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Quantifying spatiotemporal influences of climate index on seasonal extreme precipitation based on hierarchical Bayesian method

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Quantifying spatiotemporal influence of climate index on extreme precipitation will help to better understand the variability of extreme precipitation. The extreme precipitation is usually influenced by different climate indices, and mutual offset is likely to occur, thus the rotated Empirical Orthogonal Function was used to identify the different influences of climate indices on extreme precipitation in space and time. The variation of extreme precipitation in data-scarce region is also concerned, hence, a spatiotemporal regional frequency analysis model was further developed, therein the identified spatiotemporal influences of climate indices on extreme precipitation were quantified using Bayesian hierarchical method. In this study, the in-situ seasonal maximum one-day precipitation amount (Rx1day) was used to represent seasonal precipitation extremes from 1957-2010 in the Poyang Lake basin, China, and influences of El Niño-Southern Oscillation (ENSO), North Atlantic Oscillation (NAO) and Indian Ocean Dipole (IOD) on seasonal Rx1day were quantified. Results indicated that the seasonal Rx1day was influenced by different climate indices in the Poyang Lake basin, such as spring Rx1day was mainly influenced by ENSO and NAO, while summer Rx1day was influenced by IOD. The responses of extreme precipitation on climate index are varied in different regions, and this was also well distinguished and verified, such as negative ENSO (in the same year) events tends to cause spring Rx1day slight decrease in the southern part of the basin while increase in the northern part with a center around the Poyang lake.