Geophysical Research Abstracts
Vol. 12, EGU2010-6988, 2010
EGU General Assembly 2010

The deepening of cumulus convection by moisture preconditioning

Michael Waite (1) and Boualem Khouider (2)
(1) University of Waterloo, Canada (mwaite@uwaterloo.ca), (2) University of Victoria, Canada

Cloud-resolving numerical experiments will be presented that explore the connection between environmental moisture and deepening cumulus convection. There is a two-way relationship between background humidity and cloud deepening: clouds can moisten their environment by detrainment, while enhanced moisture may reduce dry-air entrainment and lead to deeper clouds. In this work, we investigate and quantify these processes in idealized numerical simulations of deepening cumulus clouds. The initial state is chosen to be favourable for shallow convection, which is excited through surface fluxes and radiative cooling. However, in the absence of large-scale subsidence, these shallow clouds grow into congestus and ultimately deep convection. Moistening in the lower troposphere is shown to result from the detrainment of water from congestus clouds, and we argue that this moistening largely accounts for the transition to deep convection. A number of sensitivity tests will be presented that analyze the dependence of cloud depth on the background profile and sub-grid scale mixing of water vapour. The implications of these findings for large-scale simulations in which resolved mixing is reduced will also be discussed.