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Organisation of the trade-wind flower-clouds: driving processes and sensitivity

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The trade-wind cumuli are a great source of uncertainty for the future climate as their net radiative effect is hardly represented in the global models. The spatial organization of these clouds, that drives their radiative effect, has been categorized into 4 major patterns: Sugar, Flower, Gravel and Fish. The processes governing their spatial organization and the relationships with the large scale environment remain however unclear. This study investigates the processes that shape the clouds organized as Flowers and observed east of Barbados on 2 February 2020, during the EUREC4A-ATOMIC campaign. These investigations are performed thanks to a Large-Eddy Simulation using the Meso-NH model and a 100-m horizontal grid-spacing, and in synergy with high-resolution cloud observations. A particular attention is paid to the realism of the simulated clouds and clear sky patterns. We show that the processes shaping the flower-clouds are wide cold pools below the clouds. At the edge of the cold pool, intense convergence of humidity drives the development of updrafts, organized in arcs. These updrafts shape the flower-cloud top and supply the cloud layer with water. The role of radiation and of meso-scale heterogeneities in determining the flower-cloud characteristics are further investigated through sensitivity studies.

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