

Sensitivity of Tropical Extreme Precipitation to Surface Warming in Aquaplanet Experiments Using the ICON Model

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Increases in atmospheric water vapor holding capacity with temperature (7% K⁻¹–8% K⁻¹, CC-rate) can lead to increasing extreme precipitation (EP). Observations show that tropical EP has increased during the last five decades with a rate higher than in the extratropics. Global climate models (GCM's) diverge in the magnitude of increase in the tropics, and cloud-resolving models (CRM's) indicate correlations between changes in tropical EP and organization of deep convection. We conducted global-scale aquaplanet experiments at a wide range of resolutions with explicit and parameterized convection to bridge the gap between GCM's and CRM's. We found increases of tropical EP beyond the CC rate, with similar magnitudes when using explicit convection and parametrized convection at the resolution it is tuned for. Those super-CC rates are produced due to strengthening updrafts where extreme precipitation occurs, and they do not exhibit relations with changes in convective organization.

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