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Research Letter

Attributing the U.S. Southwest's Recent Shift Into Drier Conditions

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Abstract

The U.S. Southwest experienced a strong hydroclimate trend from the 1980s to the 2010s, from cool and wet to warm and dry conditions. Attribution of this trend is challenging due to the influence of internal variability but desired by water managers eager to plan for robust signals of climate change in this water-scarce region. Here we use an empirical method based on constructed circulation analogues to assess the contribution of atmospheric circulation variability to the recent observed hydroclimate trend. Consistent with other studies, we find the observed precipitation trend from 1983 to 2012 to be mainly due to internal atmospheric circulation variability that is driven in part by decadal-scale tropical Pacific sea surface temperature changes. Removing this internal dynamical component brings the observed precipitation trend into closer agreement with the anthropogenically forced response in climate models, demonstrating progress toward an integrated perspective on climate change attribution.

Plain Language Summary

The U.S. Southwest has been getting drier and warmer over the last few decades. These changes fit the common narrative of what might be expected to happen in response to increasing greenhouse gas concentrations. However, natural variability of precipitation and temperature is known to be large in this region, making it difficult to clearly attribute the recent drying and warming to greenhouse gas forcing. Here we show that while the warming is largely due to greenhouse gas forcing, the drying is mostly due to internal climate variability. To date, only an insignificant drying remains after accounting for this internal climate variability. Unlike previous studies that relied exclusively on climate models, we are able to reach these conclusions based on a combination of observations, an empirical statistical method, and climate models.

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