MMM SEMINAR SERIES

Tropical deep convection, lessons from convection-permitting and large-eddy simulations

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Convection-permitting simulations (CPSs) and large-eddy simulations (LESs) have been long used for process-oriented case studies because of their ability in resolving the details of complex atmospheric circulation. This allows one to focus on convective objects, i.e. mesoscale convective systems (MCSs), convective updrafts and overshoots. Such gain in resolving fine-scale processes was also found when running convection-permitting models over longer time periods. The added value of such simulations was demonstrated using usual metrics such as the diurnal cycle of precipitation or the occurrence of extreme events, for example. This opens up new possibilities in exploring convective objects over a much larger sampling. Examples will be given from current on-going studies over the Tropics. In a Giga-LES (more than 1 billion grid points with 100 m spacing) of the Australian thunderstorm Hector the convector, the 10-km wide updrafts that overshoot into the stratosphere are characterized by a weak dilution. The km-scale eddies at the top of the overshoots produce the irreversible mixing with the stratospheric air and finally the hydration. In a CPS over northern Africa, the tracking of the MCSs shows a remarkable realism of terms of precipitation and deep convective activity when considering the radiative effect of dust. Too numerous MCSs are however predicted with a lack of organization for the longest-lived MCSs. Challenges in the CPM and LES approaches will be discussed.

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