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Understanding the role of rain evaporation during tropical cyclogenesis

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Current studies about the role of rain evaporation in the development of deep clouds and storms, show that reduced rain evaporation leads to a significant aggregation of clouds in space. This aggregation process has been called "moisture-memory aggregation". Rain evaporation removal in the boundary layer seems to be the major contributor to triggering the spatial clustering of clouds.

The absence of cold pools, which are cold regions below clouds created by rain evaporation and known to hinder aggregation, has been suggested as the leading cause, but the precise physical mechanisms underlying this type of aggregation remains unclear. Our study aims to fill this gap. Cloud-resolving simulations in idealized, doubly-periodic geometry, are conducted, comparing results with and without rain evaporation in the boundary layer. We focus on the clustering of clouds into a large-scale tropical cyclone.

The goal is to assess the sensitivity of clouds to rain evaporation during the processes preceding the formation of the tropical cyclone. The role of cold pools in the upscale growth of cloud clusters, hypothesized in earlier studies, is also exploited by Proper Orthogonal Decomposition (POD) technique. Energy associated spectra of both the spatial and temporal components are studied separately on three different ranges of scales.

The impact on atmospheric circulations is also investigated by a thermodynamical characterization, through the distributions of temperature, water vapor content and relative humidity.