Upgrades to the GFDL/GFDN Hurricane Model for 2014

(A JHT Funded Project)

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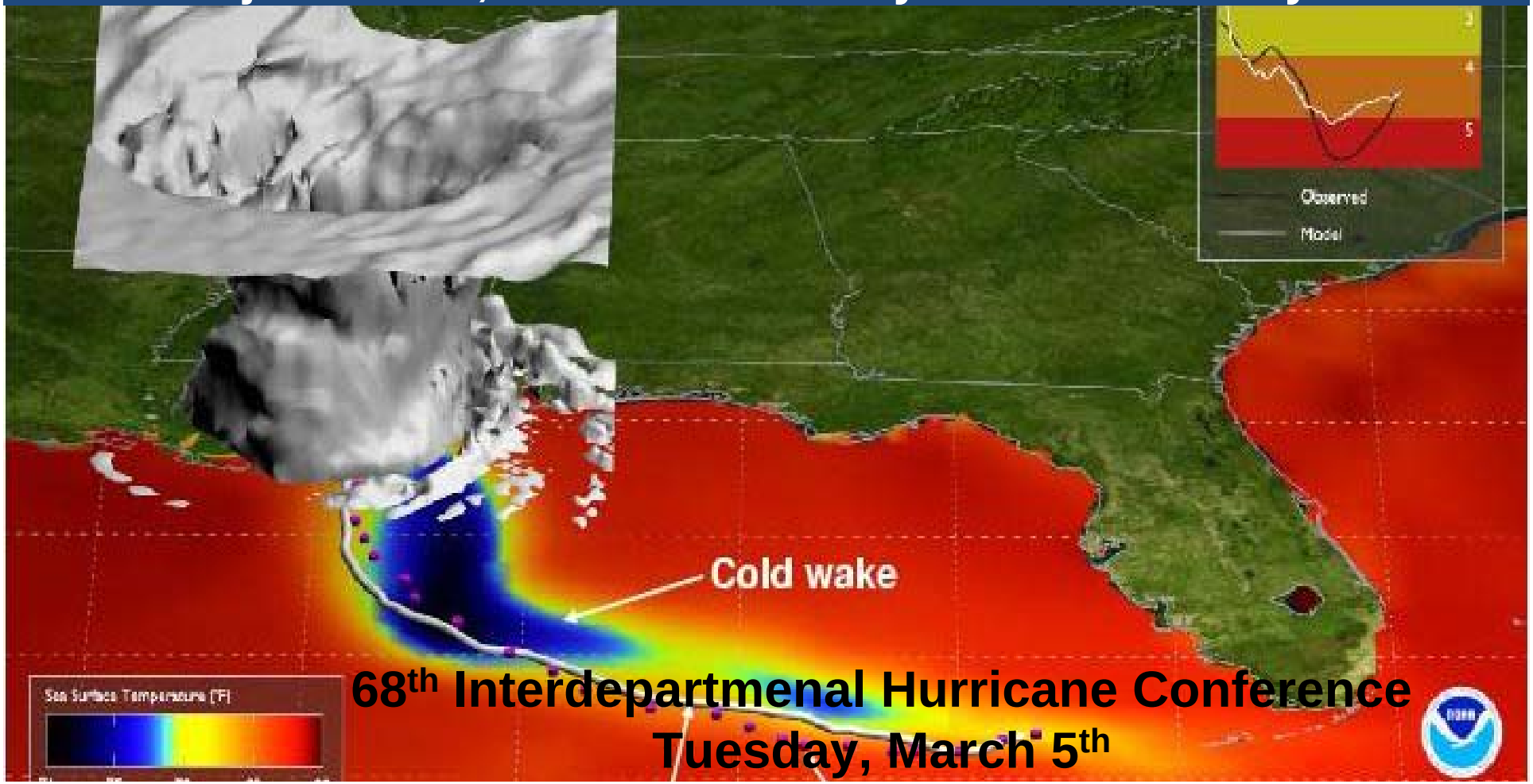


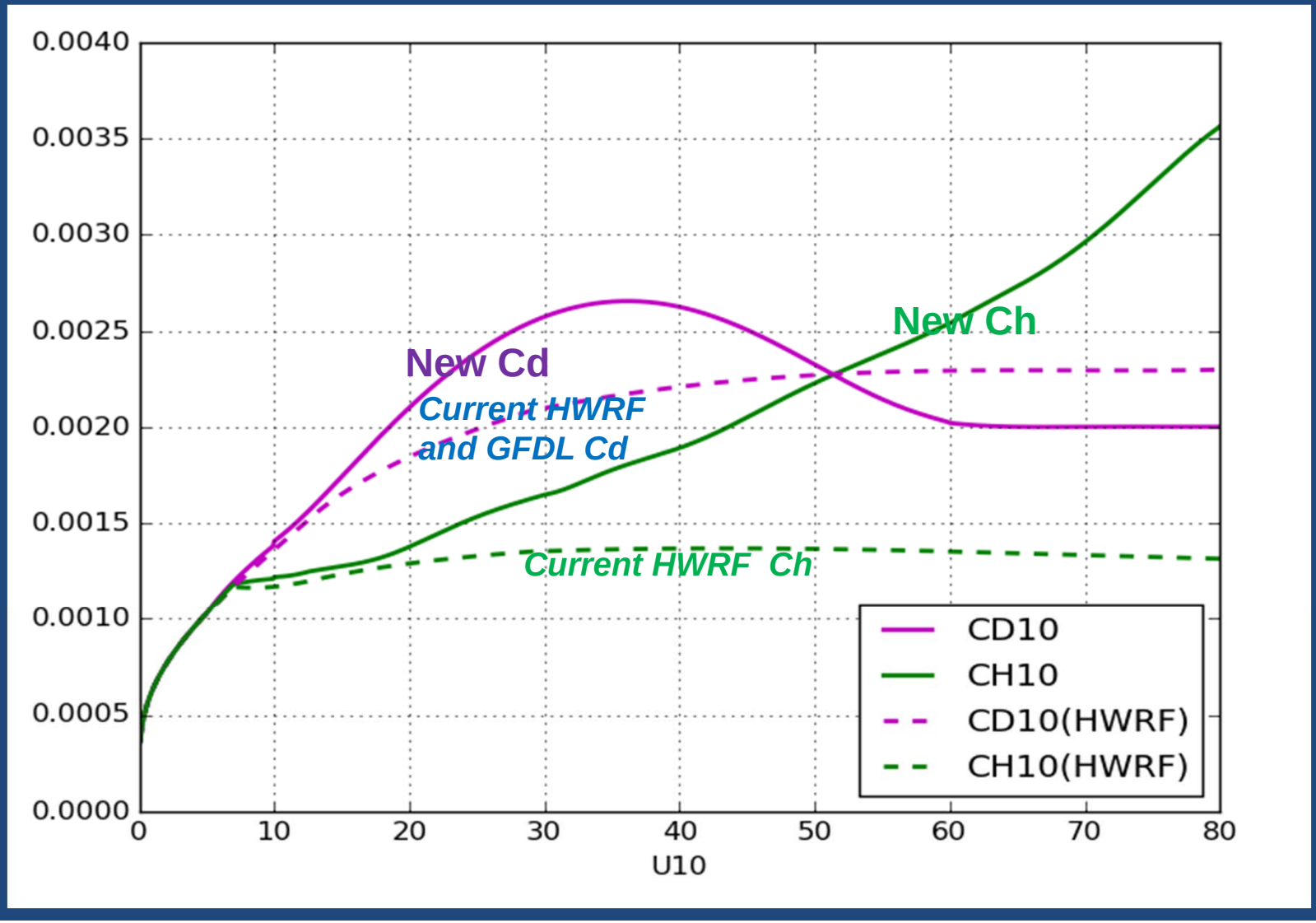
68th Interdepartmenal Hurricane Conference

Tuesday, March 5th

GFDL 2014 Hurricane Model Upgrade

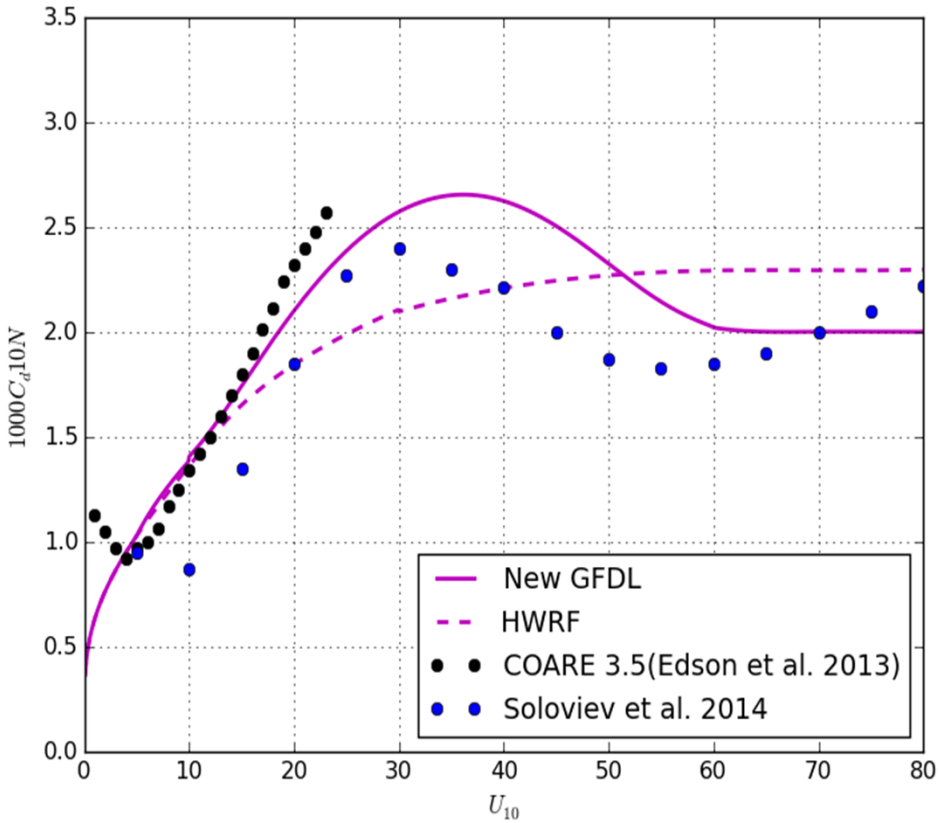
- **Increased horizontal resolution of inner nest from 1/12th to 1/18th degree with reduced damping of gravity waves in advection scheme**
- **Improved specification of surface exchange coefficients (*ch, cd*) and surface stress computation in surface physics**
- **Improved specification of surface roughness and wetness over land.**
- **Modified PBL with variable Critical Richardson Number.**
- **Advection of individual micro-physics species.**
  (*Yet to test impact of Rime Factor Advection*)
- **Improved targeting of initial storm maximum wind and storm structure in initialization. (*Reduces negative intensity bias in vortex specification*)**
- **Remove vortex specification in Atlantic for storms of 40 knots and less**
- **Upgrade ocean model to 1/12th degree MPI POM with unified trans-Atlantic basin and 3D ocean for Eastern Pacific basin**
- **Remove global_chgres in analysis step (*direct interpolation from hybrid to sigma coordinates*)**

New Cd and Ch formulation



Comparison of New cd and ch with Recent Referenced Studies

Cd



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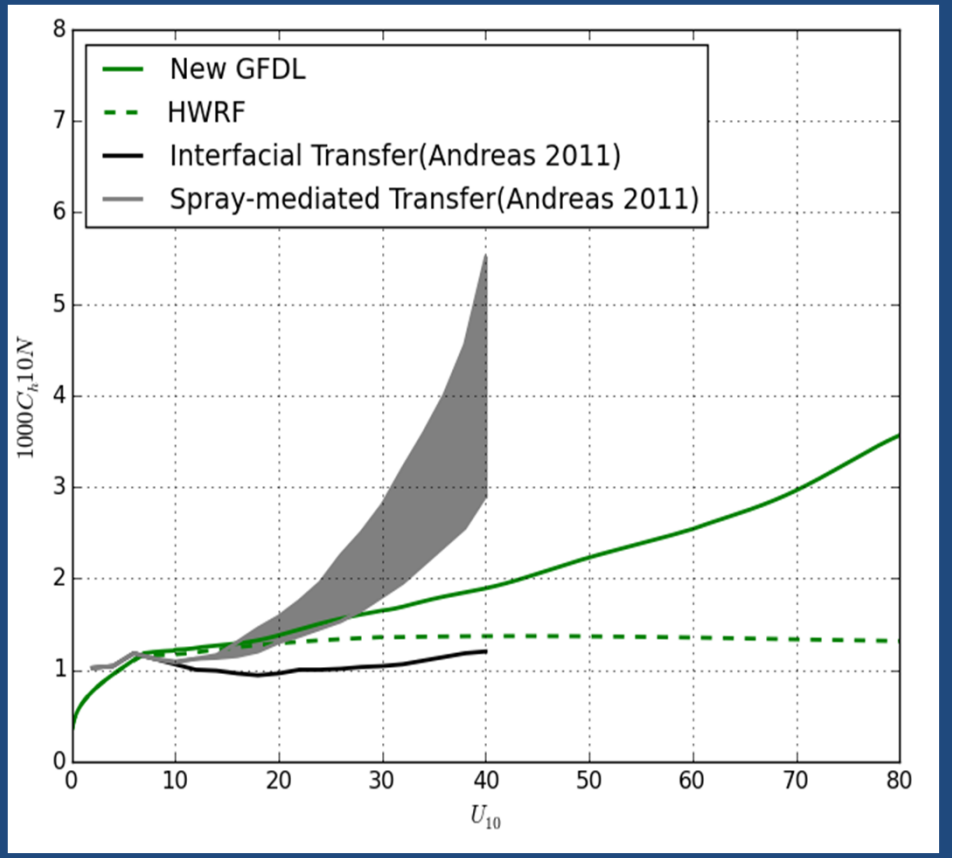
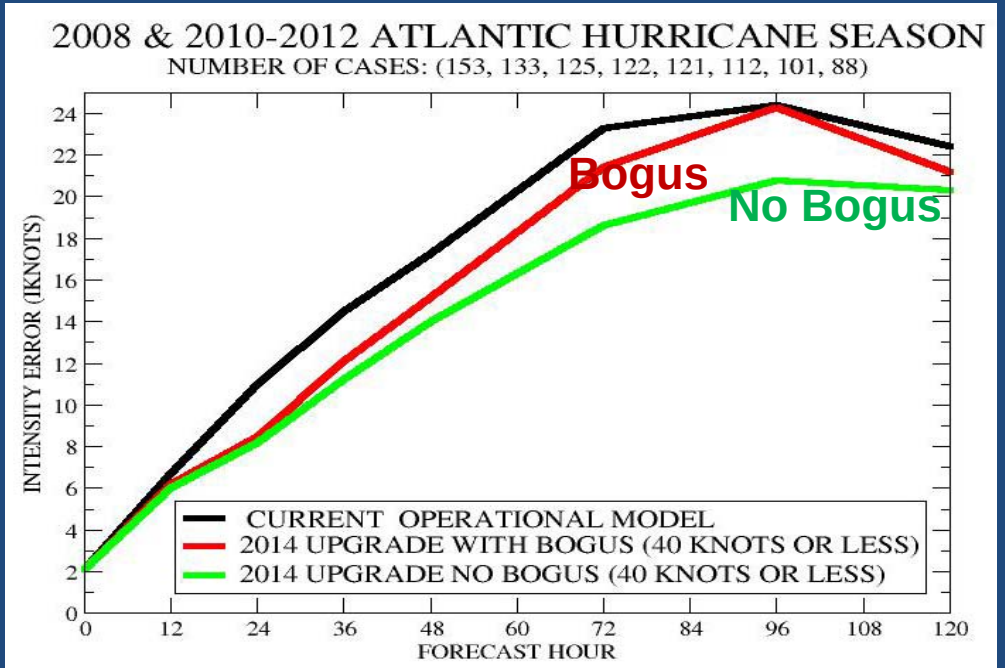


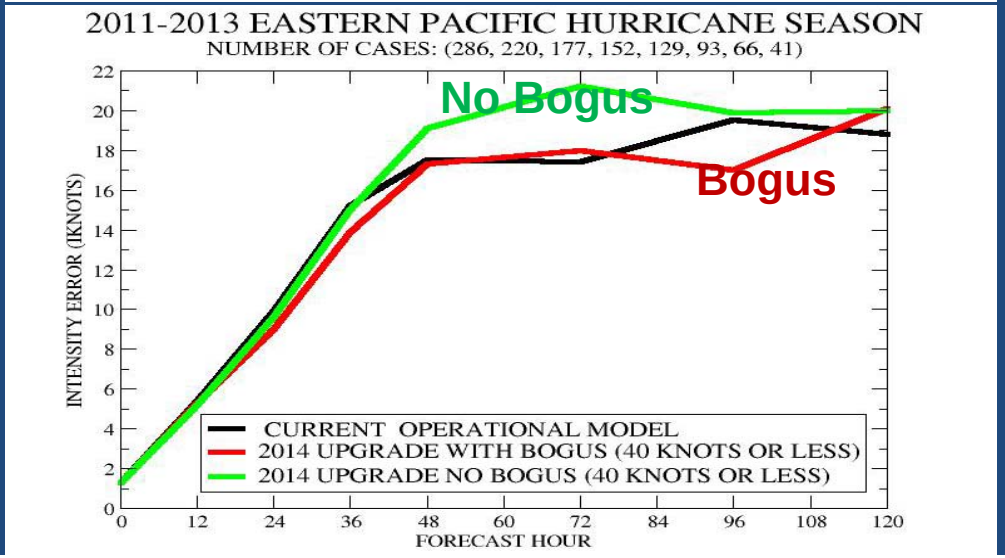
Impact of Bogusing on Intensity Errors
For Storms 40 knots or less

Atlantic



Bogusing Significantly **Degraded** performance in Atlantic for weak systems

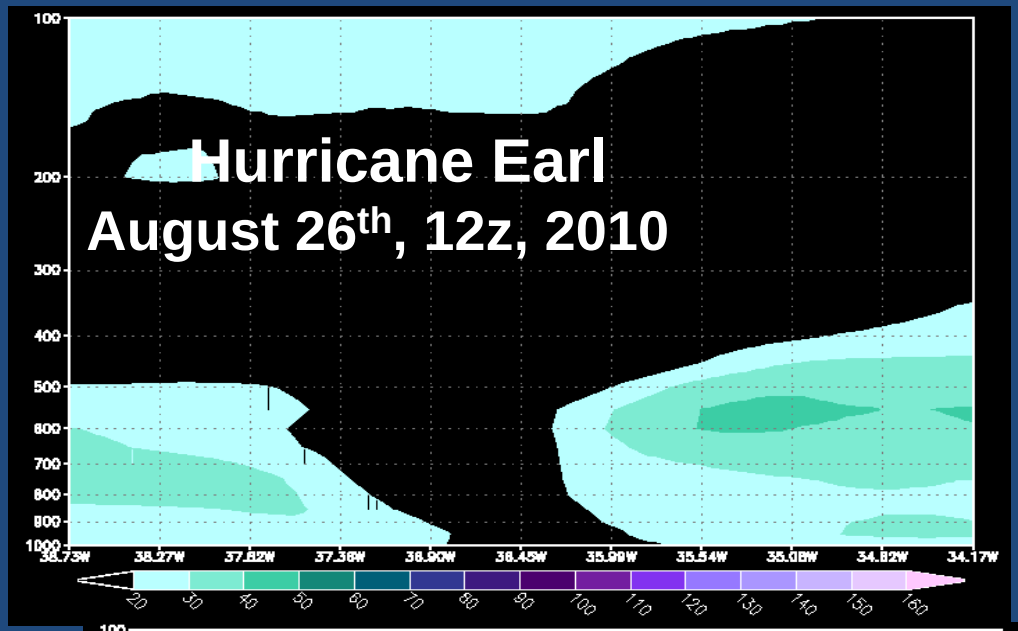
Eastern Pacific

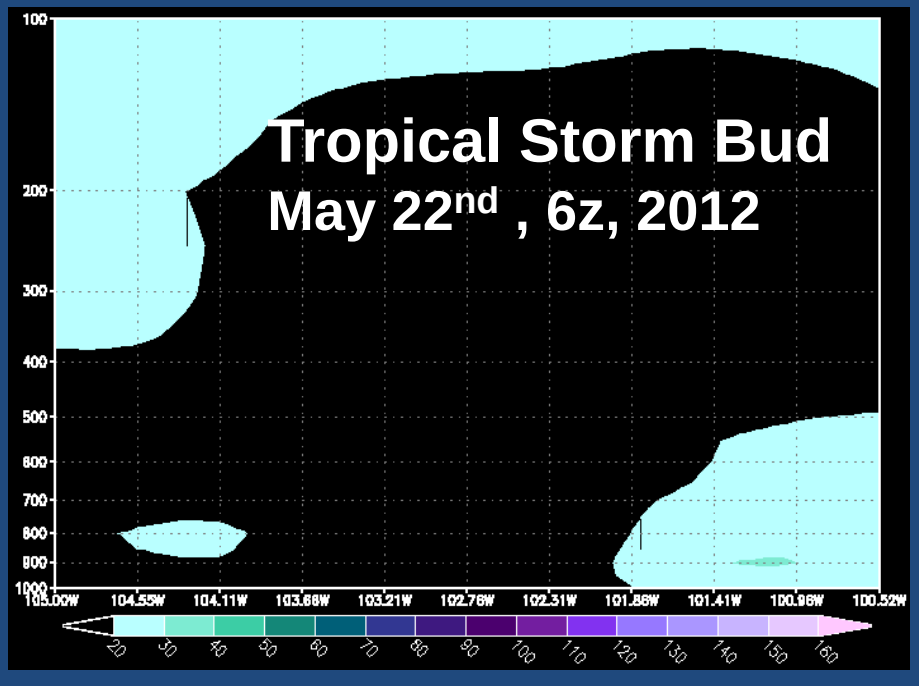


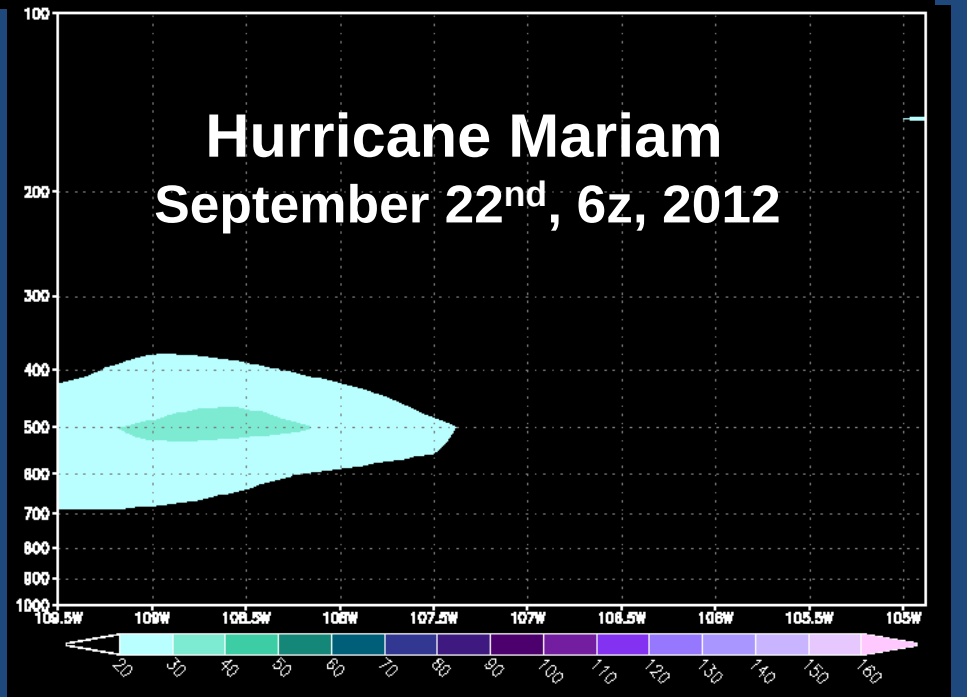
Bogusing Significantly **Improved** Performance in Eastern Pacific

VERTICAL CROSS-SECTION FOR UNBOGUSED INITIAL CONDITION THROUGH STORM CENTER

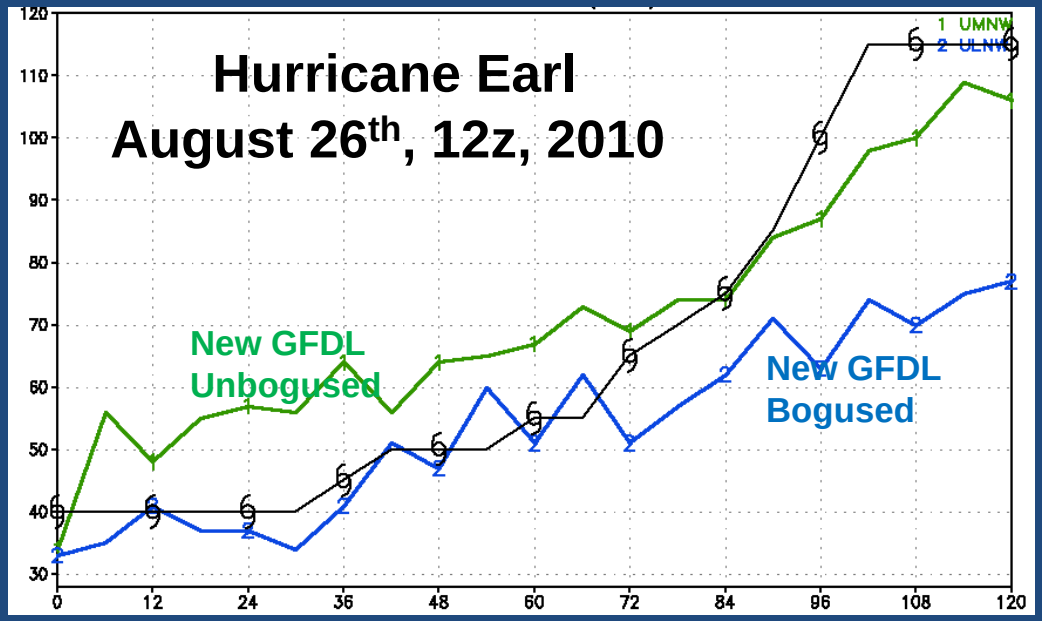
Total
Wind Speed (knots)

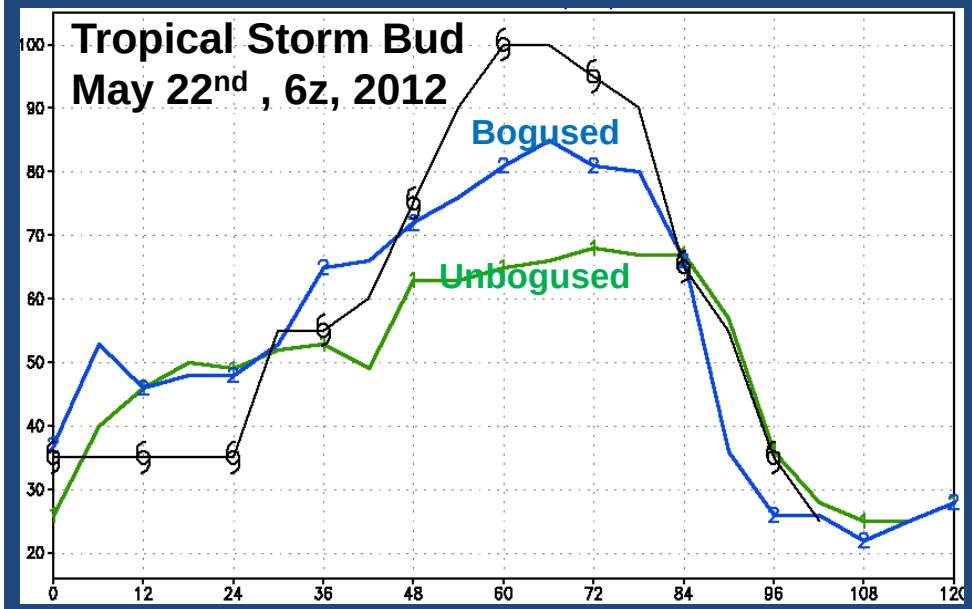


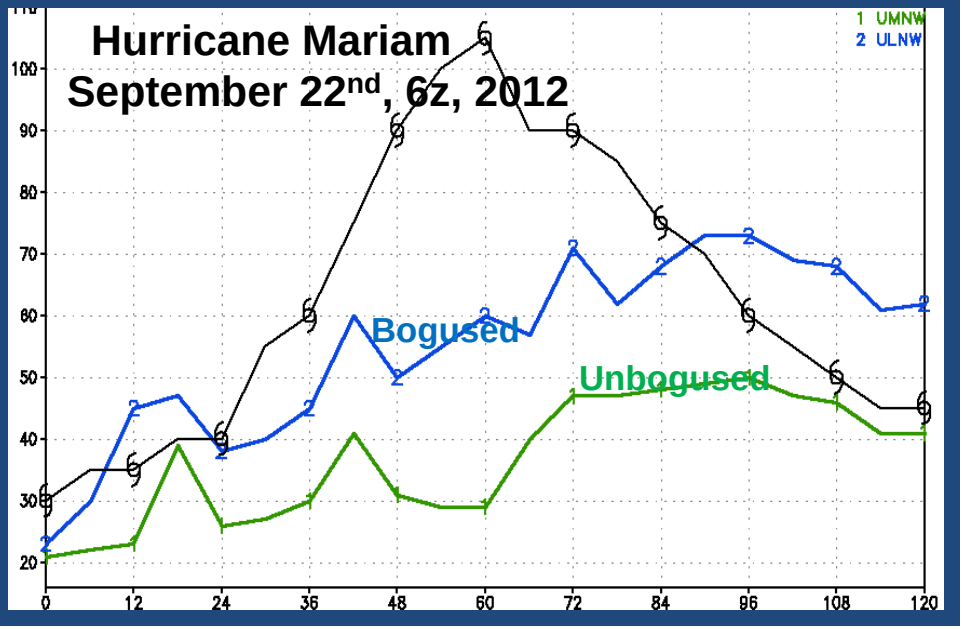




Impact of Bogusing in Atlantic and Eastern Pacific

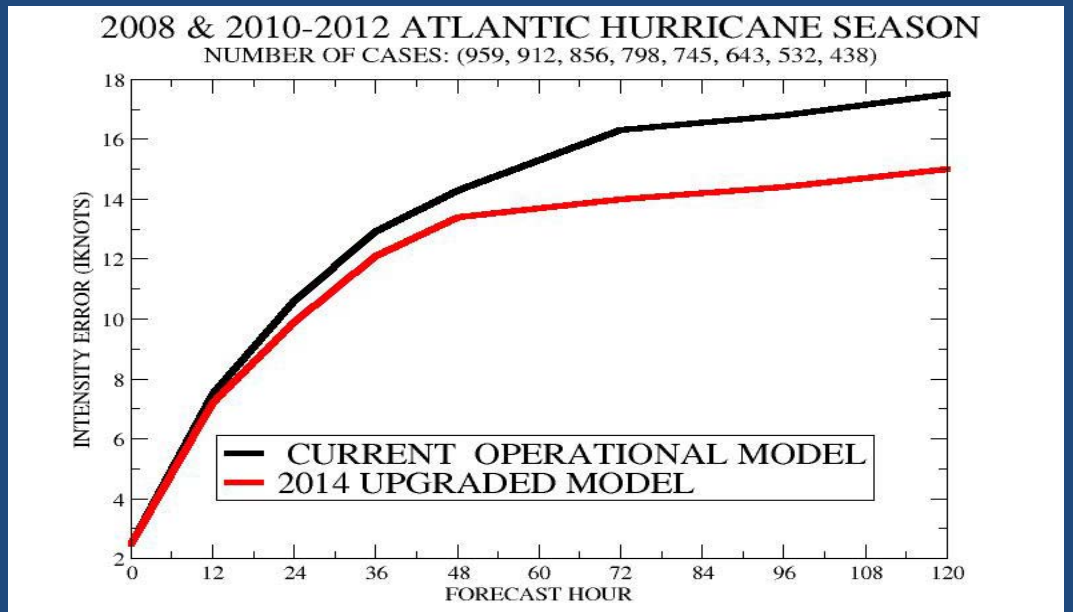




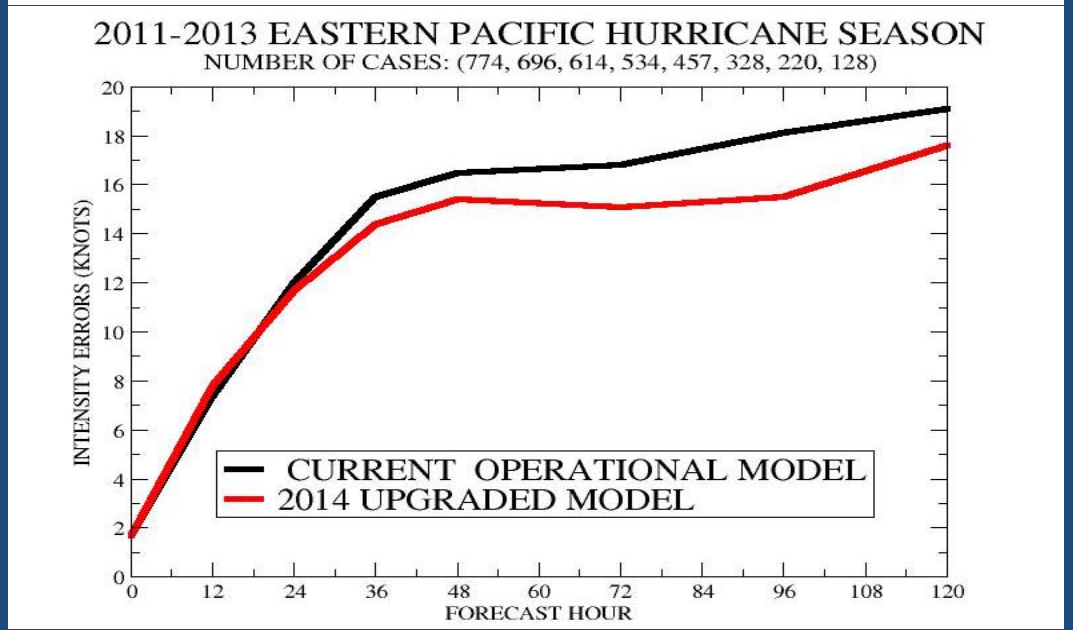


New GFDL Model Significantly Improved Intensity Skill at all Time Levels In Both Basins

Atlantic

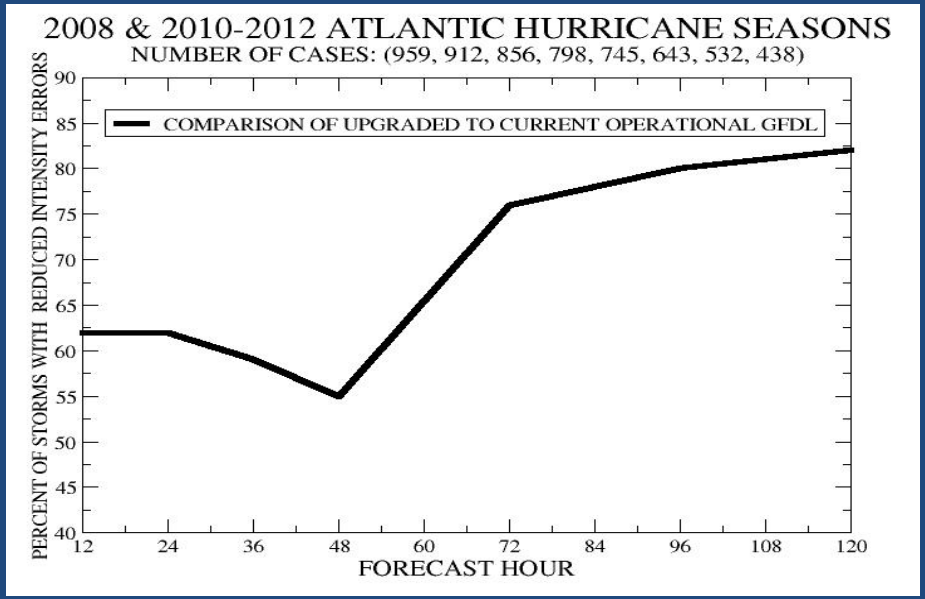


Eastern Pacific



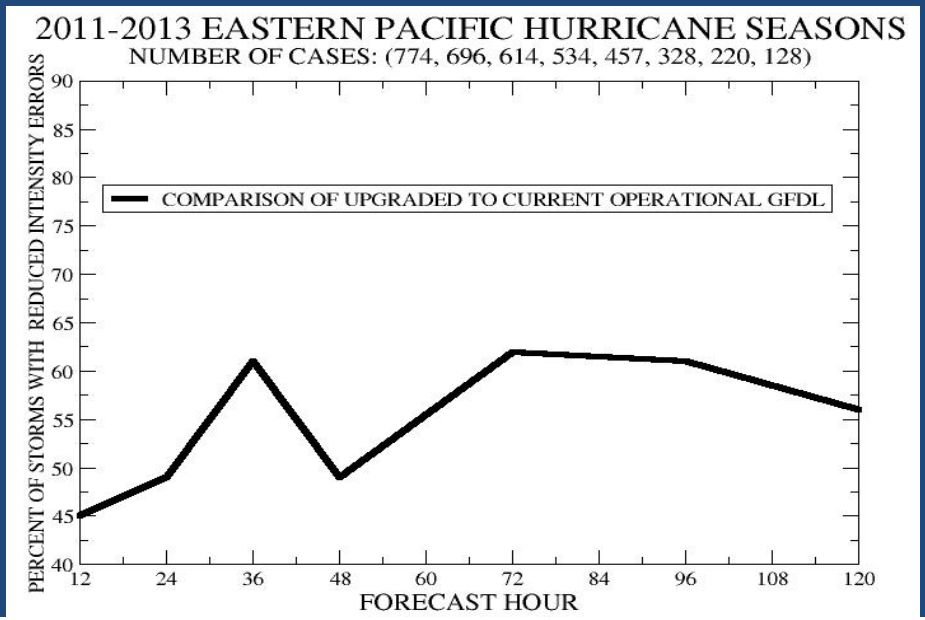
Percent of Storms which have Improved Intensity Forecasts with new model

Atlantic



For days 3-5 over 80% of storms in the Atlantic have improved Intensity Guidance

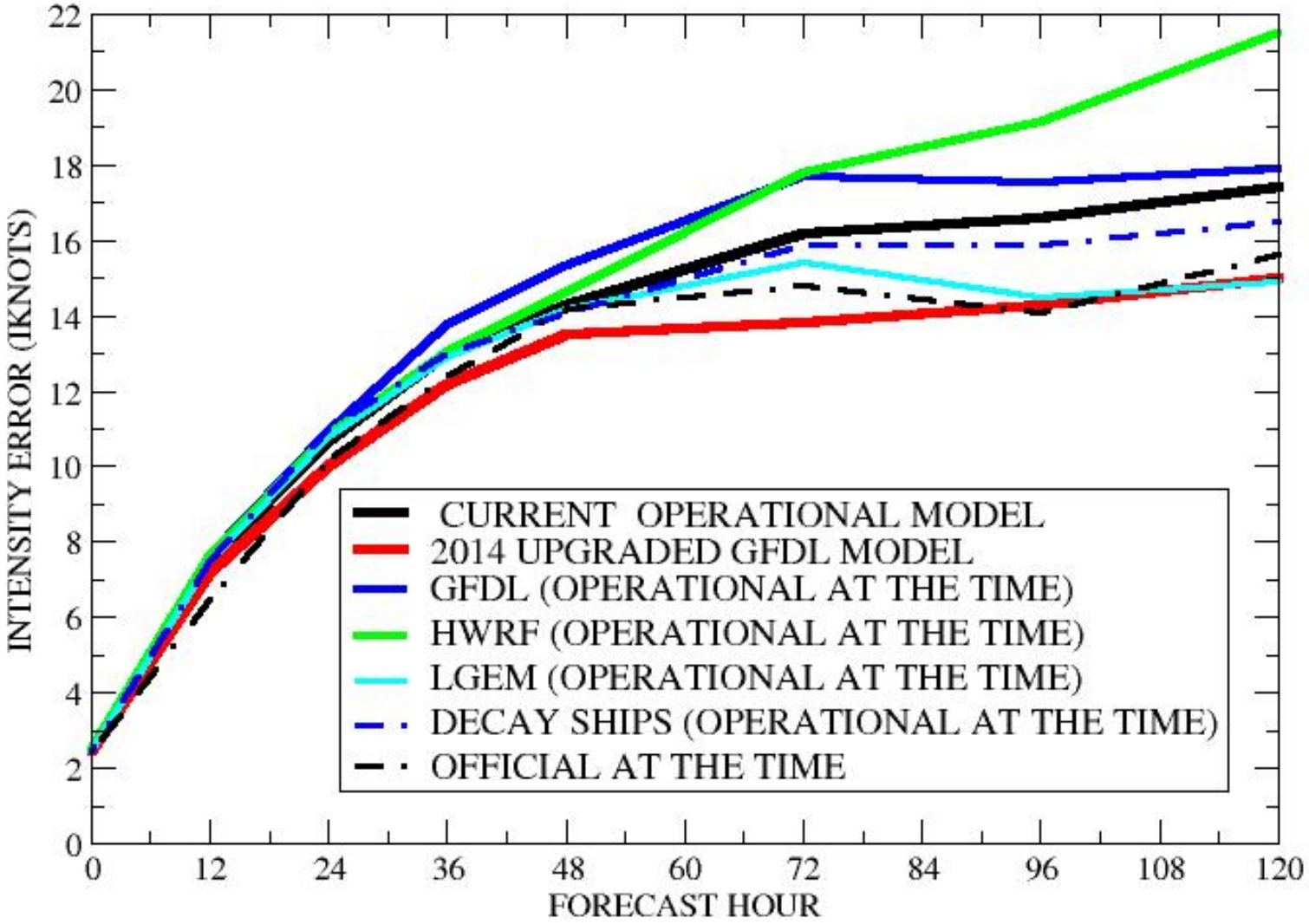
Eastern Pacific



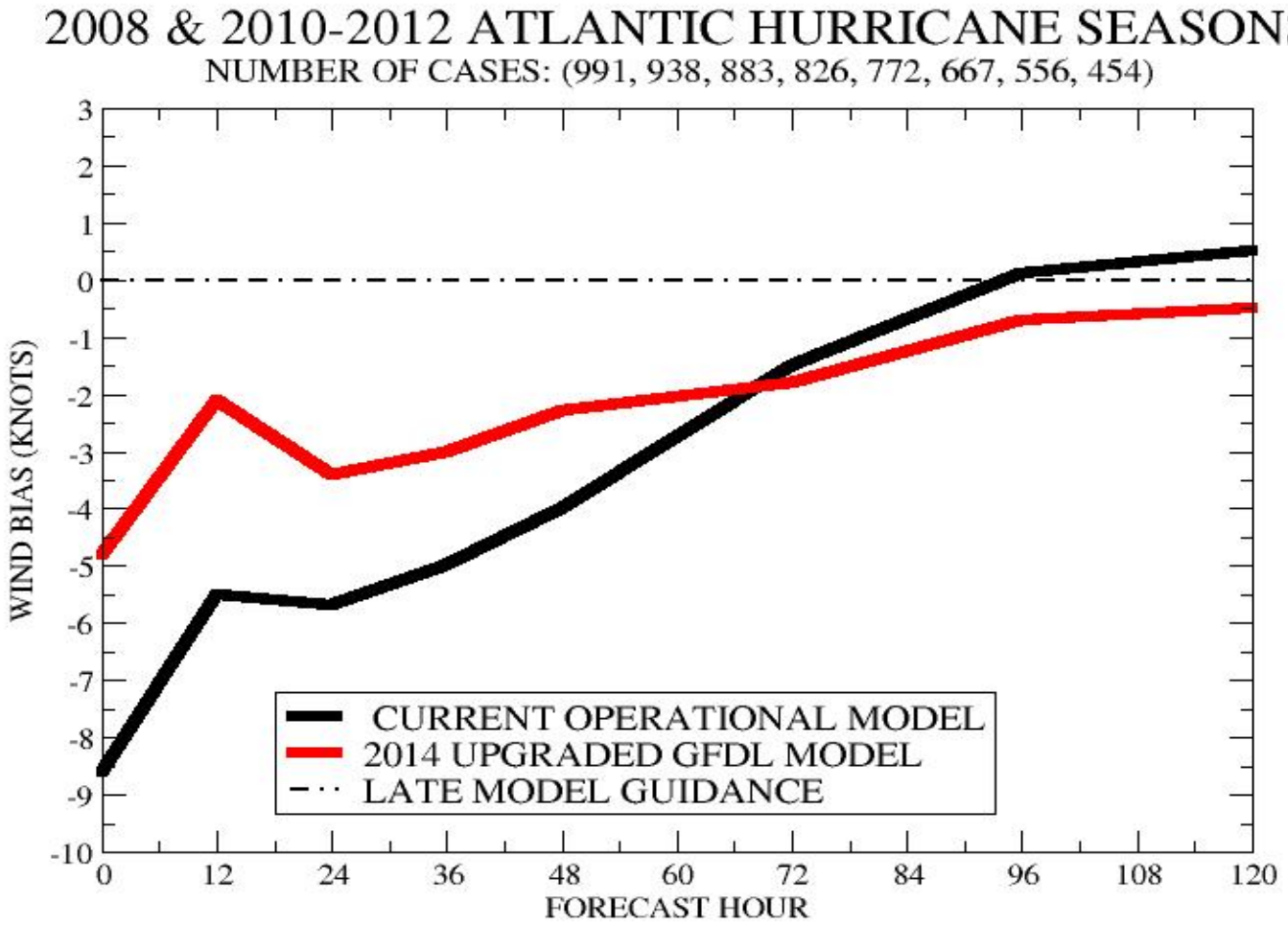
For days 3-5 60% of storms in the Eastern Pacific have improved Intensity Guidance

2008 & 2010-2012 ATLANTIC HURRICANE SEASONS

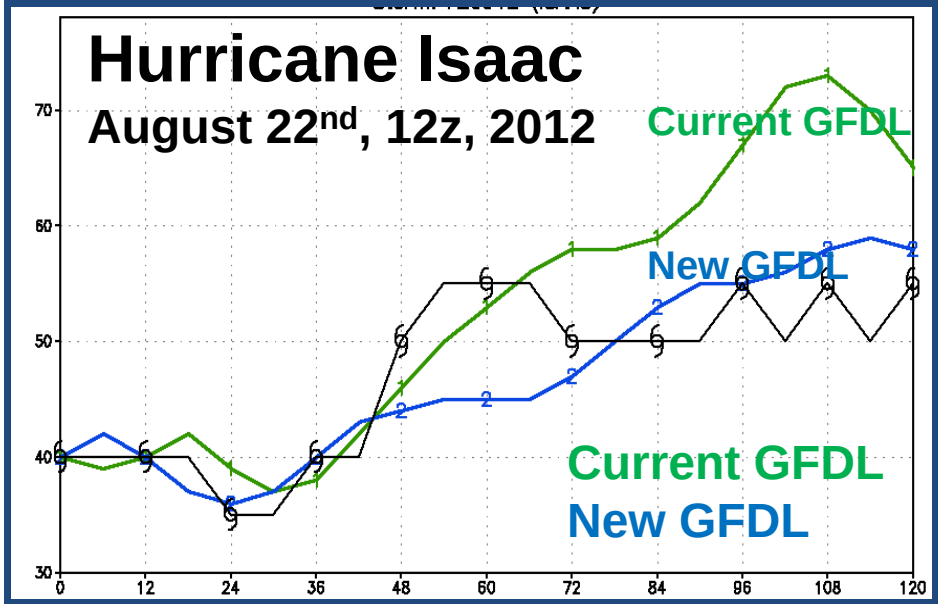
NUMBER OF CASES: (934, 891, 839, 782, 731, 631, 519, 426)

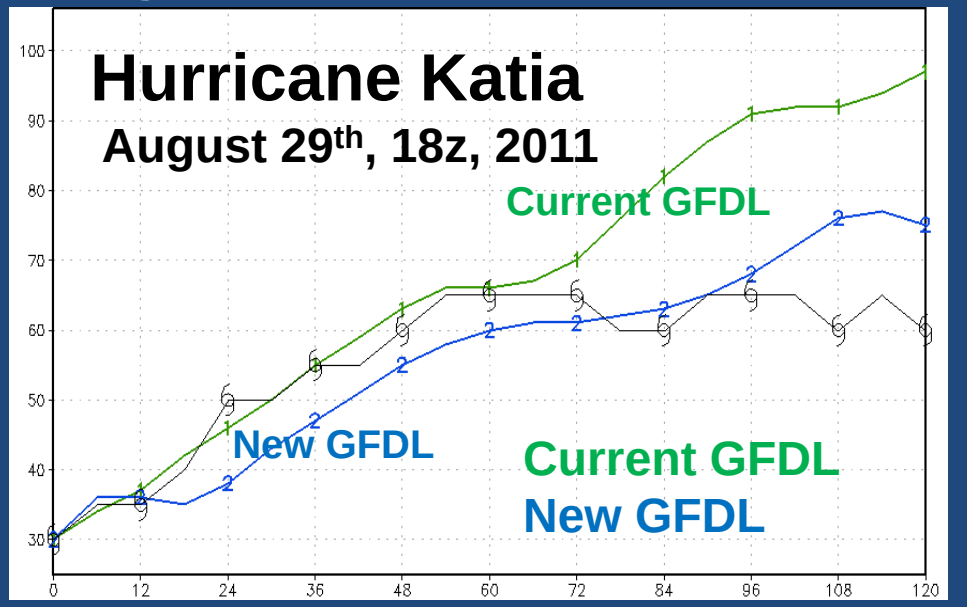


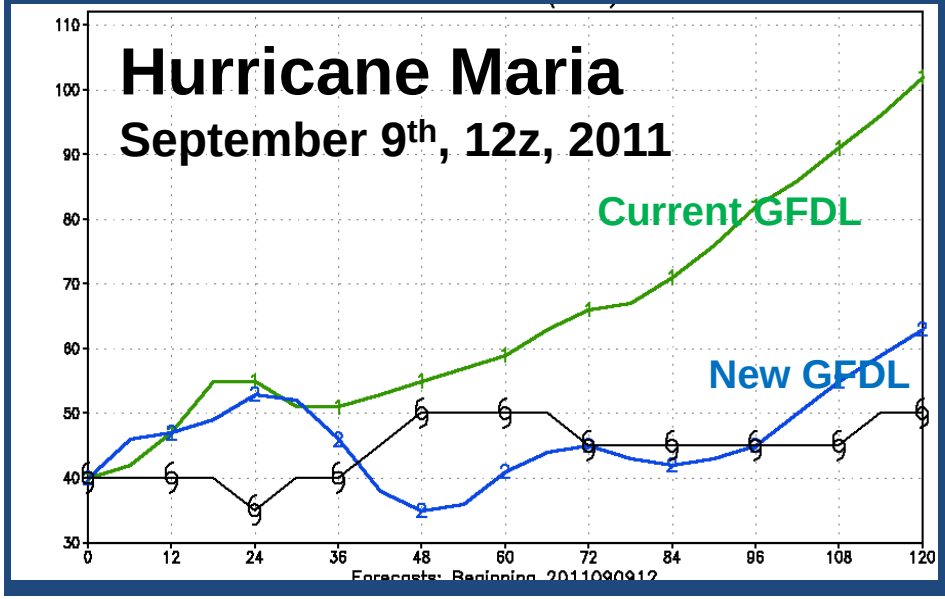
Overall Reduced Intensity Bias with New GFDL Model

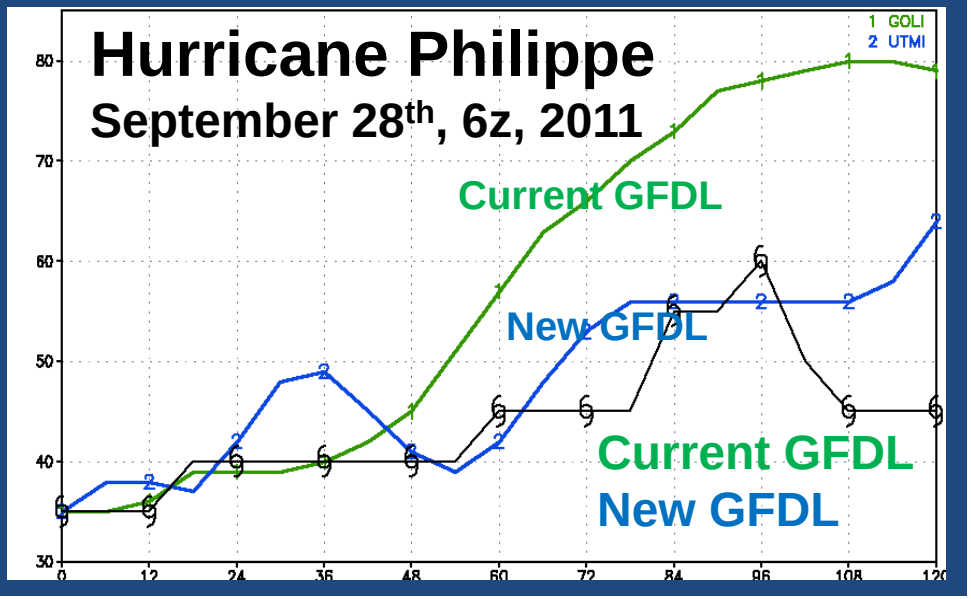


Much Reduced Over-Intensification Tendency for Weaker Storm Intensity with New Model

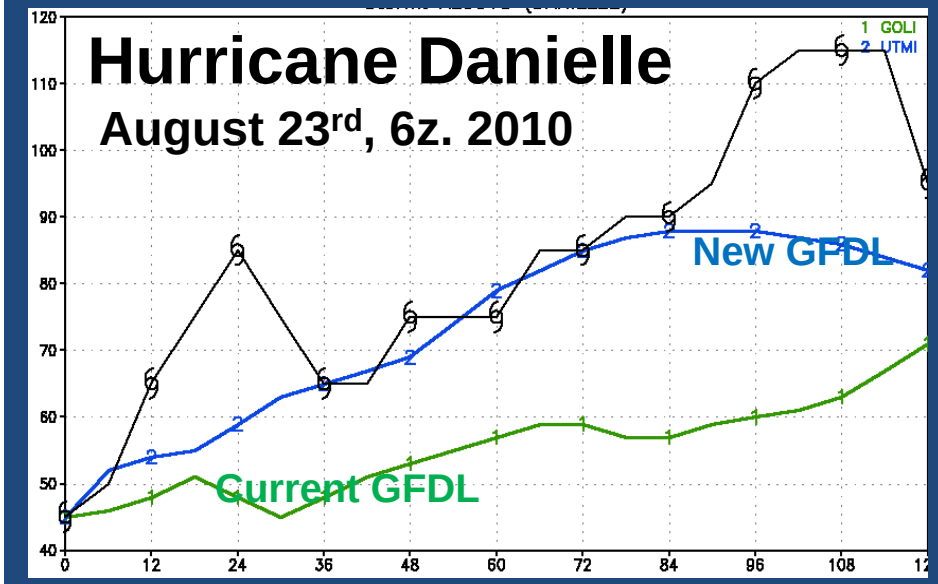


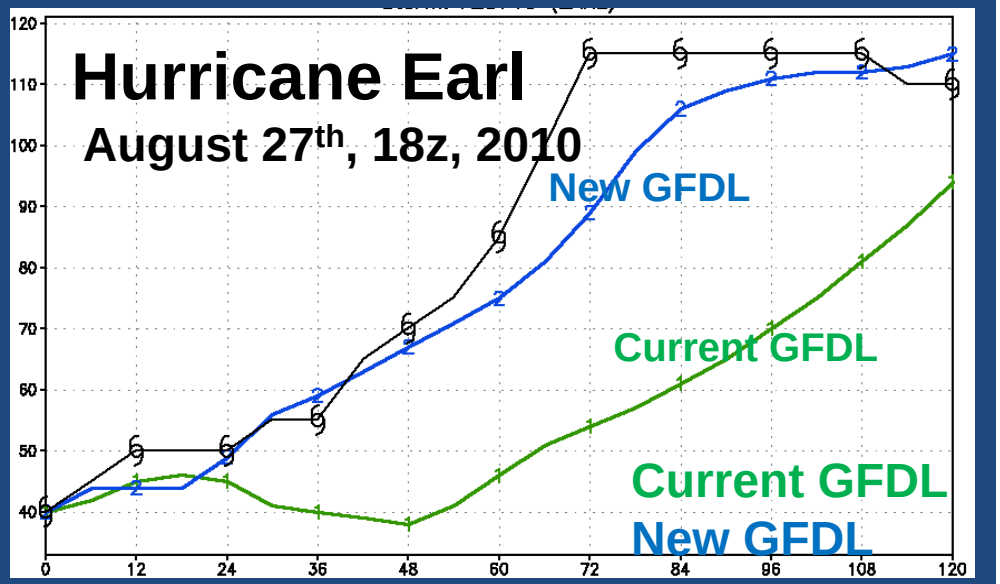


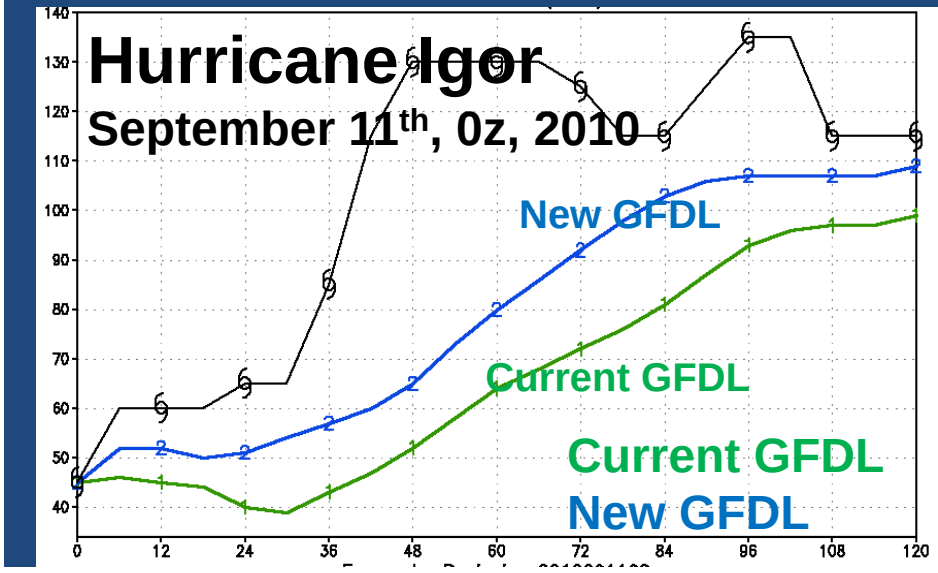


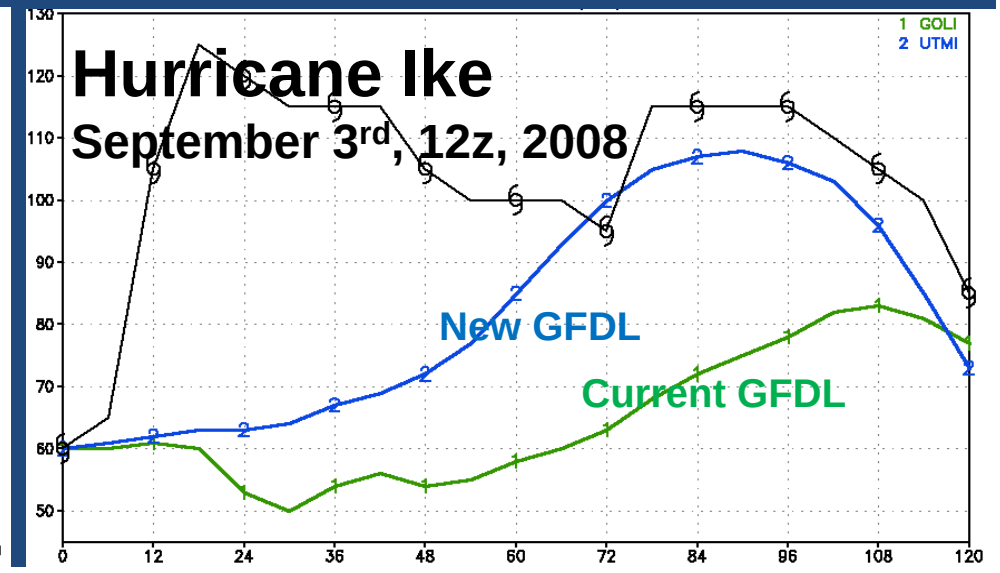


Improved Intensification for Developing Hurricanes with New GFDL Model



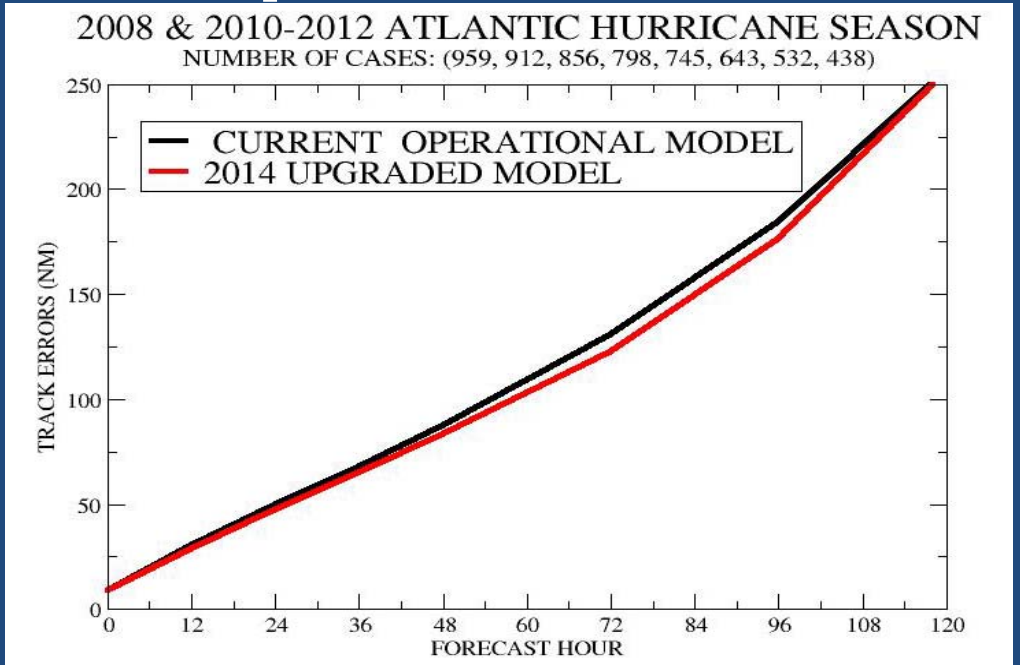




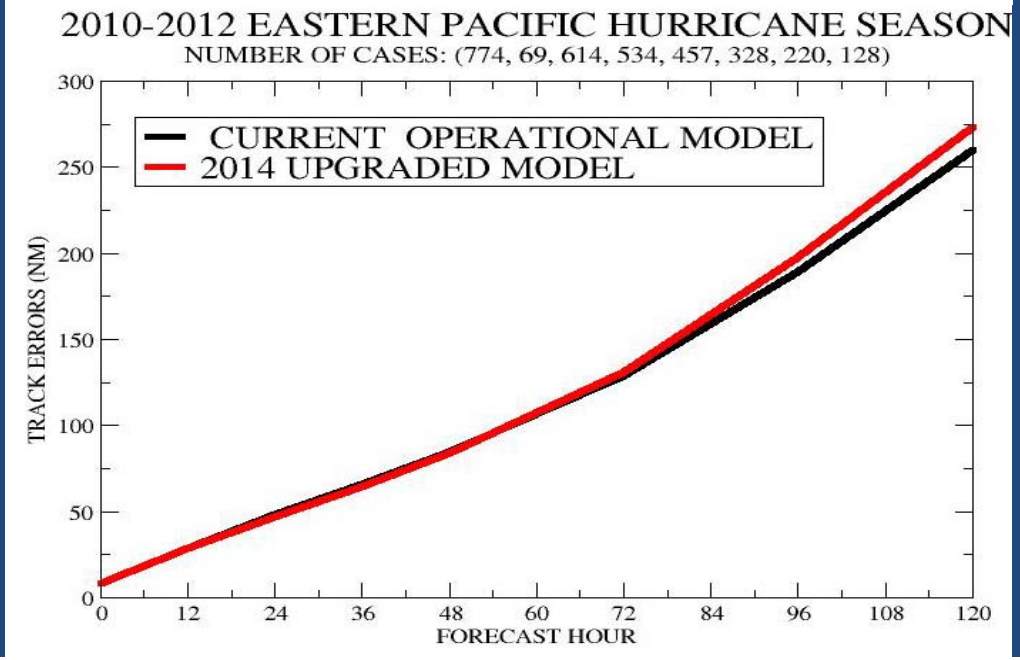


Neutral Impact on Track Errors

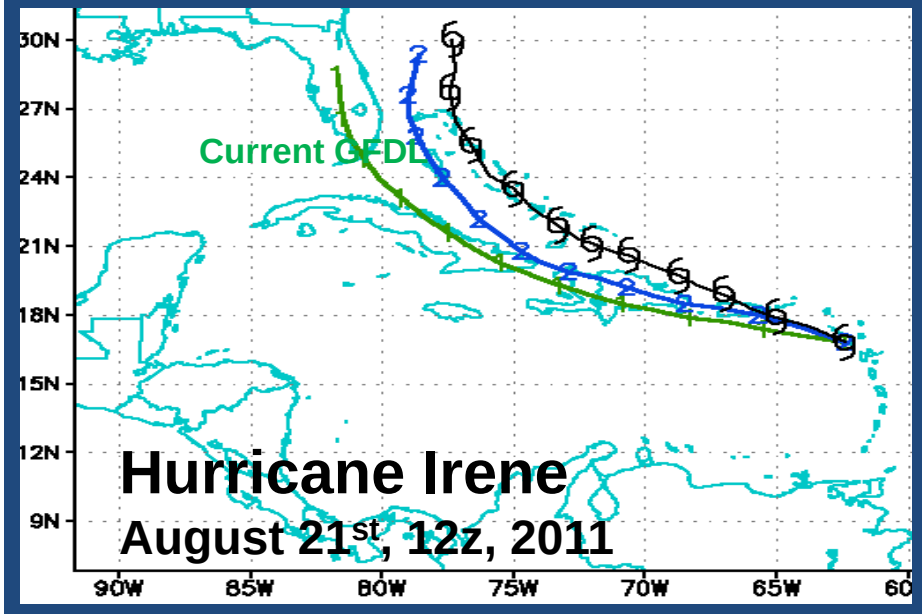
Atlantic

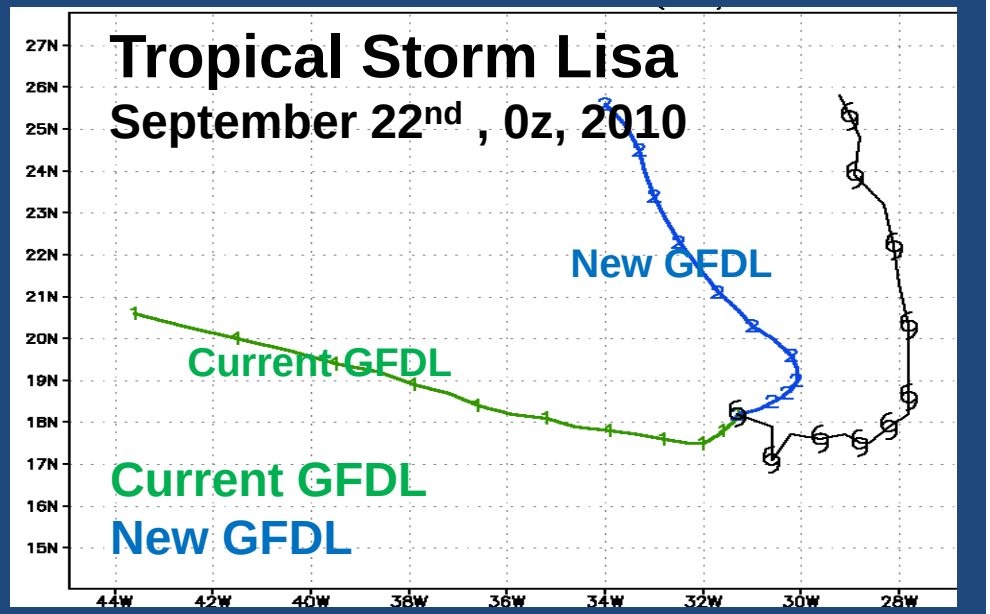


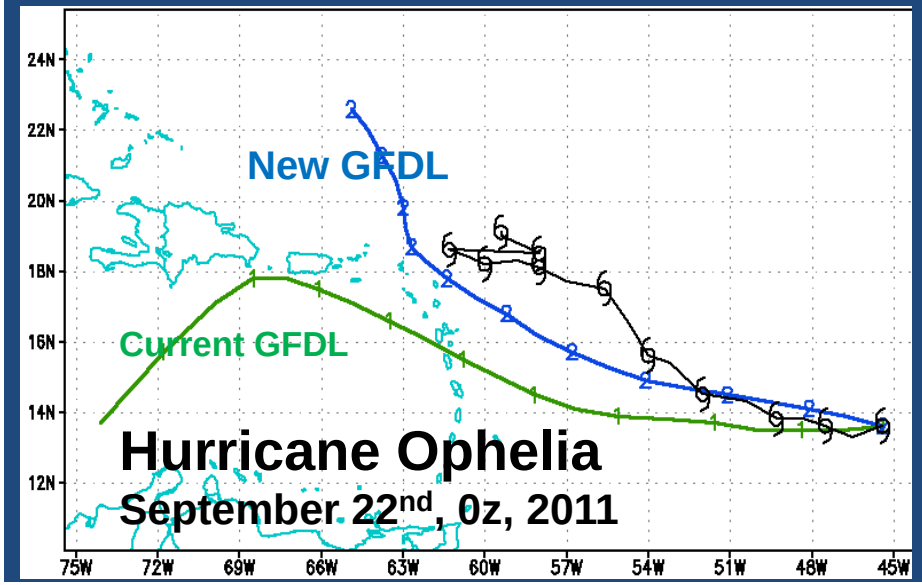
Eastern Pacific

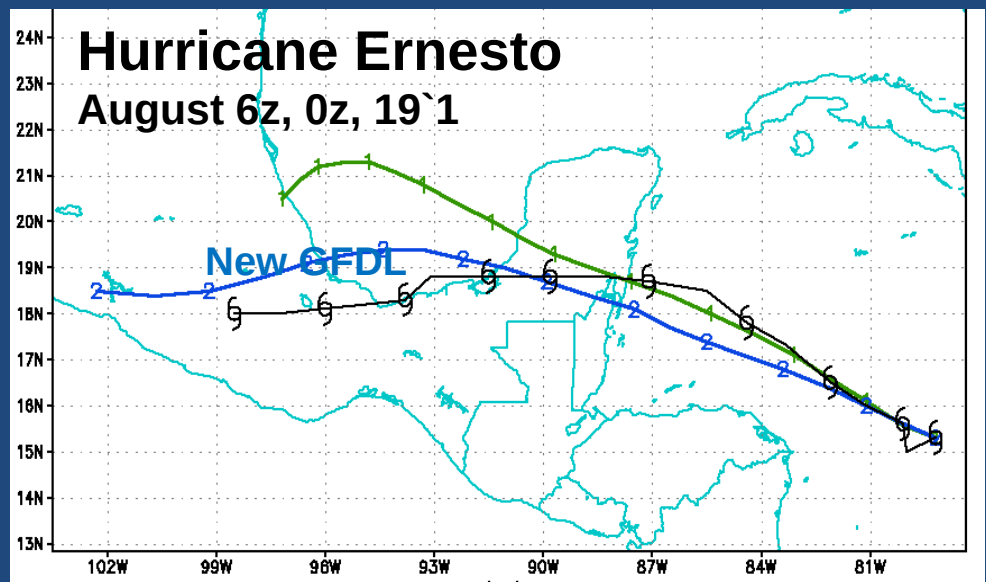


Examples of Track Improvement In Atlantic

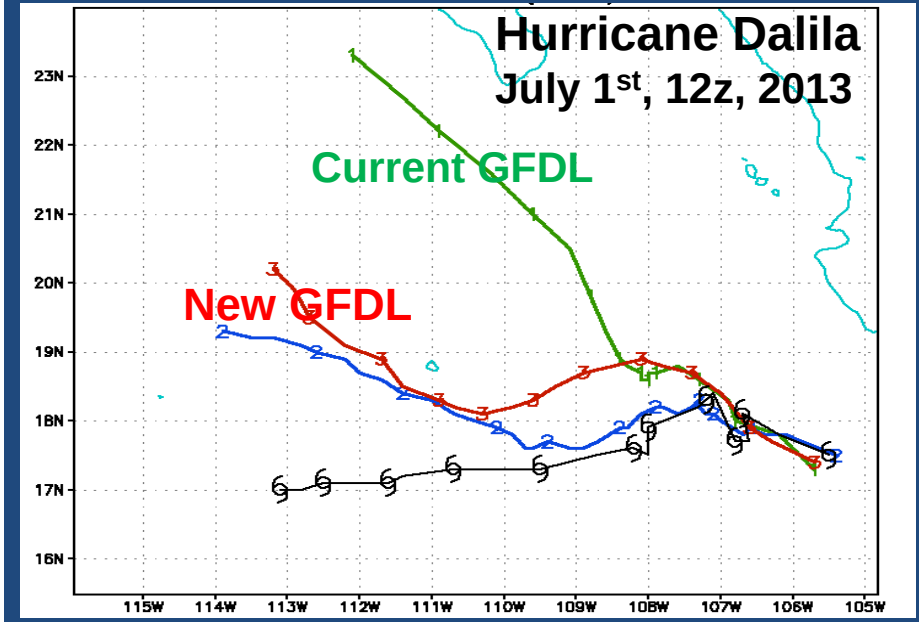


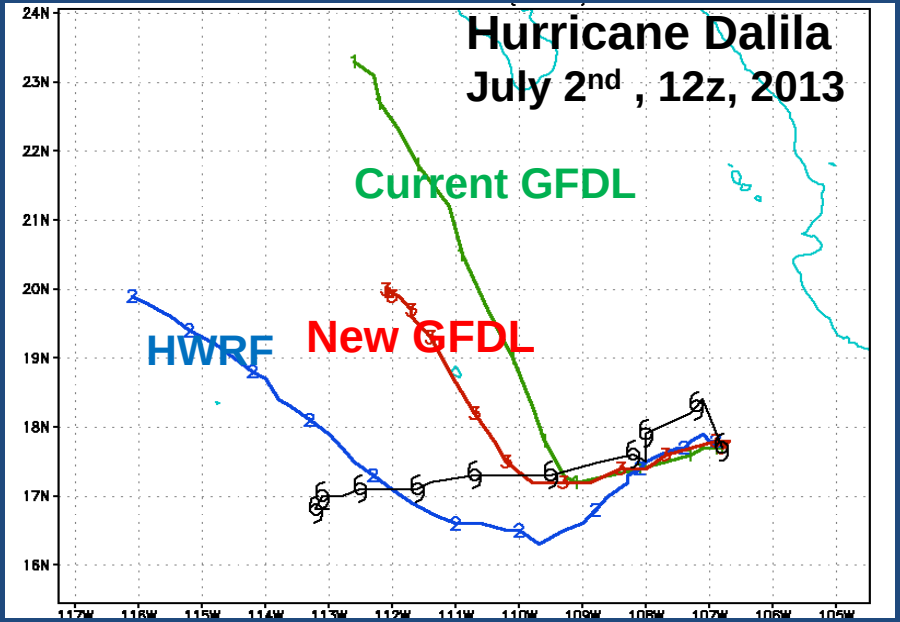


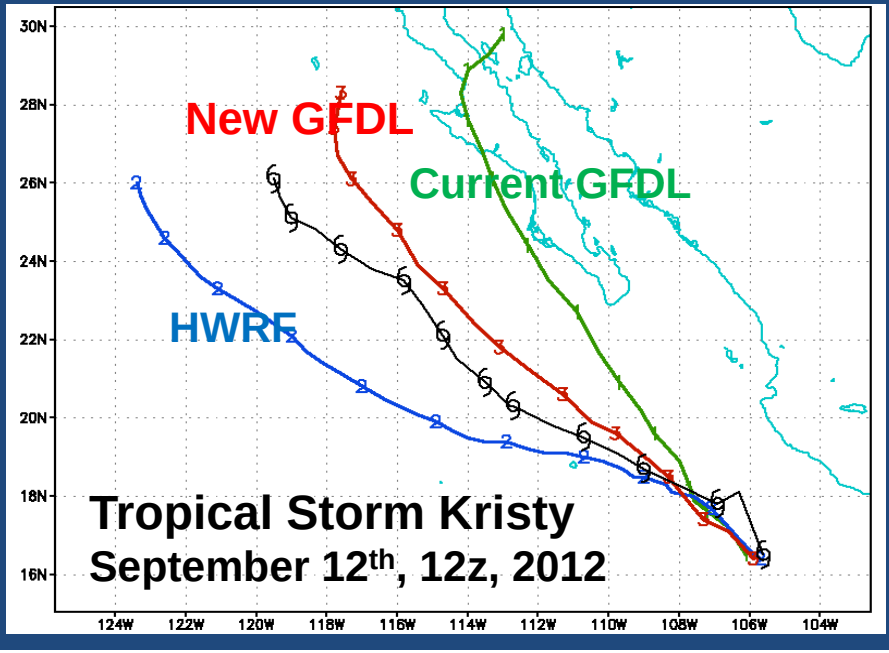


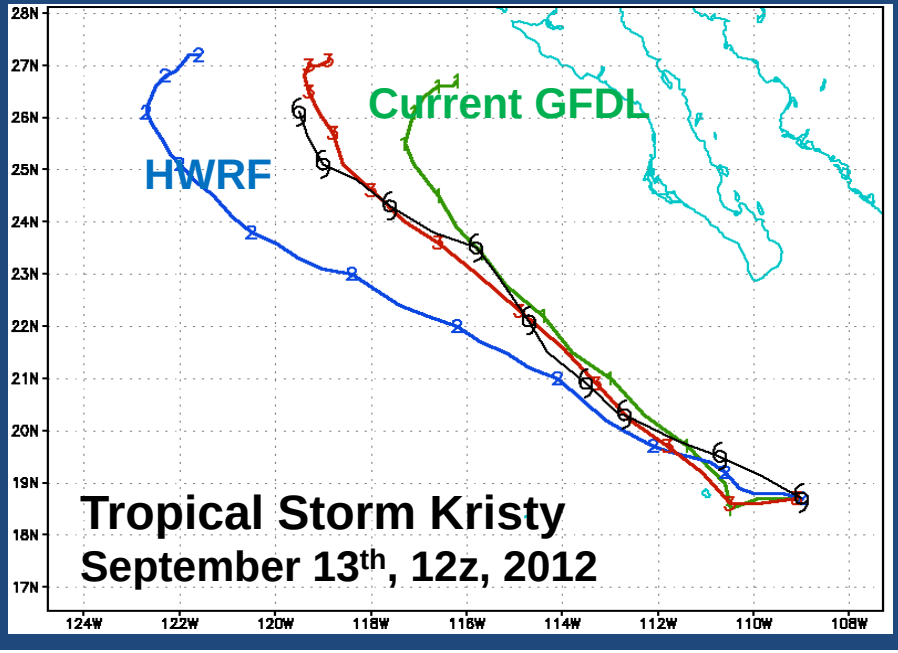


Compared to Current Model New Model Demonstrated Some Reduction in North Bias for Storms Near Mexican Coast



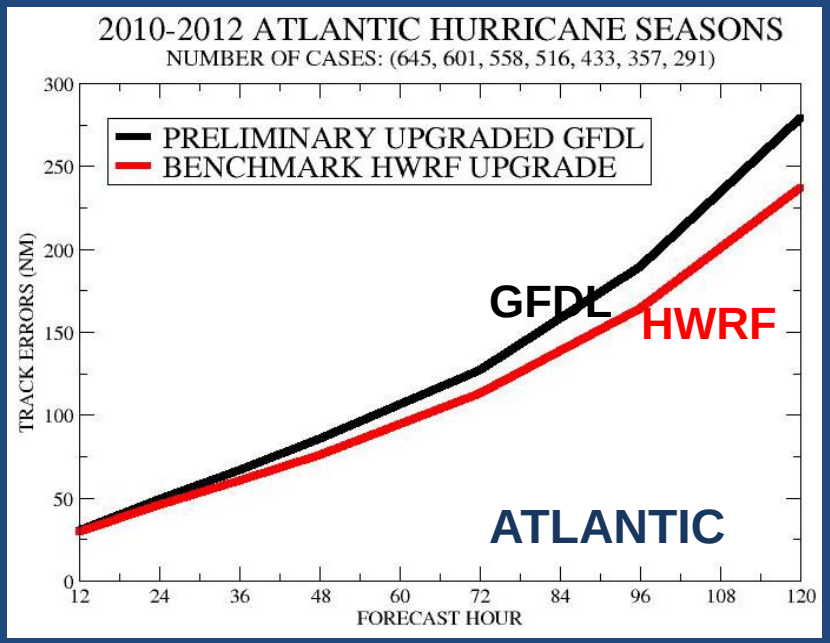


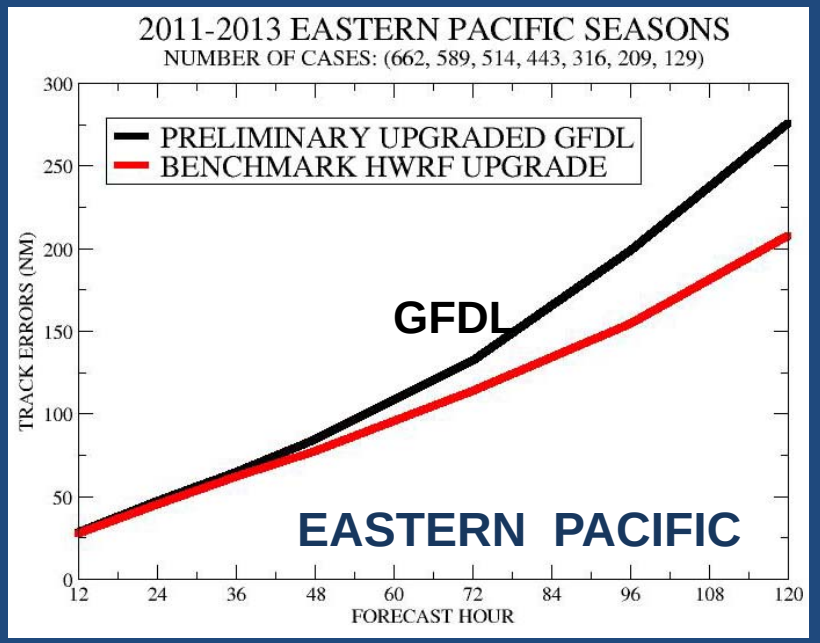




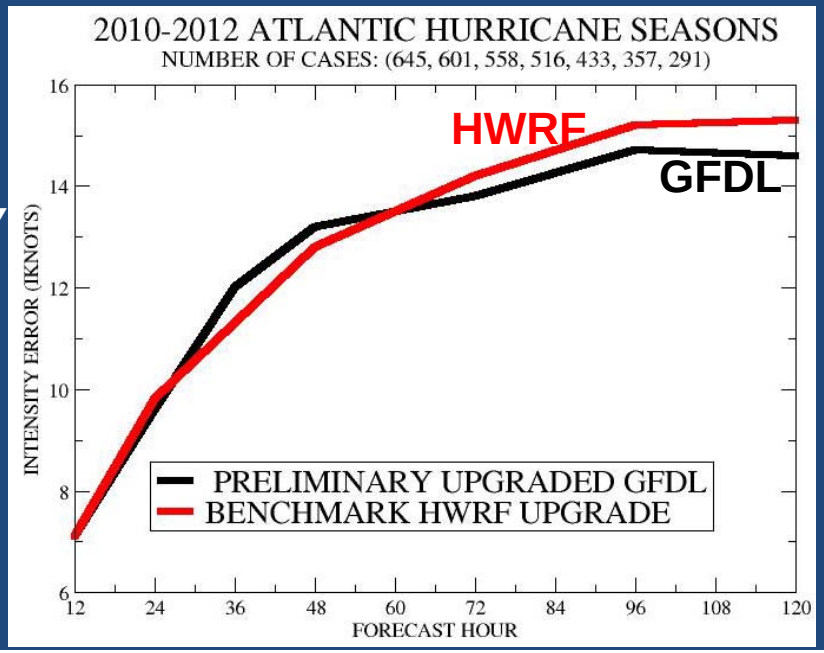
Preliminary GFDL/HWRF Comparison

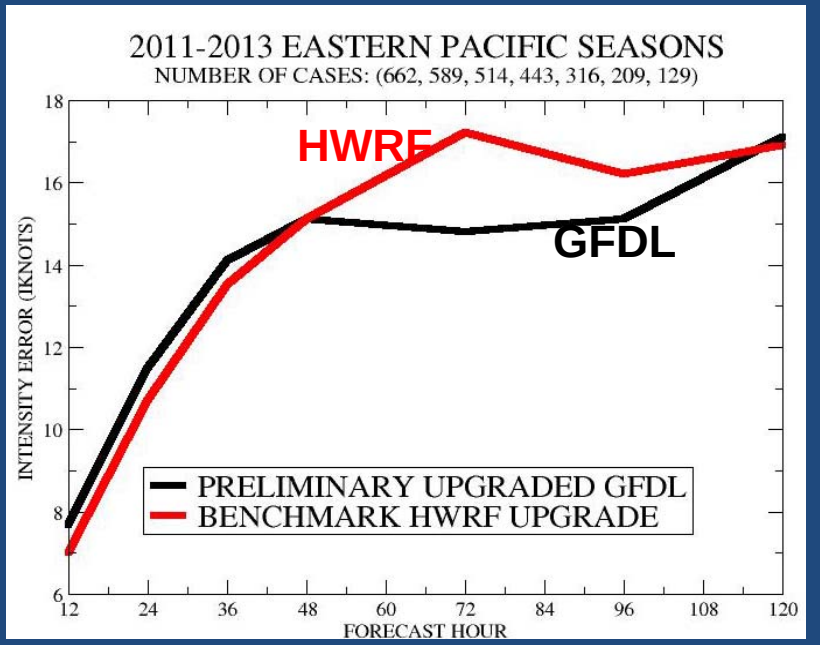
TRACK



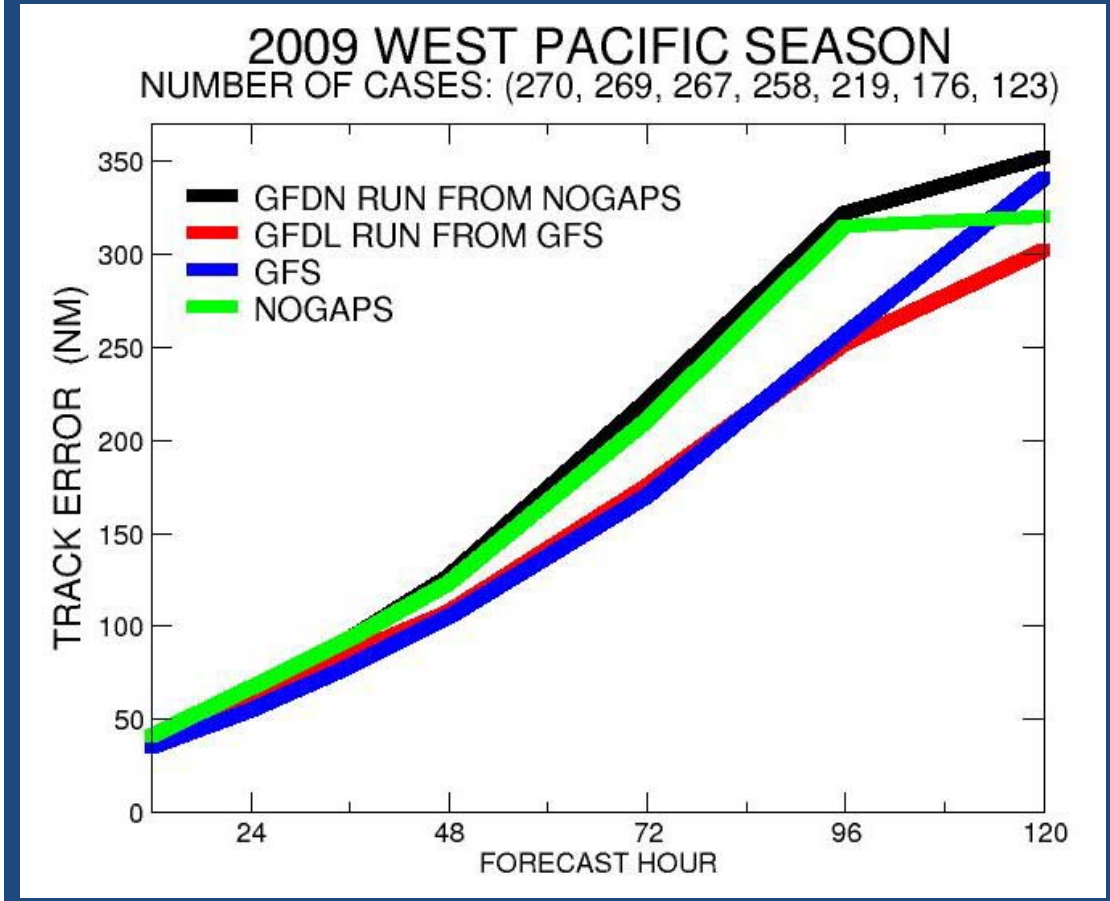


INTENSITY





New GFDL model will run in near real time in the Western Pacific on Jet Computer system during summer 2014



Earlier Study Demonstrated superior track performance in WPAC for GFDL model run from GFS boundary conditions

- **25% reduction in GFDL average track error at days 2, 3 and 4**
- **15% reduction at day 5 when run from GFS analysis compared to NOGAPS**

Example of New GFDL performance in Western Pacific (*Typhoon Haiyan*)