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The sensitivity of precipitation to temperature over islands and oceans

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Understanding how precipitation responds to atmospheric warming at global and regional scales is crucial for predicting and adapting to the impacts of climate change. However, calculating the observed precipitation sensitivity to temperature (dP/dT) over the 20th century is difficult due to the lack of long observational records in much of the world; in particular, satellite observations of ocean precipitation are only available after 1979. Available satellite observations suggest a large sensitivity of precipitation to warming temperatures, particularly over wet tropical ocean regions, and climate models capture the sign but underestimate the magnitude of these changes. By analyzing longer (1930-2005), islands-based observations, we estimate precipitation sensitivity in ocean regions using an independent, in-situ dataset. A key finding is that dP/dT for island observations of precipitation can exceed the Clausius-Clapeyron scaling in wet tropical ocean regions, in qualitative agreement with the satellite data. Furthermore, the island records clearly show an expected pattern of increasing precipitation in the tropics and decreasing precipitation in the subtropics, as predicted from physical arguments. Finally, analysis of daily station data also shows that heavy precipitation has increased more than mean precipitation, which would be expected to cause increased soil erosion on many tropical islands.