**Historical Trends in concurrent regional and global temperature extremes**

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During recent summer and winter seasons, multiple regions simultaneously experienced several high-impact extremes. Such co-occurrences of extreme conditions in disparate regions are referred to as concurrent extremes. We examine the observed trends in the occurrence of a specific pattern of winter-season concurrent extremes over North America and evaluate the influence of historical anthropogenic forcings. During the winters of 2013–2014 and 2014–2015, anomalously warm temperatures in western North America and anomalously cool temperatures in eastern North America resulted in substantial human and environmental impacts. Motivated by the impacts of these concurrent temperature extremes and the intrinsic atmospheric linkage between weather conditions in the western and eastern United States, we investigate the occurrence of concurrent “warm-West/cool-East” surface temperature anomalies, which we call the “North American winter temperature dipole.” We find that the occurrence and severity of warm-West/cool-East events have increased significantly between 1980 and 2015, driven largely by an increase in the frequency with which high-amplitude “ridge-trough” wave patterns result in simultaneous severe temperature conditions in both the West and East. Using the large single-model CESM LENS ensemble of climate simulations, we show that the observed positive trend in the warm-West/cool-East events is attributable to historical anthropogenic emissions.

Further, we extend this framework to examine concurrent temperature extremes across multiple regions of the world. Specifically, we quantify historical trends in the frequency of concurrent warm, cold, and warm/cold extremes across the northern hemisphere SREX regions, and use the LENS ensemble to attribute to historical trends to anthropogenic or natural forcings.