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Defining a cold pool-resolving scale for numerical simulations of convective self-organisation

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In state-of-the art cloud-resolving models, convective self-aggregation (CSA) finds itself consistently hampered by finer horizontal resolutions [Muller & Held (2012), Yanase et al. (2020)]. This feature was ascribed to the effect of cold pool (CP) gust fronts in opposing the positive moisture feedback underlying CSA [Jeevanjee & Romps (2013)]. Further, recent numerical experiments [Haerter et al. (2020)] with diurnally oscillating surface temperature showed how CPs promote cloud field self-organization into mesoscale convective systems (MCS). That is, in stark contrast to CSA, strengthening CPs promotes this organization effect.

Hence, in both idealized and realistic insolation conditions, numerical simulations should go beyond the typical cloud-resolving paradigm to achieve cold pool-resolving capabilities in order to study the organisation of convection.

To this end, this numerical study examines the impact of model resolution on CP-driven circulation in order to identify a cold pool resolving lengthscale to serve as an element-size requirement for explicit simulations.

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