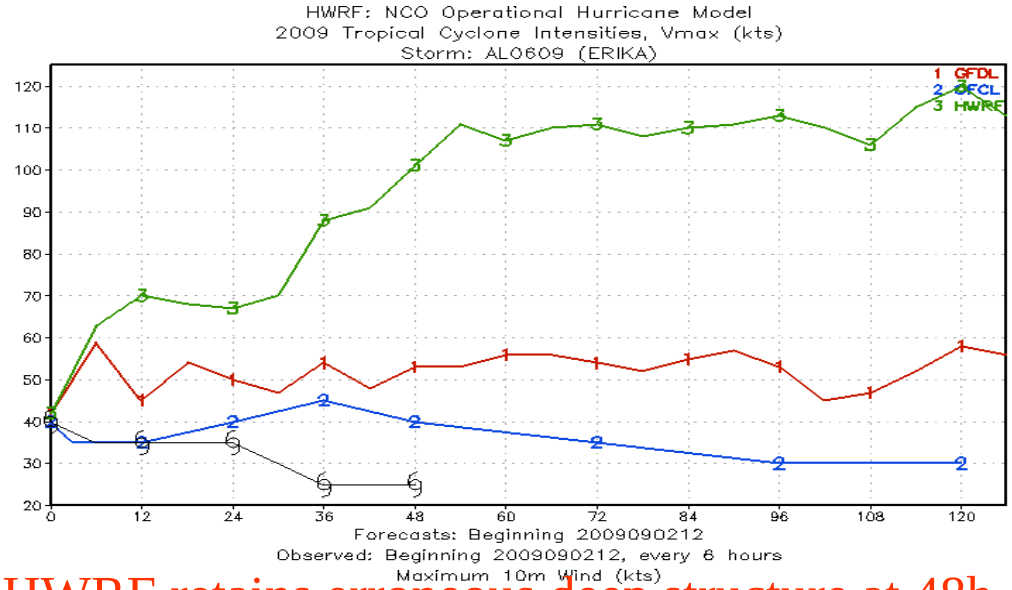
both models produce too many intense storms in 2008

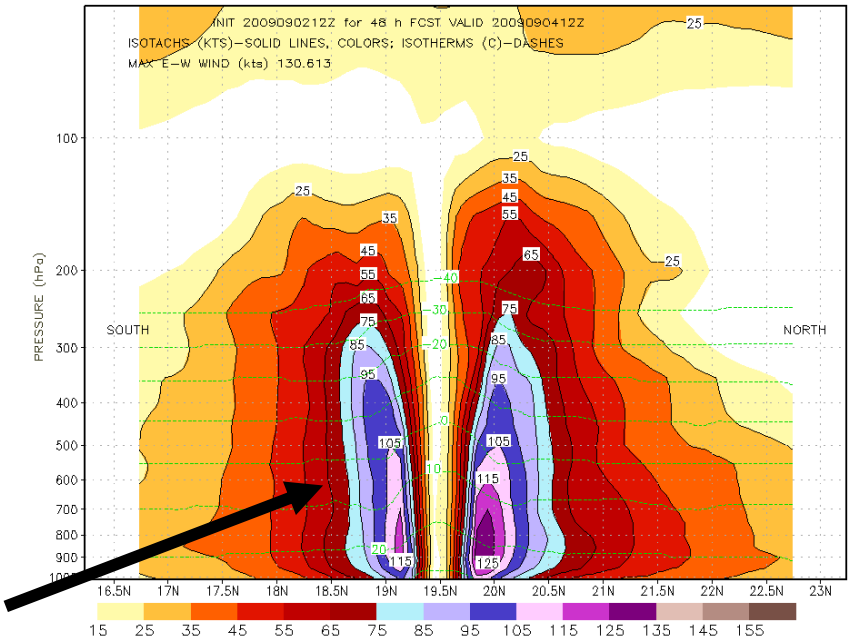
Histogram of 10m maximum wind 2009 (a year of weak systems)











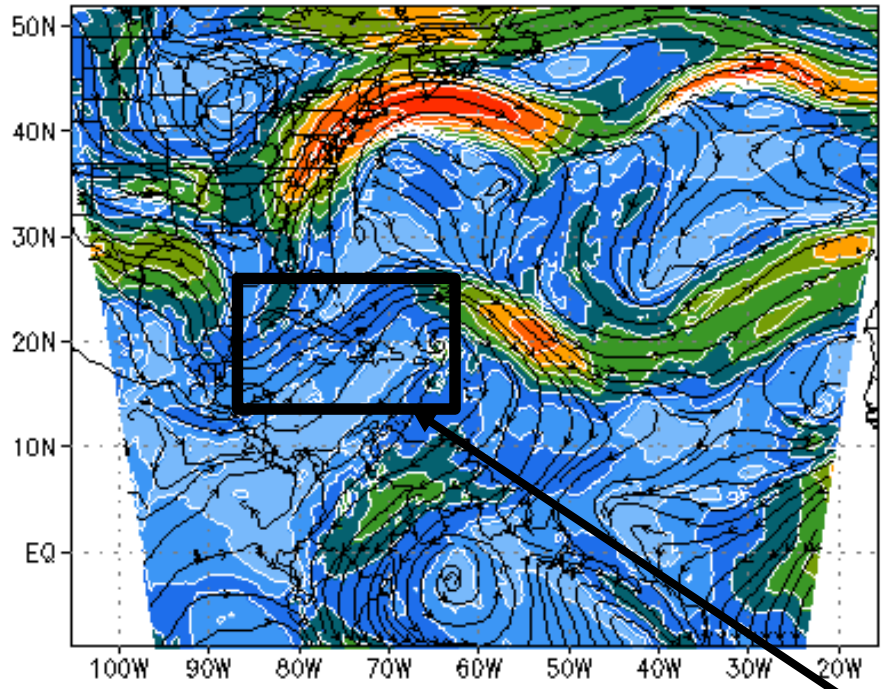
HWRF retains erroneous deep structure at 48h

Data Set #1 : HWRF PARENT GRID – ERIKA06I
Data Set #2 : GFSA PARENT GRID – ERIKA06I
It: 2009090212 vt: 2009090412 (48h)

850–200 mb vertical shear (shaded, knots)
850–200 mb vertical shear (streamlines,)

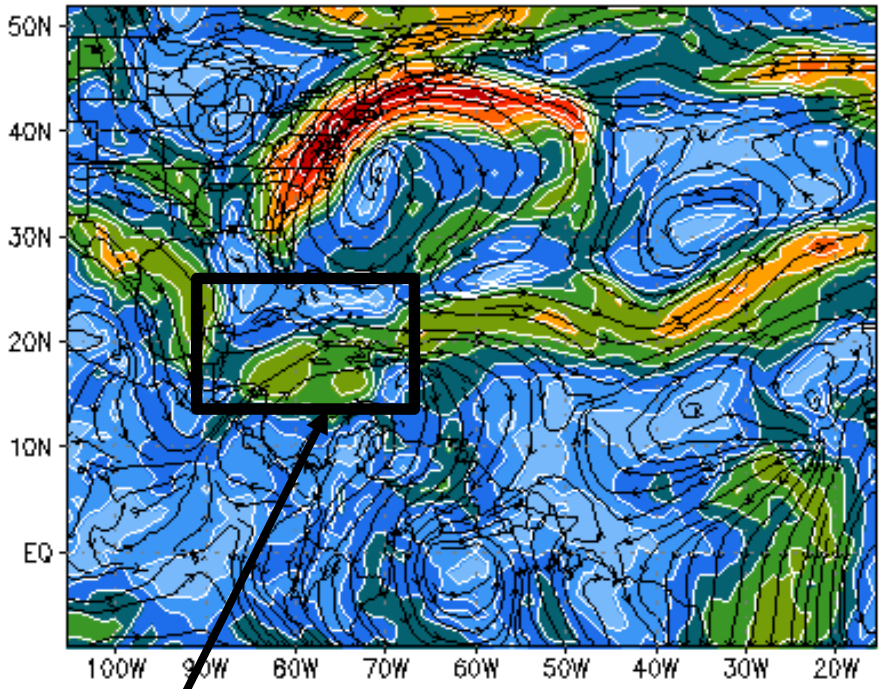
Operational HWRF

HWRF



GFS Analysis

GFSA



HWRF fails to simulate increased shear in the environment