Geophysical Research Abstracts
Vol. 16, EGU2014-5035, 2014
EGU General Assembly 2014

Modifications of the atmospheric moisture field as a result of cold-pool dynamics

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This study investigates how precipitation-driven cold pools aid the formation of wider clouds that are essential for a transition from shallow to deep convection. In connection with a temperature depression and a depletion of moisture inside developing cold pools an accumulation of moisture in moist patches around the cold pools is observed. Convective clouds are formed on top of these moist patches. Larger moist patches form with time supporting more and larger clouds. Moreover, enhanced vertical lifting along the leading edges of the gravity current connected to the cold pools is found. The interplay of moisture aggregation and lifting eventually promotes the formation of wider clouds that are less affected by entrainment and become deeper.

The modifications of the moisture field are investigated in more detail using Lagrangian particles. The individual sources of the moisture in the wet-patch area are thereby isolated. The moisture sources consist of a direct evaporation of rainfall, a dynamical modulation of the primary moisture field by the cold-pool wake and a modification of the surface moisture fluxes by the cold-pool. The individual contributions are quantified over the course of the diurnal cycle.