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Mesoscale organisation transition during the 2nd Feb EUREC4A case study simulated by a high-resolution weather model

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Tropical shallow convection exhibits strong variations in mesoscale organisation. Bretherton and Blossey (2017) used an LES to show how this convective organisation can be produced due to an advective feedback with mesoscale vertical motion and adjustment to a weak temperature gradient. Narenpitak et al. (2021) used an LES with forcings following a boundary-layer trajectory to simulate a case study from the EUREC4A field campaign where the clouds transition from disorganised small cumulus (sugar) to deeper more organised clouds with large detrainment layers (flowers). The LES produced a transition in cloud organisation and the main driving process was shown to be the advective feedback in mesoscale vertical motion seen in Bretherton and Blossey (2017).For comparison, we have looked at the same case study using high-resolution nested simulations with the Met Office's weather model, the UM. The UM reproduces the transition from sugar to flowers. Consistent with Narenpitak et al. (2021), the UM shows that the transition is associated with an increase in organisation and the mesoscale advective feedback is an important driving process. However, unlike the LES, the UM simulations show that the sugar clouds are already associated with a large amount of organisation. Because the mesoscale organisation is already present in the UM, the advective dispersion of mesoscale aggregation is an important process opposing aggregation during the transition from sugar to flowers, unlike in the LES.