High-resolution Numerical Simulations of Tropical Convection for the NASA INCUS Mission: Preliminary Analysis

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The strength and severity of convective storms depends on the strength of vertical motions and associated convective mass flux (CMF) of condensate-laden air in updrafts. The upcoming NASA INvestigation of Convective UpdraftS (INCUS) Mission will provide the first global, systematic observations of CMF and its evolution in tropical convection. One component of INCUS is the production of an extensive high-resolution (LES scale) database of simulated tropical convective systems using the Weather Research and Forecasting Model (WRF) and the Regional Atmospheric Modeling System (RAMS). Each case study is simulated three times: once with RAMS (RAMS 2-moment, bin-emulating microphysics) and twice with WRF (Morrison and Thompson microphysics). All simulations utilize 3 nested grids, with the outermost grids having 1.6 km grid spacing and typically spanning well over 1,000 km in length and width. The innermost grids also have large domain areas (~200 km by ~200 km), with 100 m horizontal grid spacing, ~100 m vertical grid spacing, and 30 second output. Using this high-frequency output, the *tobac* cloud tracking program is run offline to track 3D storm updrafts and link them to anvils and their environment. Case studies have been selected in 25+ regions across the tropics, many from field projects with extensive observations. Overall, the INCUS simulation database is an expanding collection of simulations of diverse storm morphologies spanning a variety of maritime and continental tropical environments and includes scattered congestus, multi-cell convective clouds, squall lines, and tropical cyclones. The goals of this talk are to: (1) give a brief overview of the INCUS LES database and its role in the INCUS mission, (2) present differences between WRF and RAMS vis-à-vis their kinetic energy power spectra, representation of updrafts, CMF, and anvil characteristics, and (3) provide a first look at scientific results from the INCUS storm database pertaining to the environments and properties of tropical convention.