

# Hysteresis in self-organized mesoscale convective systems driven by diurnal temperature oscillations

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Self-aggregation of convective cloud activity has attracted a lot of attention due to its role in the emergence of large scale weather phenomena such as the formation of hurricanes. Simulations with uniform boundary conditions show self-aggregation occurring on the time-scale of a few weeks [1]. Recently, numerical experiments demonstrated that spatial clustering can form within a few days, in systems driven by diurnal temperature oscillations [2]. A conceptual model has been proposed, suggesting that such systems exhibit hysteresis in the sense that clustering emerging at high temperature oscillation amplitudes might persist if the amplitude is subsequently reduced to a lower level where clustering would not emerge.

Here we test the hysteresis-hypothesis explicitly by performing cloud-resolving simulations with a high-amplitude transient period followed by a period with a low diurnal temperature amplitude. The existence of hysteresis effects in the convective cloud clustering could have profound implications: clusters formed over land, where diurnal temperature variations are large, could persist over the ocean when transported there by large-scale wind advection. Once present, the clusters could even intensify over the ocean—with possible implications for cyclogenesis.

[1] CJ Muller and IM Held, *Journal of the Atmospheric Sciences*, 69(8):2551–2565, 2012.

[2] arXiv:2001.04740 [physics.ao-ph]

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