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Memory Properties in CloudResolving Simulations of the Diurnal Cycle of Deep Convection.

Chimene Laure Daleu
University of Reading, University of Reading, Meteorology, United Kingdom of Great Britain – Northern Ireland (c.daleu@reading.ac.uk)

A series of highresolution threedimensional simulations of the diurnal cycle of deep convection over land are performed using the new Met Office NERC cloudresolving model. This study features scattered convection. A memory function is defined to identify the effects of previous convection in modifying current convection. It is based on the probability of finding rain at time t_0 and at an earlier time $t_0 - \Delta t$ compared to the expected probability given no memory. The memory is examined as a function of the lag time Δt. It is strongest at grayzone scales of 4–10 km, there is a change of behavior for spatial scales between 10 and 15 km, and it is reduced substantially for spatial scales larger than 25 km. At grayzone scales, there is a first phase of the memory function which represents the persistence of convection and it is maintained for about an hour. There is a second phase which represents the suppression of convection in regions which were raining 1 to 3 hr previously, and subsequently a third phase which represents a secondary enhancement of precipitation. The second and third phases of the memory function develop earlier for weaker forcing. When thermodynamic fluctuations resulting from the previous day are allowed to influence the development of convection on the next day, there are fewer rainfall events with relatively large sizes, which are more intense, and thus decay and recover more slowly, in comparison to the simulations where feedback from previous days is removed. Further sensitivity experiments reveal that convective memory attributed to these thermodynamic fluctuations resides in the lower troposphere.