Evaluation of vertical mass flux in high-resolution simulations of convective clouds

Katrin Scheufele, George C. Craig, Andreas Doernbrack

In this study an ensemble of cumulus clouds is simulated over a sea surface at fixed temperature. Convection is forced by applying a horizontally homogeneous radiative cooling rate and surface fluxes of sensible and latent heat are parameterized. The model is run for several days into a state of radiative-convective equilibrium. Within this state the vertical mass flux per cloud is evaluated over a couple of hours. The control simulation with a horizontal resolution of 2km shows that the distribution of vertical mass flux per cloud is exponential as expected from previous studies. As expected, at these resolutions changing the strength of the radiative cooling increases the amount of clouds in the domain, but does not result in significantly stronger or larger clouds. However, we are not sure if this behaviour persists when increasing the horizontal resolution to an order of a 100m or below. This will be evaluated in simulations with different cooling rates while stepwise increasing the horizontal resolution. Additionally, entrainment and detrainment rates will be measured in the high-resolution simulations to determine entrainment/detrainment per cloud.