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On the relationship between precipitation and the spatial structure in trade wind convection

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When trade wind convection organises into spatial patterns, it is often in conjunction with precipitation formation, raising the question of the role of convective spatial organisation for precipitation and vice versa. We analyse measurements from the C-band radar Poldirad upstream of Barbados during the EUREC4A field campaign to investigate the spatial behaviour of precipitating shallow convection and its implications for precipitation characteristics in the trades. We find that precipitation rates vary mainly independently from the spatial arrangement of precipitating cells. Mean precipitation increases with the size or number of cells, as it is closely related to the precipitating area. The cells'degree of clustering, on the contrary, is typically greatest in scenes containing rather large and few cells. Consequently, scenes that vary in the spatial structure –containing large, clustered convective structures at one time or numerous and more distributed convective structures at another time –can have similar precipitation rates. Could spatial organization, therefore, be a process to maintain precipitation rates in very different environments? We exploit large-domain realistic large-eddy simulations to investigate scenes of trade wind convection that exhibit different spatial structures but similar precipitation rates. We discuss whether the scenes differ in their environment and circulation and how this might necessitate different spatial structures to rain.

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