Geophysical Research Abstracts
Vol. 18, EGU2016-10895-4, 2016
EGU General Assembly 2016

The impact of non-local buoyancy flux on the convective boundary layer development as simulated by a 3-D TKE-based subgrid mixing scheme in a mesoscale model

Xu Zhang (1), Jian-Wen Bao (2), and Baode Chen (1)
(1) Shanghai Typhoon Institute, CMA, (2) NOAA/ESRL/PSD, Boulder, United States (jian-wen.bao@noaa.gov)

This presentation highlights a study in which a series of dry convective boundary layer (CBL) simulations are carried out using a generalized 3-dimensional (3-D) TKE-based parameterization scheme of sub-grid turbulent mixing in the Weather Research and Forecasting (WRF) model. The simulated characteristics of dry CBL are analyzed for the purpose of evaluating this scheme in comparison with a commonly-used scheme for sub-grid turbulent mixing in NWP models (i.e. the Mellor-Yamada 1.5-order TKE scheme). The same surface layer scheme is used in all the simulations so that only the sensitivity of the WRF model to different parameterizations of the sub-grid turbulent mixing above the surface layer is examined. The effect of horizontal grid resolution on the simulated CBL is also examined by running the model with grid sizes of 200, 400 m, 600 m, 1 km and 3 km. We will first compare the characteristics of the simulated CBL using the two schemes with the WRF LES dataset. We will then illustrate the importance of including the non-local component in the vertical buoyancy specification in the 3-D TKE-based scheme. Finally, comparing the results from the simulations against coarse-grained WRF LES dataset, we will show the feasibility and advantage of replacing conventional planetary boundary layer parameterization schemes with a scale-aware 3-D TKE-based scheme in the WRF model.