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Quantifying future changes in extreme precipitation events based on resolved synoptic atmospheric patterns

Xiang Gao†; adam Schlosser; erwan monier; Meghan Weber; Dara Entekhabi
† MIT, USA
Leading author: xgao304@mit.edu

One of the primary hazardous impacts of climate change is possible shifts in the extremes of regional water cycle, especially changes in patterns, intensity and/or frequency of extreme precipitation events. In this study, we quantify the potential changes in the statistics (probability) of extreme precipitation events under future climate regimes. Our approach is based on the use of the composites and statistical conditioning to identify the distinct synoptic and large-scale atmospheric conditions that support extreme precipitation events at local scales. The composite maps have been developed through the joint analysis of local, high temporal surface gauge precipitation observations (quantiles) and global reanalysis atmospheric fields (e.g. vertically integrated moisture flux, low-level winds, sea-level pressure, and 500hPa geopotential height, etc.) across various regional domains of U.S, including Central Great Plains, south central, and southwestern regions. These established composites are first evaluated amongst the collection of the 20th century climate model simulations from IPCC AR4 (and AR5 where available) archive to determine whether the statistical nature of extreme-event analogues (i.e. the numbers of occurrences over each season) correspond to that of the observed. The approach is then applied to climate-model projections from various climate change scenarios in the next century to assess the potential changes and/or shifts in the probability of extreme precipitation events. The presented analyses will highlight the complementary/comparative nature of these results to previous studies that have considered modeled precipitation output to assess extreme-event trends. Holistically speaking, these studies are of particular importance to help society develop adaptive strategies and prevent catastrophic losses.