

The Transition from Shallow to Deep Convection over Land: A Diurnal-cycle Analysis of ARM SGP Observations

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Zhang Y. and S. A. Klein, 2010: Mechanisms affecting the transition from shallow to deep convection over land: Inferences from observations of the diurnal cycle collected at the ARM Southern Great Plains site. *J. Atmos. Sci.*, **67**, 2943–2959.

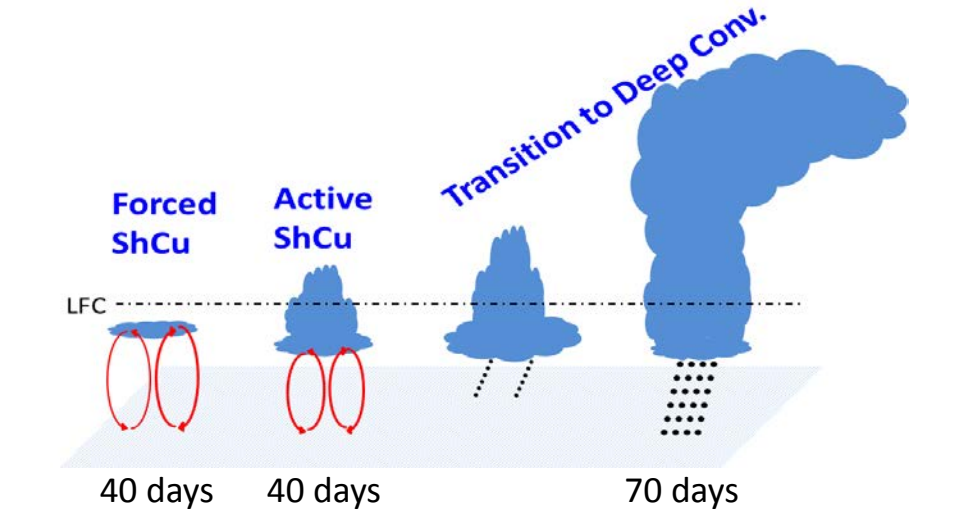
Zhang, Y. and S. A. Klein, 2012: Factors controlling the vertical extent of fair-weather shallow cumulus clouds over land: Investigation of diurnal-cycle observations collected at the ARM Southern Great Plains site. *J. Atmos. Sci.*, submitted.

What determines whether daytime shallow convection remains shallow or transitions to late-afternoon deep convection?

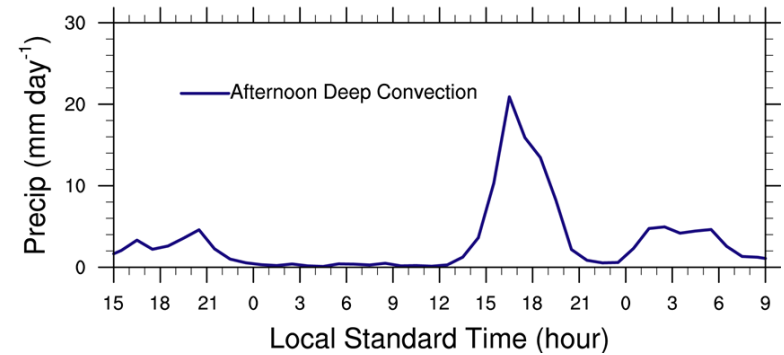


- Main Result: Humidity slightly above the PBL appears to be most important factor controlling whether or not the transition takes place; other factors (CAPE, CIN, boundary layer heterogeneity, surface fluxes) not as important
- Differences with transition over ocean: (a) shorter time-scale, (b) no congestus phase, (c) moisture above PBL from large-scale advection, not moistening by shallow convection
- Plans: We are now constructing “composite forcing” SCM/CRM cases for the days that shallow convection transition – We are looking for collaborators!
- Process-level observations: Great potential for vertically-pointing and 3-D cloud / precipitation radars to observe cloud sizes, orientation, vertical velocities, downdrafts/cold pools

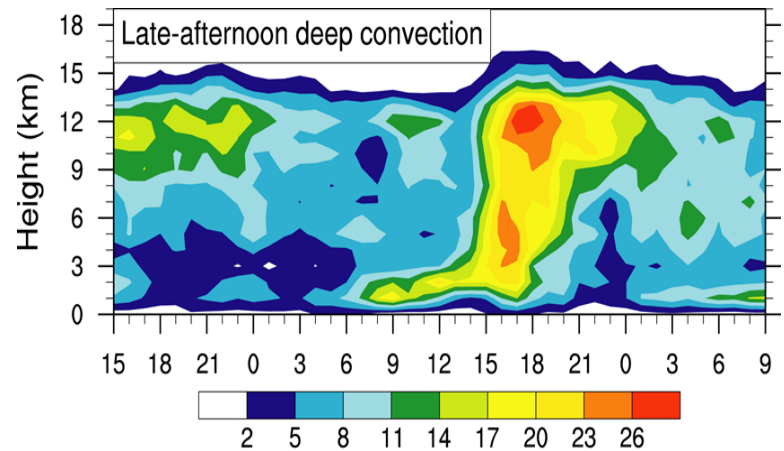
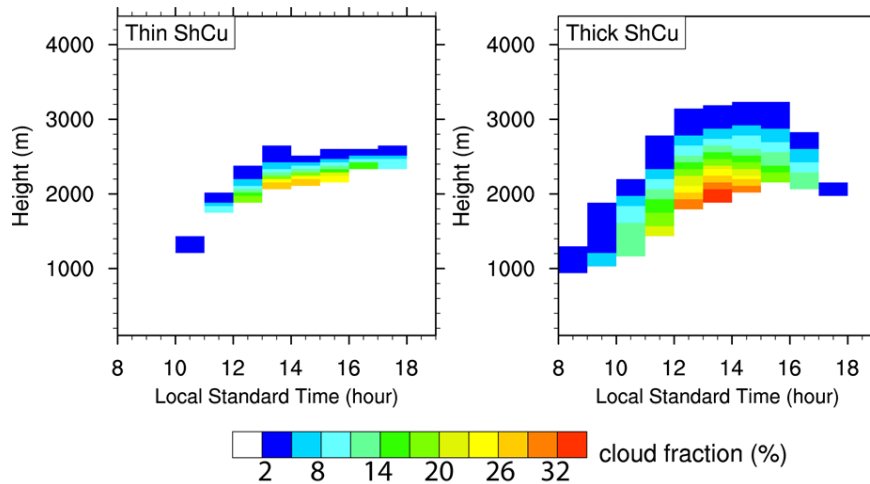
Days with locally-generated convection coupled to the surface & PBL



PRECIPITATION



CLOUD



We determine which environmental parameters control the regime by

- Contrasting parameters between days with different regimes
- Examining co-variability of parameters with precipitation characteristics on days with late-afternoon deep convection

Humidity plays a dominant role

- Higher moisture in the layer 2 – 4 km above ground is present on days with late-afternoon deep convection
- Extra moisture in this layer comes from deeper southerly flow, not moistening by local convection
- Higher moisture in this layer promotes an earlier onset time to deep convection

