Geophysical Research Abstracts
Vol. 17, EGU2015-7845, 2015
EGU General Assembly 2015

Convectively Aggregated Structures Across a Hierarchy of Models

Levi Silvers, Anurag Dipankar, and Cathy Hohenegger
The Max Planck Institute for Meteorology, Hamburg, Germany (levi.silvers@mpimet.mpg.de)

Convective clouds are among the most interesting and poorest understood atmospheric phenomena. This study explores the interaction between deep convection and the lower troposphere with a focus on the coupling of deep convection to the lower tropospheric clouds, water vapor, and relative humidity. We are particularly interested in the controlling factors of the cloud amount and cloud size at cloud base across various model set-ups. In particular we seek to determine how the generation of large convective structures depends on the characteristics of the lower troposphere and parameterization choices. Our experiments are analyzed by comparing the mean state, the probability distribution functions of particular quantities, and snapshots in time of the spatial distribution of cloud related fields. It is shown that the formation of aggregated convective structures depends on the different model setups.

Experiments performed using an NWP model (ICON-NWP) and two cloud-resolving models (ICON-LES and UCLA-LES) are compared. The ICOsahedral Nonhydrostatic (ICON) model is used to provide a unified modeling framework in which both the NWP and CRM versions use the same dynamical core but different physics packages. This allows for a fair comparison between the GCM and CRM and leads to a better understanding of both. To check the robustness of the CRM results we also compare the ICON experiments with the UCLA-LES model. The initial analysis looks at the ICON-NWP and both CRM experiments with a uniform domain size of (1800 km)̂2 and doubly periodic boundary conditions to determine some of the fundamental differences between the models. The NWP experiment has an effective resolution of 13.5 km while the CRM's have resolutions in the range of 5 km. We run the NWP experiments with the full suit of physics parameterizations as well as with the convection turned off. Further sensitivity studies are then made to isolate some of the key characteristics of the convection in each model. We find that a thorough understanding of the robust behavior shown by CRMs is needed to better inform the interpretation of global and climate model experiments.