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How will climate change affect the land/sea constrast of tropical precipitation?

Marianne Pietschnig, Hugo Lambert, and Geoff Vallis
University of Exeter, United Kingdom (mp586@exeter.ac.uk)

While tropical precipitation over oceans seems to be governed by changes in SST patterns, the situation is more complex over land surfaces (Byrne and O'Gorman, 2015). We use the 'Isca' atmospheric general circulation model (Vallis et al., 2017), which gives us the flexibility to carry out both idealized and more realistic experiments. Shape, size and distribution of continents, as well as surface properties can easily be varied in this modelling framework.

By keeping the configuration as simple and transparent as possible, we seek to identify the basic land surface processes that are essential to produce realistic past, present and future rainfall patterns. We mainly focus on idealized continental configurations — for example a single flat, rectangular land surface in the tropics — but also study 'real world' continents and topography.

Our experiments suggest that land evaporation must be limited by soil moisture (e.g. using a 'bucket hydrology' similar to Manabe, 1969) in order to obtain realistic rainfall patterns. A constant land evaporative resistance with infinite moisture supply does not allow land regions to dry out with global warming. Finding an appropriate simple representation of the contribution of vegetation to land surface hydrology may be important. Additionally, our results show that the parametrization of ocean heat transport plays an important role in determining the location of the ITCZ.

References:
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