A numerical evaluation of the sources of moisture for atmospheric rivers that impact the West Coast of the United States in the modern era and 2100.

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Atmospheric rivers are one of the major causes of extreme precipitation and flooding in many extratropical regions around the world, and have been found to contribute substantially to global poleward moisture transport. However, the evaporative origin of the moisture in atmospheric rivers remains unclear both on synoptic and climatological time-scales. Here we use the water tracer and water isotope-enabled CAM5 model to examine the moisture sources of atmospheric rivers that impact the West Coast of the United States, as well as the average climatological moisture sources, for both the modern-era and for 2100 under an RCP8.5 scenario. It is found that 33 to 53 % of the precipitable water for the West Coast of the United States originates from the Northeast Pacific, in particular the midlatitudes and subtropics, although in JJA more moisture is recycled from continental regions. It is also found that although atmospheric rivers are at least 70 % Northeast Pacific moisture, they also pull a significant amount of moisture from the tropics (>19 %), indicating a connection to more southerly latitudes. It is also found that as the climate warms, more moisture is transported from regions that are further away, including from the Southern Hemisphere, during both DJF and JJA, for atmospheric rivers as well as for the average climatology. Finally, it is shown that water isotopes provide an observational constraint on the moisture transport pathways, and provides the possibility to observe changes in moisture source for a particular location rather than relying only on numerical techniques to track water.