

A cold pool perturbation scheme to improve convective initiation in convection-permitting models

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Cold pools are essential for organizing and initiating convection. In a recent investigation, we identified several sensitivities of cold pool driven convective initiation to model resolution within hectometer simulations. In particular, a causal graph analysis has revealed that the dominant impact of model resolution on convective initiation is a direct consequence of weak vertical velocities at the gust fronts, rather than being related to changes in the buoyancy or other properties of the cold pools.

To address this deficiency, we develop a parameterization for convection-permitting models to improve the representation of cold pool gust fronts. We enhance vertical wind tendencies within these gust fronts towards a target vertical velocity based on similarity theory. This parameterization strengthens gust front circulations and thereby enhances cold pool driven convective initiation. Consequently, precipitation is amplified and becomes more organized in the afternoon and evening.