Geophysical Research Abstracts
Vol. 19, EGU2017-8540-1, 2017
EGU General Assembly 2017

Properties of shallow convection from Large-Eddie simulations

Leif Denby (1) and Michael Herzog (2)

(1) Institute for Climate and Atmospheric Science, University of Leeds, United Kingdom (l.c.denby@leeds.ac.uk), (2) Department of Geography, University of Cambridge, United Kingdom

Utilizing Large-Eddie simulations (LES) of isolated individual convective clouds in an idealised conditionally unstable atmosphere and large-domain LES simulations of radiative-convective equilibrium (RCE) from the RICO measuring campaign (Rauber et al. 2007), vertical profiles of individual clouds and statistical properties of the cloud ensemble have been extracted and compared against predictions by an 1D entraining parcel model and against the cloud-ensemble model of the CCFM (Wagner and Graf 2010) convection scheme (which comprises a solution of a Lotka-Volterra population dynamics system). For the simulations of isolated clouds it was possible to achieve agreement with the entraining parcel model when simulations were carried out with 2D axisymmetry and the entrainment rate was prescribed using an entraining profile estimated from LES simulation using a passive tracer (in place of the traditional Morton- Turner entrainment rate parameterisation), this agreement was not achieved when comparing against 3D simulations. Integrating the entraining parcel model using the horizontal mean environment profile of the RCE simulation (and so the vertical profile as would be predicted by a climate model) it was not possible to achieve the variation in cloud-top height seen in the RCE simulation, even when greatly increasing the entrainment rate. However, if the near-environment of a convective cloud was used as the environmental profile the variation in cloud-top height was achieved (by varying the cloud-base state variables within values extracted from RCE simulation). This indicates that the near-cloud environment is significantly different that the horizontal mean environment and must be taken into account if the effect of entrainment is to be correctly captured in parameterisations for convection. Finally, size-distribution of convective clouds extracted from RCE simulation showed qualitative agreement with predictions of CCFM's spectrum model.