Geophysical Research Abstracts
Vol. 18, EGU2016-10869-3, 2016
EGU General Assembly 2016

Large eddy simulation for evaluating scale-aware subgrid cloud parameterizations

Wei Huang (1,2), Baode Chen (1,2), and Jian-Wen Bao (3)

(1) Shanghai Innovation Center of Regional High Resolution NWP, China, (2) Shanghai Typhoon Institute, CMA, China, (3) NOAA/ESRL/PSD, Boulder, United States (jian-wen.bao@noaa.gov)

We present results from an ongoing project that uses a Large-Eddy Simulation (LES) model to simulate deep organized convection in the extratropics for the purpose of evaluating scale-aware subgrid convective parameterizations. The simulation is carried out for a classical idealized supercell thunderstorm (Weisman and Klemp, 1982), using a total of 1201 $\times$ 1201 $\times$ 200 grid points at 100 m spacing in both the horizontal and vertical directions. The characteristics of simulated clouds exhibit a multi-mode vertical distribution ranging from deep to shallow clouds, which is similar to that observed in the real world. To use the LES dataset for evaluating scale-aware subgrid cloud parameterizations, the same case is also run with progressively larger grid sizes of 200 m, 400 m, 600 m, 1 km and 3 km. These simulations show a reasonable agreement with the benchmark LES in statistics such as convective available potential energy, convective inhibition, cloud fraction and precipitation rates. They provide useful information about the effect of horizontal grid resolution on the subgrid convective parameterizations. All these simulations reveal a similar multi-mode cloud distribution in the vertical direction. However, there are differences in the updraft-core cloud statistics, and convergence of statistical properties is found only between the LES benchmark and the simulation with grid size smaller than 400 m. Analysis of the LES results indicates that (1) the average subgrid mass flux increases as the horizontal grid size increases; (2) the vertical scale of subgrid transport varies spatially, suggesting a system dependence; and (3) at even 1 km, sub-grid convective transport is still large enough to be accounted for through parameterization.