Contribution ID: **57** Type: **Talk**

Cold pool and mesh refinement: what is gained at higher resolutions?

Tuesday, 17 May 2022 11:15 (15 minutes)

It is well-recognized that triggering of convective cells through cold pools is key to the organization of convection, as reviewed in Zuidema et al. (2017). Yet, numerous studies have found that both the characterization and parameterization of these effects in numerical models is cumbersome - in part due to the lack of numerical convergence ($\Delta x \longrightarrow 0$) achieved in typical cloud-resolving simulators. Through a comprehensive numerical convergence study, we systematically approach the $\Delta x \longrightarrow 0$ limit in a set of idealized large-eddy simulations capturing key cold pool processes: propagation, merging and collision of gust fronts. We characterize at which Δx convergence is achieved for physically relevant quantities, namely accumulated upwards water mass fluxes, integrated vortical rates and gust front's group velocity.
We hope that the understanding gained from this analysis can help develop robust subgrid models for CP dynamics able to sustain their growth and combat artificial numerical dissipation and dispersion.

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Session Classification: Shallow convection