Geophysical Research Abstracts
Vol. 14, EGU2012-11855, 2012
EGU General Assembly 2012

The Effect of Atmosphere-Ocean-Wave Interactions and Model Resolution on Hurricane Katrina in a Coupled Regional Climate Model

C.M. Patricola (1), P. Chang (2,1), R. Saravanan (1), and R. Montuoro (3)

(1) Department of Atmospheric Sciences, Texas A&M University, College Station, TX, USA (christina.patricola@gmail.com), (2) Department of Oceanography, Texas A&M University, College Station, TX, USA (ping@tamu.edu), (3) Supercomputing Facility, Texas A&M University, College Station, TX, USA (rmontuoro@tamu.edu)

The sensitivity of simulated strength, track, and structure of Hurricane Katrina to atmospheric model resolution, cumulus parameterization, and initialization time, as well as mesoscale ocean-atmosphere interactions with and without small-scale ocean-wave effect, are investigated with a fully coupled regional climate model. The atmosphere, ocean, and wave components are represented by the Weather Research and Forecasting Model (WRF), Regional Ocean Modeling System (ROMS), and Simulating WAves Nearshore (SWAN) model. Uncoupled atmosphere-only simulations with horizontal resolutions of 1, 3, 9, and 27 km show that while the simulated cyclone track is highly sensitive to initialization time, its dependence on model resolution is relatively weak. Using NCEP/CFSR reanalysis as initial and boundary conditions, WRF, even at low resolution, is able to track Katrina accurately for 3 days before it made landfall on August 29, 2005. Katrina's strength, however, is much more difficult to reproduce and exhibits a strong dependence on model resolution. At its lowest resolution (27 km), WRF is only capable of simulating a maximum strength of Category 2 storm. Even at 1 km resolution, the simulated Katrina only reaches Category 4 storm intensity. Further WRF experiments with and without cumulus parameterization reveal minor changes in strength. None of the WRF-only simulations capture the observed rapid intensification of Katrina to Category 5 when it passed over a warm Loop-Current eddy (LCE) in the Gulf of Mexico, suggesting that mesoscale ocean-atmosphere interactions involving LCEs may play a crucial role in Katrina's rapid intensification. Coupled atmosphere-ocean simulations are designed and carried out to investigate hurricane Katrina-LCE interactions with and without considering small-scale ocean wave processes in order to fully understand the dynamical ocean-atmosphere processes in the observed rapid cyclone intensification.