

Using a self-organizing map (SOM) we distinguish large-scale meteorological patterns (LSMPs) that are common on atmospheric river (AR) days in western North America. The relative frequency of each of the LSMPs is compared between a reanalysis and each of 30 models from the Coupled Model Intercomparison Project - phase 5 (CMIP5). Some models better match the relative frequency of these patterns than others, explaining some of the variability between models in total AR count. We also investigate the amount of variance in pattern frequency that can be produced due to internal variance alone using the multiple ensemble members. Some LSMPs in the SOM are uncommon in the historical period but become more common towards the end of the century under Representative Concentration Pathway (RCP) 8.5, depending on the model. We summarize the model-dependent range of possibilities for the end-of-century frequency of each AR-associated LSMP compared to historical. We also investigate sources of inter-model spread in the placement of the jet stream and projected jet shifts under climate change. Finally, we discuss the implications for the changing character and frequency of extreme precipitation events, comparing the Northwest with California.