FSU Meteorology Seminar Series, Fall 2019

Prof. Allison Wing
Earth, Ocean, and Atmos. Sci.
Florida State University

The role of radiative-convective feedbacks in tropical cyclone formation in numerical simulations

Abstract

Interactions between convection, moisture, clouds, and radiation can cause tropical convection to "self-aggregate" in idealized numerical simulations. Here, we explore the role of these processes in tropical cyclone formation. First, we perform a hierarchy of idealized numerical simulations of tropical cyclogenesis - (1) a set of simulations in rotating radiative-convective in which a circulation is allowed to form spontaneously; and (2) a set of simulations initialized from a moist bubble. Sensitivity tests reveal that radiative feedbacks are significantly accelerate cyclogenesis in both cases but are not strictly necessary for it to occur.

We then explore tropical cyclogenesis and intensification processes in realistic historical simulations of tropical cyclones with five high-resolution global climate models. We track the formation and evolution of tropical cyclones in the climate model simulations and apply a moist static energy budget analysis both along the individual tracks and composited over many tropical cyclones. We find that the genesis processes, in terms of the contributions to the moist static energy variance budget, are qualitatively similar across all models and to the cloud-resolving model simulations. Radiative feedbacks contribute to TC development in all models, especially in storms of weaker intensity or earlier stages of development, while the surface flux feedback is stronger in models that simulate more intense TCs. These results imply that the representation of the interaction between spatially varying surface fluxes and the developing TC is responsible for at least part of the intermodel spread in TC simulation by climate models

Time: Thursday, Nov. 14 @ 3:30 PM
Location: LOV 353