

EGU21-447

<https://doi.org/10.5194/egusphere-egu21-447>

EGU General Assembly 2021

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Seasonality of precipitation extremes and their connections with large-scale climate patterns over the contiguous United States

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Despite the importance of seasonality of extreme precipitation events to stormwater management, there are limited number of studies examining seasonality of daily and monthly precipitation extremes over the contiguous United States. In this study, a circular statistical method was used for spatio-temporal assessment of seasonality of daily and monthly precipitation extremes and their teleconnections with large-scale climate patterns over the contiguous United States. Historic precipitation time series over the period of 64 years (1951–2014) for 1108 sites was used for the analysis. Calendar dates for extreme precipitation were used to characterize seasonality within a circular statistics framework which includes indices reflecting the mean date and variability of occurrence of extreme events. The rainfall seasonality during negative and positive phases of the El Niño–Southern Oscillation, North Atlantic Oscillation, and Pacific Decadal Oscillation were also investigated. Results showed that extreme precipitation seasonality varied across the contiguous United States with distinct spatial pattern of seasonality (strong seasonality) in the western and mid-western regions and mixed spatial pattern in the eastern region. In addition, extreme precipitation seasonality during negative and positive phases of three climate indices revealed that large-scale climate variabilities have strong influence on the mean date of occurrence of extreme precipitation but generally weak influence on the strength of seasonality in the contiguous United States. Results from our study might be helpful for sustainable water resource management, flood risk mitigation, and prediction of future precipitation seasonality.