U.S. West Coast Versus the U.K. Atmospheric Rivers: Differences in Future Climate Projections

Christine A. Shields, *Climate and Global Dynamics Division, National Center for Atmospheric Research, P.O. Box 3000, Boulder, CO, 80307, USA, shields@ucar.edu, (303) 497-1312*

***Jeffrey T. Kiehl**, Climate and Global Dynamics Division, National Center for Atmospheric Research, P.O. Box 3000, Boulder, CO, 80307, USA*

Atmospheric rivers (ARs) are key contributors to the hydrological cycle that can significantly impact regional water balances. Abundant moisture, sourced from the ocean below, combined with the dynamics of an extratropical cyclone, form a potent source of intense precipitation that spans across days and produces major flooding. Regionally unique topography and geography define different flavors of ARs across the globe. Here, we compare the characterization of ARs for two distinct regions: U.S. West Coast and the United Kingdom, by employing the high resolution (~50km) Community Earth System Model (CESM) for historical and warm future climate change scenarios.

First, we validate our AR detection algorithm for both regions by comparing frequency, duration, seasonal cycle, and latitude of landfall to ERA-I observational data. Our detection algorithm defines ARs using the empirical formulation given by Zhu and Newell (1998) where a unique moisture threshold is calculated for each time step using maximum and mean values for each latitude band. This relative measure can be applied with consistency across both historical and RCP8.5 (Representative Concentration Pathway) simulations, where atmospheric moisture content is projected to increase following the Clausius-Clapeyron relationship.

Next, we show how precipitation, runoff, and tracking statistics change in a warmer world and examine the difference between the two regions. Projected modulations in the jetstream over the Pacific and Atlantic oceans play an important role in defining the AR latitude of landfall and, therefore, regions of extreme precipitation and flooding. Mechanisms to explain the differences between the Pacific and Atlantic ARs will be explored.

Lastly, modes of natural variability, such as ENSO, AO, and the PNA pattern, play a crucial role in the defining AR variability from year to year. Future changes to these modes may affect each region differently and must be considered when characterizing precipitation impacts.

Zhu, Y., and R. E. Newell, 1998: A proposed algorithm for moisture fluxes from atmospheric rivers. Mon. Wea. Rev., 126, 725–735.