Response of North Pacific Atmospheric Rivers to Climate Change Conditions

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Atmospheric rivers (ARs) are known to play an important role in the global hydrologic cycle and in bringing extreme precipitation to multiple places around the globe, highlighting the necessity to understand how these features will be affected by climate change. Numerous previous studies using global climate models have been focused on how future AR frequency and strength will change. Despite the difficulty for these coarse models to get a complete picture of future AR characteristics and downstream impacts, we can glean further information available on observed ARs to fill in this picture. Given the importance to understand how ARs have and will change with anthropogenic warming, there is a need to understand and analyze the characteristics of atmospheric rivers in these expected conditions.

A warmer earth can alter atmospheric rivers by both thermodynamical and dynamical effects, including a) enabling more moisture in the air, b) changing the sea surface temperatures and thereby the heat transport between the ocean and atmosphere, and c) altering the atmospheric circulation patterns under which an atmospheric river forms.

By examining detected atmospheric rivers in modern era reanalysis models, we investigate if ARs' characteristics and impacts have been altered in conditions of a changing climate. We specifically focus on North Pacific ARs that make landfall on the west coast of North America 1979-2014 and compare moisture transport and precipitation during AR events in climate change conditions against the observed mean conditions. We define "conditions expected from climate change" by analyzing time periods that are characteristic of conditions a), b), and c) and use model output and precipitation observations to analyze an AR's characteristics and impacts under these conditions.