3.1 Model physics influences on tropical cyclone size

Fovell, Robert, and Yizhe Peggy Bu, *University of California, Los Angeles*

The size or width of a tropical cyclone (TC) is an important characteristic requiring improvement in current forecast models. Using a semi-idealized version of the operational Hurricane WRF (HWRF) model, we show that model physical parameterizations can dramatically influence TC size as measured by metrics such as the 34-kt near-surface wind radius. In particular, enabling cloud-radiative forcing (CRF) and enhancing planetary boundary layer (PBL) vertical mixing can both lead to wider storms, but for different reasons. More precisely, the direct mechanism is different but the indirect mechanism is same.

In the case of CRF, hydrometers interact with radiation to force gentle ascent, elevating the relative humidity through a deep layer mainly above the PBL, whereas enhanced PBL mixing transports more moisture from the sea surface to the top of the boundary layer. Both of these moistening processes lead to larger storms via encouraging more convective activity in the TC's outer region, the heating from which broadens the wind field. These two processes can cooperate or compete, making these influences difficult to deconvolve and complicating the implementation and evaluation of model physics improvements. In the case of the HWRF model, we demonstrate that inadequacies in the representation of CRF was largely masked via apparently excessive vertical mixing in the PBL scheme.