

From Sugar to Flowers: A Transition of Shallow Cumulus Organization During ATOMIC

Friday, 7 May 2021 16:00 (1h 45m)

The Atlantic Tradewind Ocean-Atmosphere Mesoscale Interaction Campaign (ATOMIC) took place in January–February 2020. It was designed to understand the relationship between shallow convection and the large-scale environment in the trade-wind regime. Lagrangian large eddy simulations, following the trajectory of a boundary-layer airmass, can reproduce a transition of trade cumulus organization from “sugar” to “flower” clouds with cold pools, observed on February 2–3. The simulations were driven with reanalysis large-scale meteorology and ATOMIC in-situ aerosol data. During the transition, large-scale upward motion deepens the cloud layer. The total water path and optical depth increase, especially in the moist regions where flowers aggregate. Mesoscale circulation leads to a net convergence of total water in the already moist and cloudy regions, strengthening the organization. Stronger large-scale upward motion reinforces the mesoscale circulation and accelerates the organization process by strengthening the cloud-layer mesoscale buoyant turbulence kinetic energy production.

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Session Classification: Organisation in Shallow Convection

Track Classification: Organisation in Shallow Convection