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The impact of land-sea contrasts in the aggregation of convection

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The self-aggregation of convection in idealised models has been widely studied. Work has been done to identify key physical mechanisms responsible for both driving and maintaining aggregation in a range of idealised radiative-convective equilibrium (RCE) models. These idealised models are typically run without any land, rotation, variation in sea-surface temperatures (SSTs), or a diurnal cycle. Due to these idealisations, a key question in the study of convective aggregation is how these convective processes and mechanisms manifest in the real-world. Several studies have tried to tackle this question by increasing the complexity of processes in the idealised models, such as SST gradients, adding a slab ocean, adding a diurnal cycle, or adding an aerosol diabatic heating perturbation. Particularly, the inclusion of interactive ocean surfaces has been shown to strongly impact the formation of aggregated clusters.

The interactions between land surfaces and aggregation are currently less well understood. Early studies have found that convective aggregation may favour land areas over oceans, and that soil moisture feedbacks can act to oppose the aggregation altogether. Thus, in this study we investigate the relationship between land, oceans, and aggregation, addressing the following questions:

- How does the inclusion of an idealised island into a global RCE model impact the aggregation of convection?
- Are the physical mechanisms responsible for the aggregation similar to those seen in land-free simulations?
- How sensitive are these results to our choice of land parameters, such as initial soil moisture, surface temperature, soil type, and land topography?