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Squall line sensitivity in LES simulations

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Upper tropospheric (UT) divergence is potentially an important mediator between convective scale error growth and advective/non-linear large scale error growth at jet stream scales (Baumgart et al. 2019). To investigate possible mechanistic links of error growth from small convective scales to the synoptic scales, but also to gain insight in convective processes and their (representation) uncertainty, we have compared UT divergence in an array of idealized LES-simulations of convective systems with different degree of organisation.

Using ensemble and physics perturbations, we have found that isolated convective systems roughly seem to obey the expected near-linear relationship between latent heating and mass divergence, but squall lines are found to be anomalous in this sense. At the same time, large intrinsic variability among squall lines with extremely similar initial conditions and unperturbed physics is explored in much detail. A link between the squall line anomaly and amount recirculated updraft air into the cold pool and its possible role in latent heat consumption is tested. Furthermore, the origin of squall line variability is investigated in depth.