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Ultra-high-resolution future coupled model projections of atmospheric rivers

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Atmospheric rivers (ARs) are narrow, elongated structures, transporting large amounts of water vapor from the tropics towards polar regions. These synoptic scale features play an important role in the global hydrological cycle and for extreme precipitation events. To study how ARs will change in response to greenhouse warming we use a series of century-long fully coupled ultra-high-resolution simulations conducted with CESM 1.2.2 with an approximate horizontal resolution of ~25 km in the atmosphere and 10 km in the ocean. The simulations were carried out for present-day, 2xCO2 and 4xCO2 conditions. In this high atmospheric resolution, we obtain a much more realistic representation of complex orographic features (such as the Rocky Mountains), which can greatly influence the extreme precipitation often associated with ARs. Results from the present-day simulation are compared with ERA-Interim data to validate the model's fidelity in representing ARs. Our analysis focuses on future greenhouse-warming induced changes in AR frequency, geometry, landfalling latitude and strength. We find a global increase in the frequency of ARs amounting to ~0.5% for 2xCO2 and 0.9% for 4xCO2 respectively. In subtropical areas, such as the southwestern part of the United States AR frequencies increase by up to 7%. The presentation will further document the underlying processes for this increase.