Contribution ID: **63** Type: **Poster**

Momentum transport and the organization of shallow convection

Monday, 16 May 2022 12:20 (2 minutes)

Simulations of a marine cold air outbreak with the mesoscale weather model HARMONIE suggest that parameterized shallow convective momentum transport acts to diminish circulations that accompany cellular cloud structures. In this study we test this hypothesis in the trade-wind region where various type of shallow cumulus cloud patterns occur using a hierarchy of model simulations of the EUREC4A campaign.
We select a ten-day period within EUREC4A and run the Dutch Atmospheric Large-Eddy Simulation (DALES) on a 150 km x 150 km domain with a resolution of 100 m. Its boundaries are forced hourly with dynamical tendencies from the mesoscale weather model HARMONIE. HARMONIE is also run on a 3200 km x 2000 km domain with 2.5 km resolution, in runs with shallow convective momentum transport on and off.
First, we validate the model output with observations. Observations from EUREC4A suggest that in early February, deeper cumulus mediocris and larger cloud structures are associated with a different profile of eddy momentum flux divergence than days with shallower cumulus humilis. Second, we analyze the profiles of eddy momentum flux associated with turbulence, convection, and mesoscale flows. We show the momentum budget associated with different patterns of cloud organization and, lastly, we evaluate whether momentum transport has a significant influence on shallow cloud organization.

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Session Classification: Poster pitches