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How weakened cold pools open for convective self-aggregation

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In radiative-convective equilibrium (RCE) simulations, convective self-aggregation (CSA) is the spontaneous organization into segregated cloudy and cloud-free regions. Evidence exists for how CSA is stabilized, but how it arises favorably on large domains is not settled. Using large-eddy simulations (LES), we link the spatial organization emerging from the interaction of cold pools (CPs) to CSA. We systematically weaken simulated rain evaporation to reduce maximal CP radii, R_{max}, and find reducing R_{max} causes CSA to occur earlier. We further identify a typical rain cell generation time and a minimum radius, R_{min}, around a given rain cell, within which the formation of subsequent rain cells is suppressed. Incorporating R_{min} and R_{max}, we propose a toy model that captures how CSA arises earlier on large domains: when two CPs of radii $r_{i,j}$ □ [R_{min}, R_{max}] collide, they form a new convective event. These findings imply that CPs play a crucial role in RCE simulations by preventing the onset of CSA.