Geophysical Research Abstracts
Vol. 20, EGU2018-10336, 2018
EGU General Assembly 2018

Role of entrainment on the clustering of cumulus convection

Adrian Tompkins (1) and Addisu Semie (2)

(1) ICTP, Earth System Physics, Trieste, Italy (tompkins@ictp.it), (2) Laboratoire de météorologie dynamique (LMD), Paris, France (asemie@lmd.jussieu.fr)

It has been suggested by other authors that convective clustering and its possible sensitivity to SST could represent an important missing feedback in present generation climate models. Here, a set of radiative-convective equilibrium simulations with a 2km "convection-permitting" resolution show that the occurrence of convective clustering is critically dependent on the turbulence mixing scheme used. This is linked to the entrainment of humidity into the updraft cores, which, using 2 km resolutions, is completely parameterized by the turbulence scheme. The turbulent entrainment of water vapour that is key and there is a large uncertainty between turbulence schemes that can differ in mixing strength by over an order of magnitude. Previous studies into the resolution sensitivity of organization may be interpreted in light of these results, since the resolution impacts the parameterized entrainment rate. It is shown that the diabatic forcings of surface fluxes and radiation act to cluster convection even in simulations where convection remain random, and are offset by a dynamical moist static energy transport from the convecting to subsidence regions. With higher entrainment rates this mechanism is shut down and convection clusters. A tipping point for the onset of clustering is identified in the CRM model integrations. Finally, a simple two column conceptual model is presented to show entrainment can lead to highly nonlinear clustering behaviour across SSTs and it is suggested that the high uncertainty in entrainment representations is the key cause for non-robustness across convection-permitting models.