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Some observational evidence for dry soils supporting cumulus onset

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The relative humidity tendency at the top of a clear convective boundary layer (RHtop) as indicator of cloud formation is studied over a semi-arid region within a conceptual framework introduced by Ek and Holtslag (2004). Their framework is based on a mixed layer model, coupled to the land surface via the surface energy budget. In a regime of relatively high soil moisture, the tendency of RHtop increases if the evaporative fraction at the land surface increases which supports boundary-layer moistening but only when boundary-layer growth is limited by atmospheric factors, such as dry air entrainment, boundary-layer growth and boundary-layer heating. This regime was confirmed earlier by Cabauw observations. Here we provide the first observational evidence that the tendency of RHtop can also increase as the surface becomes more dry, as consistent with a second regime of the conceptual framework. The observations used are from the AMMA intensive observational campaign near Niamey, Niger, June 20-25, 2006. In addition, we evaluate whether the WRF single-column model confirms the different regimes of the conceptual framework for a typical day in the AMMA campaign and it appears that the model confirms that dryer soils can support cloud formation.