BLUE WATERS
SUSTAINED PETASCALE COMPUTING

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Geoscience

EXTREME CONVECTIVE STORMS UNDER CLIMATE CHANGE

Research Challenge

The future impact of thunderstorms and thunderstorm systems such as hurricanes under a globally warmed climate are still uncertain. PGW (pseudo global warming) simulations show that hurricanes under climate change appear to be more hazardous in terms of inland flooding and tornado generation. This research is important from the perspective of basic science but will also help to inform decision-makers such as emergency managers on how to prepare for future disasters.

Methods & Codes

Used an event-based implementation of the PGW methodology. Modified atmospheric states drawn from GCM (global climate model) output were applied to constrain WRF (Weather Research and Forecasting) model simulations at high resolution. Supplemented these PGW simulations with idealized simulations using CM1 (Cloud–Model 1).

Both WRF and CM1 are community codes.

Results & Impact

PGW simulations exhibited more intense TCs (tropical cyclones). The TCs under PGW also produced significantly more accumulated rainfall. These and other experiments lend support to the hypothesis that an increase in sea surface temperature due to human-induced climate change will intensify landfalling TC , which in turn will result in more numerous tornadoes.

Why Blue Waters

This research requires very large geospatial domains that have fine grid point spacings and long-time integrations with high rates of model output. Moreover, quantifications of uncertainty require that such realizations be repeated over multiple experiments. The Blue Waters allocation is providing us with the resources needed to achieve this unprecedented level of climate simulation.