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Center for Space and Earth Science

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The Impacts of Numerical Schemes on Asymmetric Hurricane Intensification

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1:00 PM - 2:00 PM

Research Park, 203A Conference Room
(TA-03, Bldg. 4200)

Abstract: The fundamental pathways for tropical cyclone (TC) intensification are explored by considering axisymmetric and asymmetric impulsive thermal perturbations to balanced, TC-like vortices using the dynamic cores of three different nonlinear numerical models. Attempts at reproducing the results of previous work, which used the atmospheric science community model WRF (Nolan and Grasso 2003; NG03), revealed a discrepancy with the impacts of purely asymmetric thermal forcing. The current study finds that thermal asymmetries can have an important, largely positive role on the vortex intensification whereas NG03 and other studies find that asymmetric impacts are negligible.

Analysis of the spectral energetics of each numerical model indicates that the vortex response to asymmetric thermal perturbations is significantly damped in WRF relative to the other models. Spectral kinetic energy budgets show that this anomalous damping is primarily due to the increased removal of kinetic energy from the vertical divergence of the vertical pressure flux, which is related to the flux of inertia-gravity wave energy. The increased kinetic energy in the other two models is shown to originate around the scales of the heating and propagate upscale with time from nonlinear effects.

The results of this research indicate that the numerical treatment of small-scale processes that project strongly onto inertia-gravity wave energy can lead to significant differences in asymmetric TC intensification. Sensitivity tests with different time integration schemes suggest that diffusion entering into the implicit solution procedure is partly responsible for the anomalous damping of energy.

Bio: Steve Guimond received his B.S. in atmospheric science from Iowa State University in 2004 and his Ph.D. in atmospheric science from Florida State University in 2010. As a graduate student, he worked extended summers at LANL on numerical modeling activities as part of an LDRD project in EES-2 (atmospheric dynamics). After graduation (2010 – 2012), he was a NASA Postdoctoral Fellow at NASA Goddard Space Flight Center (GSFC) working on airborne radar and hurricane dynamics. He is currently an assistant research scientist at the University of Maryland and works as a contractor at NASA GSFC. Steve's research interests are broad and include geophysical fluid dynamics and turbulence, algorithm and model development, remote sensing and data analysis.

For more information contact the technical host, Jon Reisner, XCP-4, 665-1889

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*Hosted by Reiner Friedel * Center for Space and Earth Science*