Improved Track and Intensity Forecasts for Atlantic Hurricanes

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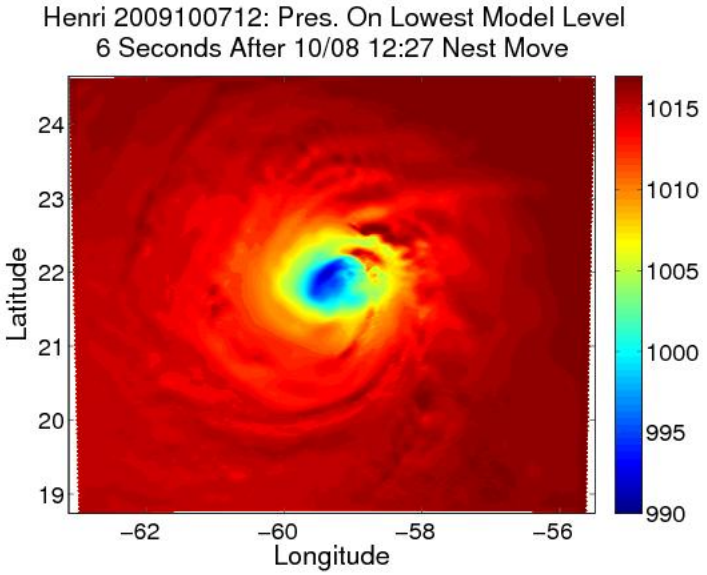
An important area of current research on hurricanes is improving hurricane track and intensity forecasts with numerical weather prediction models. Recent work suggests that increasing model resolution to a few km might be necessary for improved forecasts because the strong upward motion that leads to increased intensity is concentrated at small scales. There are severe computational challenges in model execution and analysis including model run time, and terabyte memory and storage requirements. The NSF-supported UMBC High Performance Computing Facility, http://www.umbc.edu/hpcf, with its parallel analysis and visualization tools, has been invaluable in analyzing high resolution hurricane simulations performed with HWRF (Hurrricane Weather Research Forecast) model in support of NOAA's Hurricane Forescasting and Improvement Project. The HWRF model uses a grid that moves with the storm and UMBC's cluster has allowed us to diagnose problems with non-physical strong pressure perturbations that amplify within a few seconds after the grid has been moved as shown in the figure. The cluster has also allowed a comprehensive analysis of observational hurricane data using novel statistical approaches that have documented km-scale strong convective bursts; ongoing research is aimed at understanding their role in hurricane intensity change.

There has been little progress in hurricane intensity forecasting in recent years, partly due to the lack of sufficient model spatial resolution. This research contributes to our knowledge about how small scale processes contribute to hurricane intensity, and investigates how to best incorporate that knowledge in order to improve hurricane forecasting.

This research directly impacts the population living in the hurricane-prone regions of the US along the Gulf coast and mid-Atlantic by improving skill in hurricane forecasting. It strengthens ties between UMBC and NOAA in joint efforts to improve hurricane model diagnostics and enhance discovery via novel statistical and computational approaches to the analysis of very large data sets. These results will be publicly presented at the AAMS Hurricane Conference. Finally, this activity is preparing the next generation of numerical weather prediction specialists, as it is the PhD dissertation work of a student who is working directly with scientists at NOAA.



Caption: High-resolution simulations of the pressure field simulated by the operational HWRF hurricane model. The structure shows the non-physical pressure perturbations 6 seconds after moving the high resolution inner model grid.

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