Statistics of Clusters of Tropical Convection as Simulated by a Global Cloud-Resolving Model

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Representation of moist convection on global scale remains challenging for global climate models (GCMs), which typically resolve scales much larger than individual clouds or even cloud clusters. With rapid progress in the supercomputer technology, several global cloud-resolving models have emerged over the past decade or so, with the premise to advance our understanding of the role of moist convection in regulating the Earth’ s climate system. A global version of a widely used cloud-resolving model (CRM), the System for Atmospheric Modeling (SAM), has recently been developed. The time and cost of development have been minimized by preserving most features and numerics of the SAM's existing anelastic non-hydrostatic dynamical core while generalizing it from rectangular to latitude-longitude grid. The main software challenge has been the development of efficient and highly scalable hybrid FFT-multigrid solver for elliptic equation for pressure. The model uses a single-moment bulk microphysics, comprehensive radiation transfer module, the Simplified Land Model (SLM) with 16 IGBP land types, single layer of vegetation, multilayered interactive soil, and a block representation of topography in the height coordinates. The preliminary results of multi-month global cloud-resolving simulations with a 4 km horizontal grid spacing at the equator will be presented. In particular, the statistics of convective clusters in the simulated Tropics and the diurnal cycle of precipitation over land and ocean will be discussed.

Keywords: global cloud-resolving model, convection, large-scale organization of clouds

