

Geophysical Fluid Dynamics Laboratory Review

June 30 - July 2, 2009



GFDL's Triply-Nested High Resolution Hurricane Model

Presented by
Morris Bender

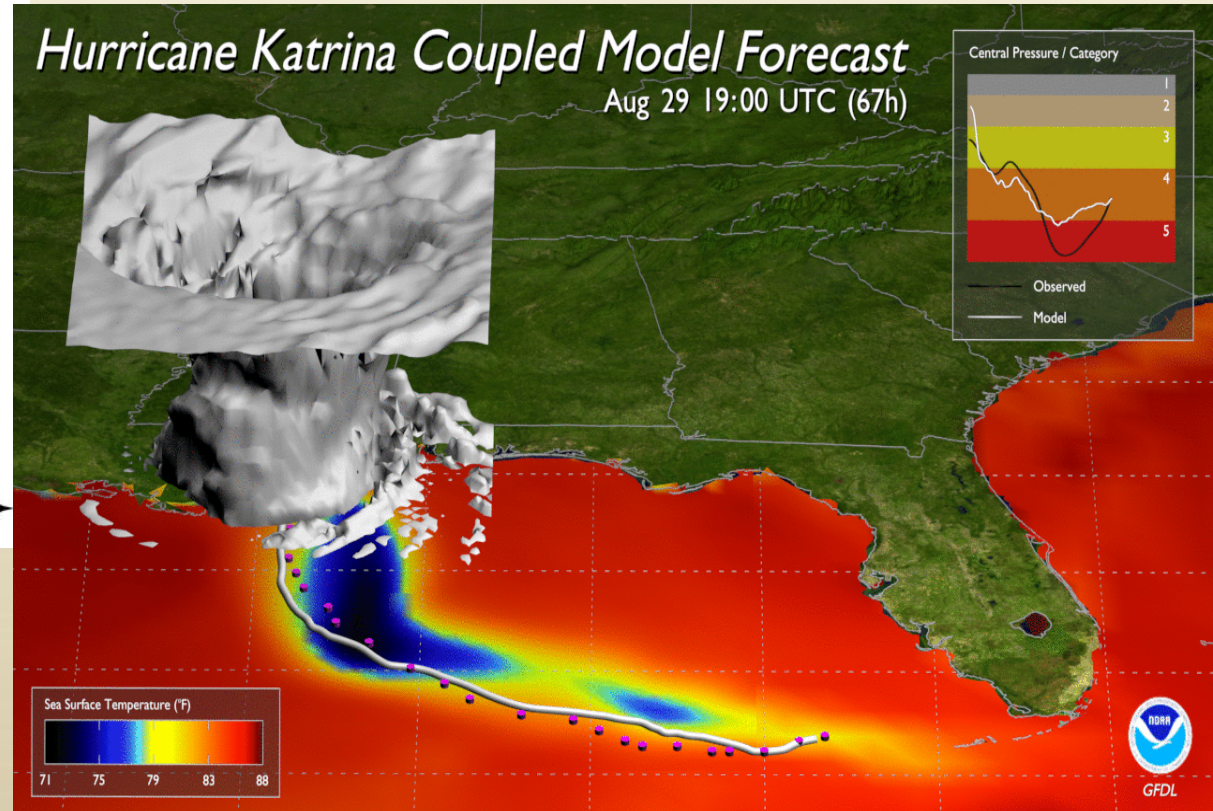
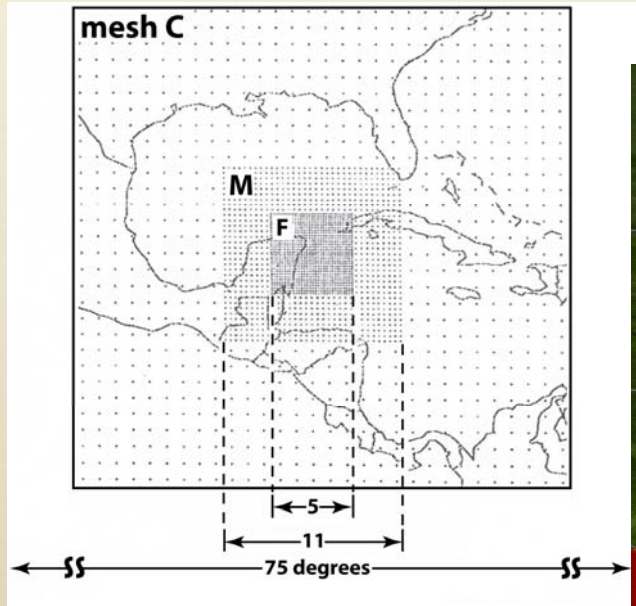
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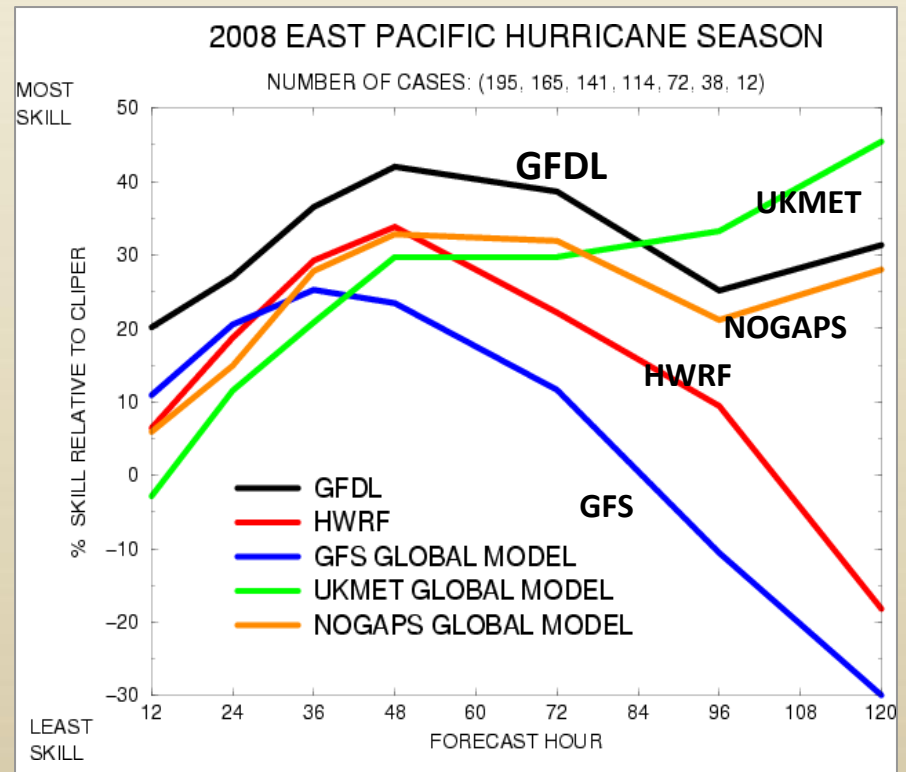
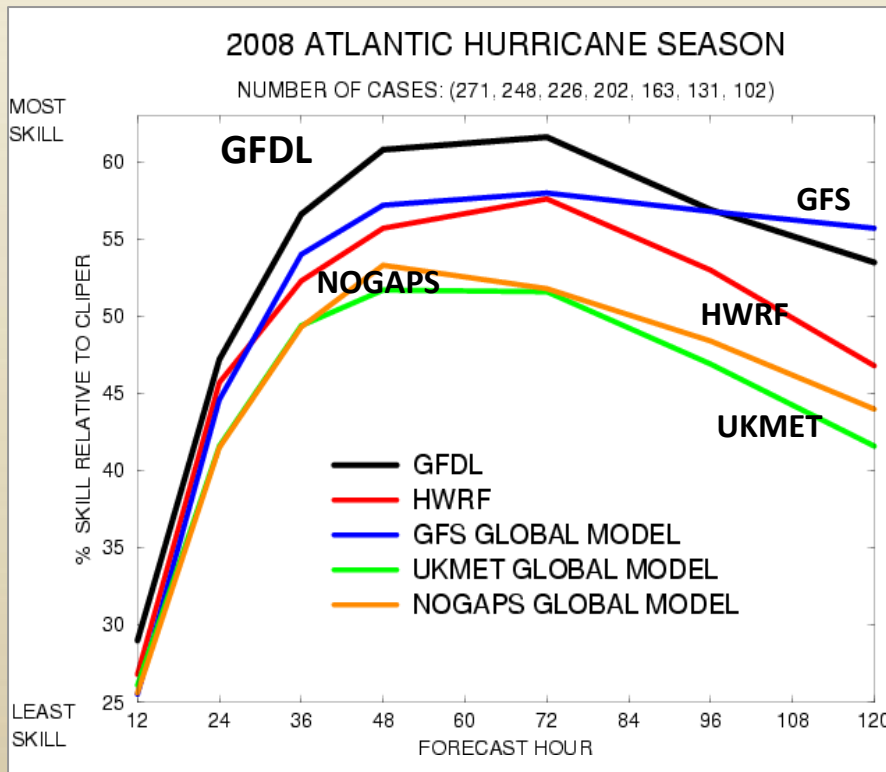
Moving-Mesh Hurricane Model



Full Ocean Coupling made Operational in 2001

The Operational GFDL hurricane prediction system remains among the most reliable forecast models

Average Track Skill Compared to other current Operational Models



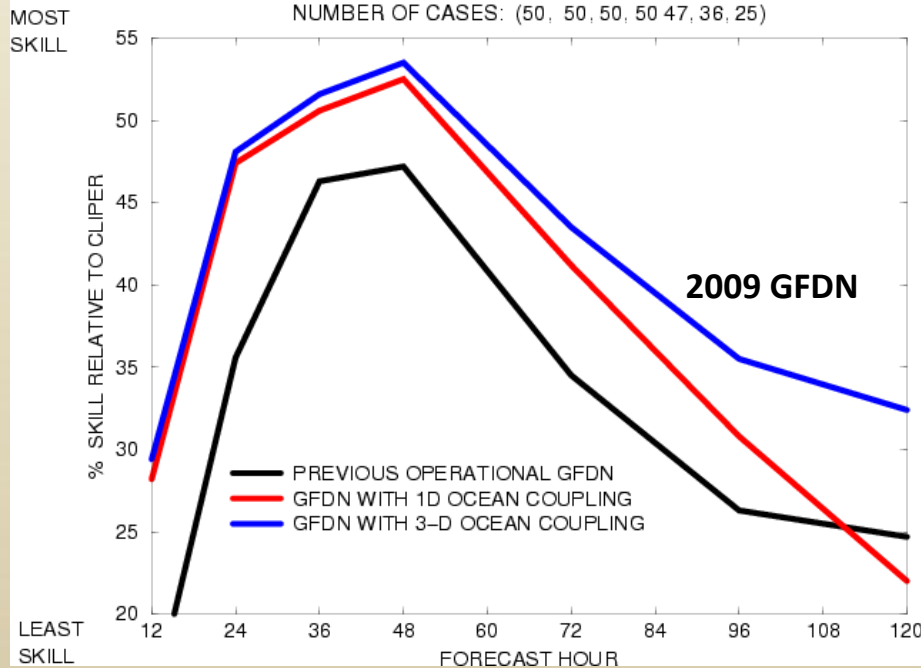
In collaboration with the University of Rhode Island, GFDL continues to upgrade the Navy's version of the GFDL hurricane model (GFDN)

Latest version implemented in mid-June

Average Track Skill

WESTERN PACIFIC TRACK SKILL

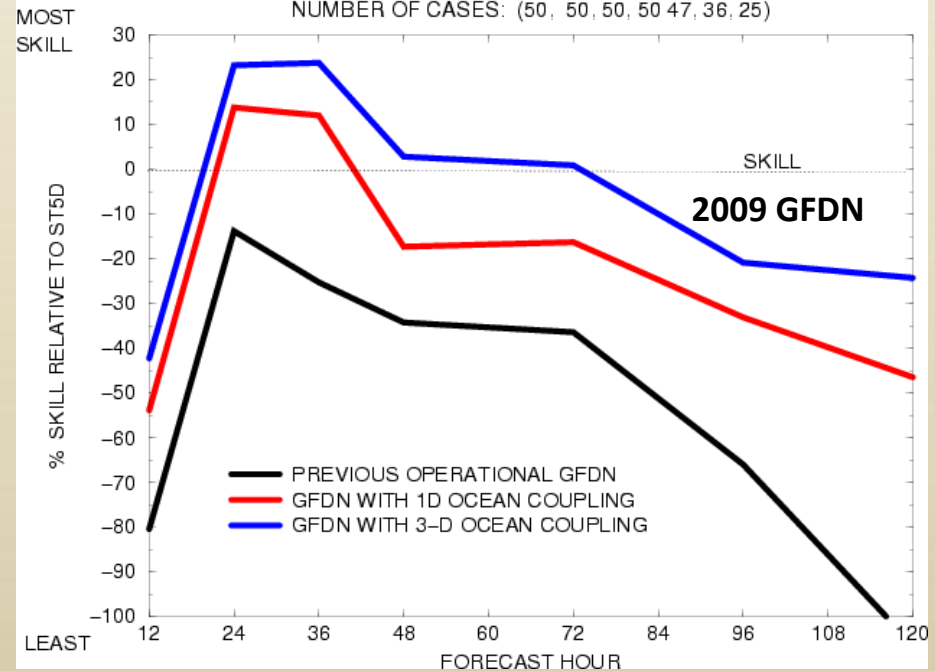
NUMBER OF CASES: (50, 50, 50, 50, 47, 36, 25)



Average Intensity Skill

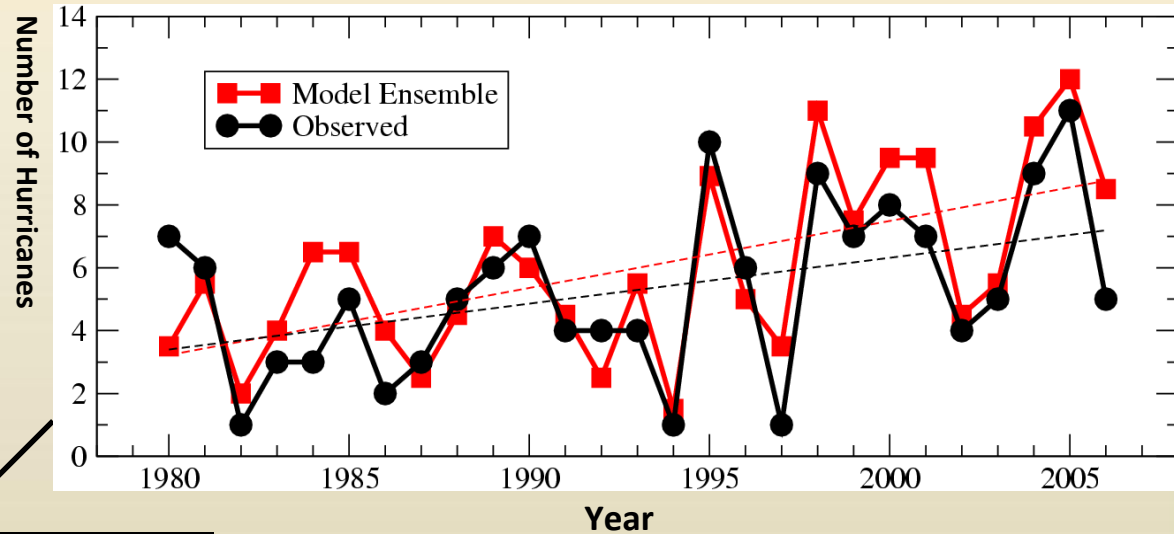
WESTERN PACIFIC INTENSITY SKILL

NUMBER OF CASES: (50, 50, 50, 50, 47, 36, 25)



GFDL Hurricane model now being used for climate warming studies

Knutson et al., 2007 reproduced the inter-annual hurricane storm counts in the Atlantic for 27 hurricane seasons using GFDL's non-hydrostatic regional model.



Initial condition modified with an 80-year climate change perturbation field determined from an average of 18 CMIP3 climate models and 4 individual climate models.

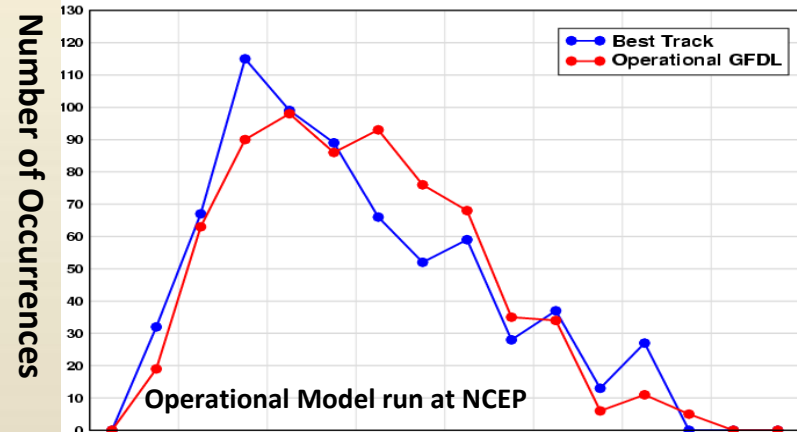
Every individual ZETAC model storm was further downscaled to the GFDL operational hurricane model

Histograms of Maximum Surface Winds in the Atlantic Basin

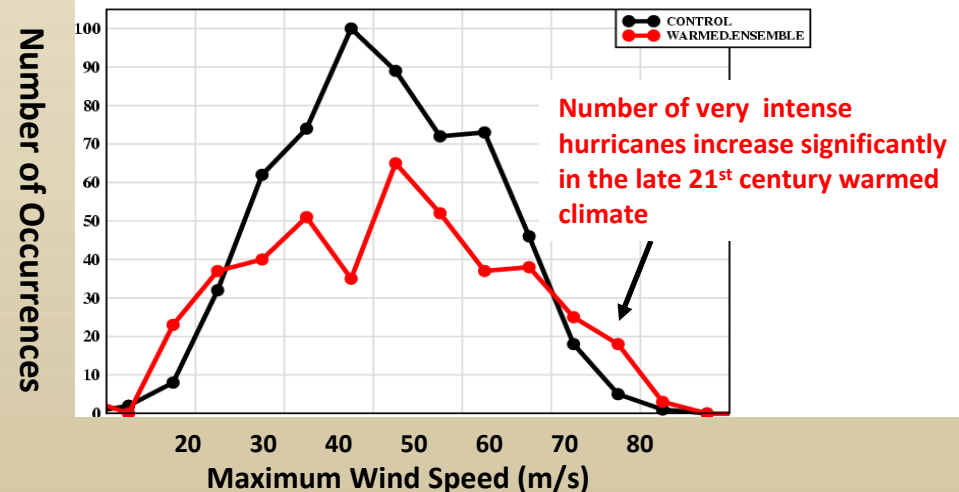
The distribution of maximum winds of the Operational Hurricane model matches well with the observations.

The number of total storms decreased in the late 21st Century warmed climate, with the number of very intense storms significantly increasing

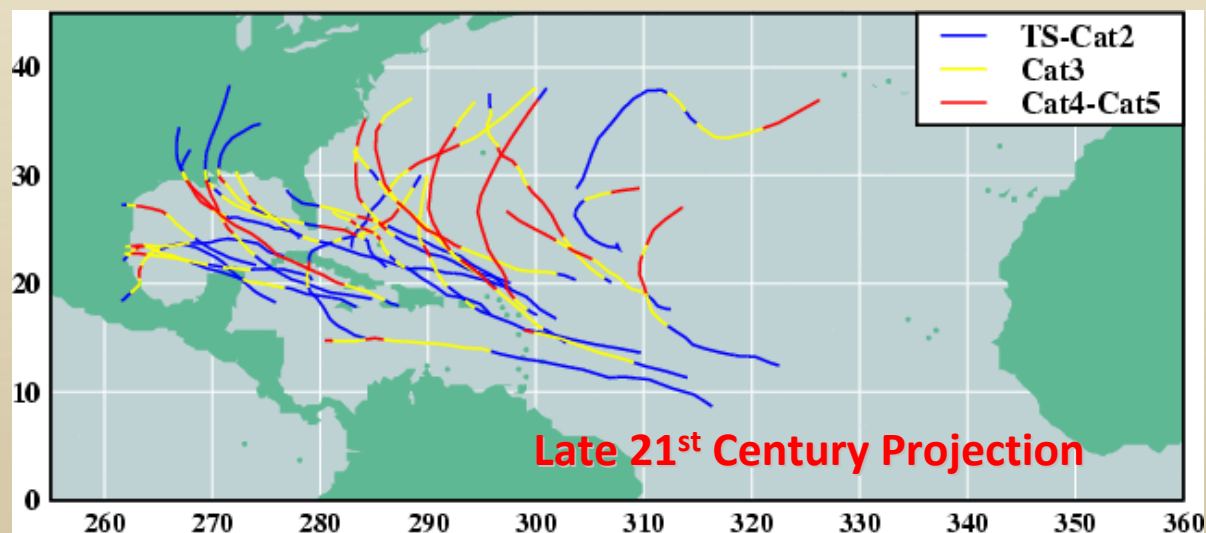
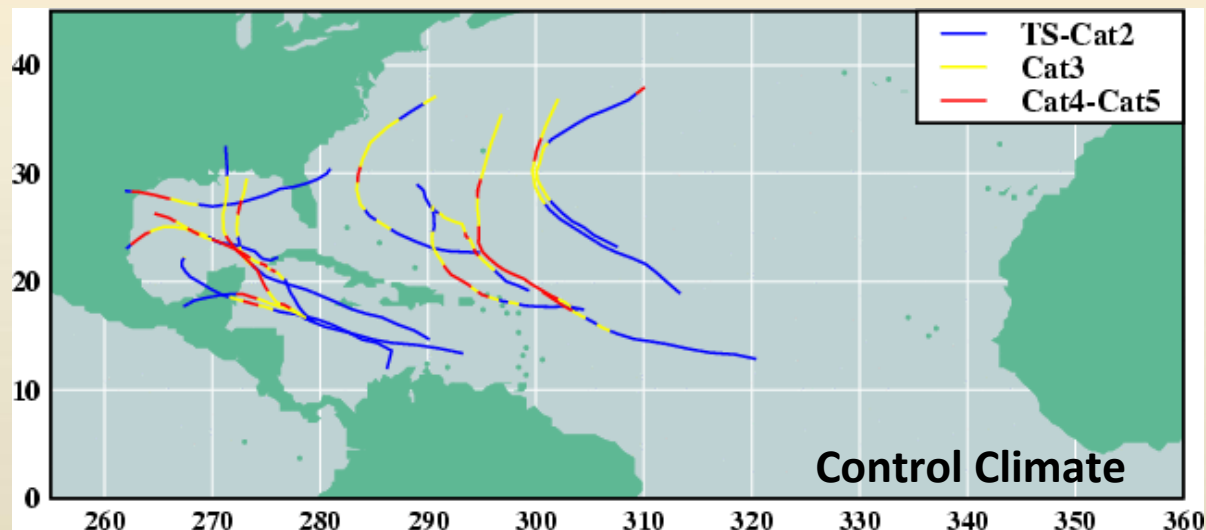
Distribution of Maximum Winds Per 120h Forecast Period
2006-2008 Atlantic Seasons



Distribution of Maximum Wind Speed for the Control Climate
vs. the Climate Simulated by the Average of 18 CMIP3 Models

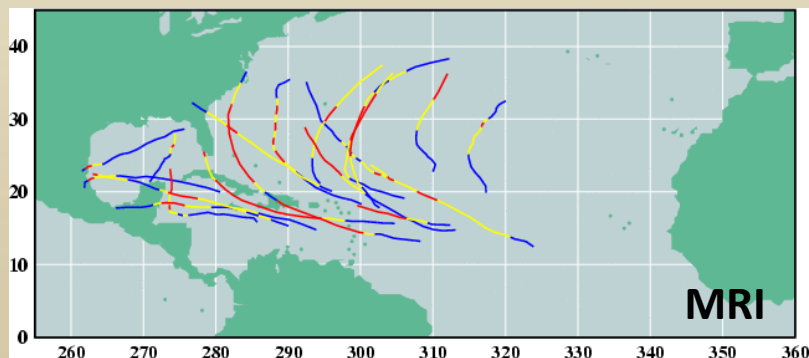
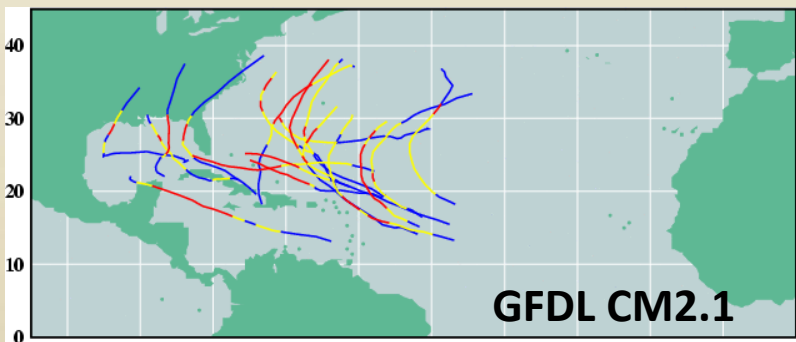
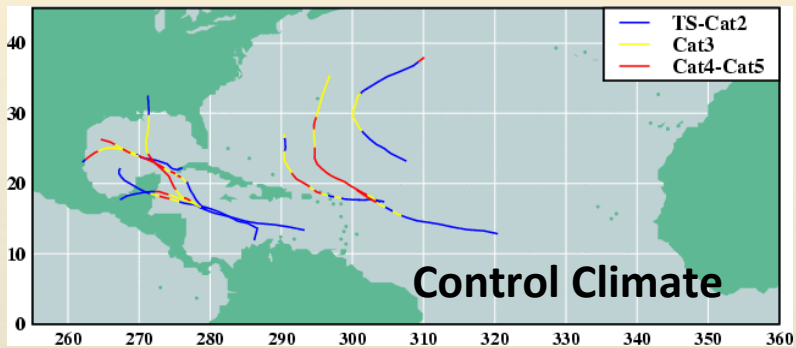


Tracks of Storms that Reached Category 4 or 5 Intensity (27 Simulated Hurricane Seasons)

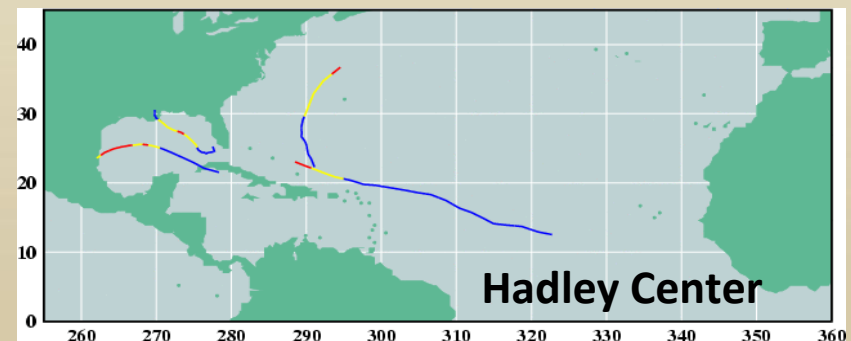
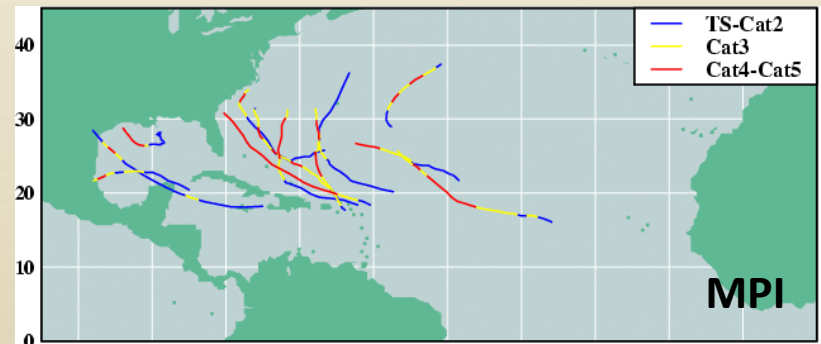


Late 21st Century
Warmed Climate
Projection
Determined by
Average of 18
CMIP3 Models

Tracks of Storms that Reached Category 4 or 5 Intensity



Late 21st Century Warmed Climate Projection Determined by Four Individual CMIP3 International Climate Models



Summary

- GFDL hurricane model continues to provide outstanding forecast guidance to both the National Weather Service and the U.S. Navy.
- The GFDL operational hurricane model was used to simulate late 21st century Atlantic hurricane activity, and indicates that the number of very intense hurricanes may significantly increase.
- Largest increase of intense hurricane activity was in the Western Atlantic, north of the Main Development Region.

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