Session: C39 Poster: TH170B

Understanding the spatial variation in timescales of extreme precipitation across the United States

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Understanding potential changes in the distribution of extreme events is essential for assessing regional scale impacts of climate change. These changes are difficult to ascertain due to the fact that atmospheric processes vary across many spatial and temporal scales and are correlated with other processes at disparate scales. As climate change occurs, understanding the nature of this cross-correlation becomes essential for successful mitigation efforts. Here, we present a methodology combining wavelet multiresolution and information theory approaches for quantifying the scalewise nature of extreme precipitation and the correlation structure with low frequency climate signals. We apply this methodology to the United States Historical Climate Network (USHCN) observations of daily precipitation values. The wavelet decomposition allows us to determine the dominant temporal scales of precipitation dynamics at each station. Utilizing information theory metrics such as the relative entropy, we can quantify which temporal scales of the extreme value distributions are most sensitive to alteration by low-frequency climate forcings and regional circulations including El Niño and the Pacific Decadal Oscillation. By examining the spatial variation in these metrics, we will show the spatial distribution of sensitivity to the regional circulation patterns on the extreme precipitation across the United States. These results will highlight the nature of precipitation extremes for assessing potential impacts of climate change on the hydrological cycle.