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- towards climate change services

The evolution of turbulence during the transition from shallow to deep convection over land as estimated by LES

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This work analyzes a set of LES simulations of the transition from shallow to deep convection over land, as described in one of the GCSS-WG4 case-studies, namely the TRMM-LBA case. We performed a set of simulations using the MesoNH numerical model. These are used to study the dependency of the results to model resolution and to the evaporation of the precipitation. We analyze the evolution of the mean properties and turbulent quantities throughout the process, and we found significant differences not only in different stages of the process but also between experiments. Namely, the suppression of the evaporation of precipitation inhibits the formation of cold pools and formation secondary convection, an effect that is clearly visible in the dominant length scale analysis. We also computed a conditional sampling of properties to isolate the structures that are responsible for the major part of the convective transport. Cloudy and clear updrafts are responsible for the upward turbulent transport within the cloudy layer in almost equal parts, especially in the deep convection stage, and they are compensated by dry downdrafts. In this layer relatively strong downdrafts are found in the vicinity of each cloud, caused by the presence of negatively buoyant air detrained from the neighbor cloud. These coherent structures are also very important in the vertical redistribution of properties, as suggested in some recent studies of shallow cloudy boundary layers. The information provided here might be useful to design a parameterization that is capable of representing the diurnal cycle of convection over land, which is still not well represented in the majority of global atmospheric models.