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Interactions between aerosol, clouds and circulation in high-resolution, cloud-resolving simulations with an imposed SST gradient

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The coupling between clouds and circulation has long been recognised both as an essential aspect of tropical circulations as the circulations that accompany clouds are also known to play a role in their spatial organization. For example, mesoscale circulations driven by the heating contrast between convecting and non-convecting regions can drive moisture aggregation in the convecting region.

To study the two-way coupling between clouds and circulation in the tropics, it is desirable to have minimal models in which they can interact realistically. One such approach is to run large-domain, cloud-resolving simulations without rotation and with an imposed sea-surface temperature (SST) gradient, thereby generating an overturning circulation between regions of deep and shallow convection.

In this study we aim to understand how radiative cooling (from clouds and humidity) and latent heating (from precipitation) influence the temperature profiles in the subsiding branch of the circulation and thus the strength of the overturning circulation. As clouds and precipitation are both influenced by aerosol, we approach this question by varying the aerosol concentrations in the subsiding branch, which we hypothesize will alter the circulation strength by changing the cloud optical depth as well as the height at which convection begins to precipitate.

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