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Simulations of the diurnal cycle of convection and its shallow-to-deep transition over eastern Mexico

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General circulation models (GCMs) often misrepresent the diurnal cycle of convection over land, exhibiting a peak in rainfall that occurs earlier than in reality. This issue has implications for the estimation of the surface water balance and for the representation of cloud radiative effects; it is therefore important to provide insight into this aspect. In the present study, the Weather Research and Forecasting (WRF) model at a cloud-resolving resolution (400 m), is used to characterize the diurnal cycle of convection over land, and its shallow to deep transition over eastern Mexico, specifically on the Yucatan peninsula which is rather flat and with small variability in terms of land cover. While rainfall in the tropics may be synoptically controlled, driven by large-scale dynamics or by orography, in this study the simulations focus on a particular case where no synoptic forcing was influencing the area, in order to isolate the process and explore the mechanisms that control the transition from shallow to deep convection. In this simpler case, shallow convection initiates in the morning over the eastern region of the Yucatan peninsula and as the day progresses, there is further deepening of the cumulus clouds (oriented in a north-south direction), along with a westward shift of the cloud system during late afternoon. Simulations are performed with a few combinations of turbulence and microphysical parameterizations relevant for shallow convection development over land. Results are compared with measurements from a GPS network (Suominet), which includes variables such as surface pressure, temperature, relative humidity and precipitable water. Preliminary results show the relevance of thermodynamic factors, such as the stability, in the transition from shallow to deep convection