# Unravelling the spatial diversity of Indian rainfall teleconnections using event synchronization-based multiscale nonlinear method

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**Key findings**

**Abstract**

An advanced understanding of synchronous occurrences of heavy rainfall teleconnection and their spatial diversity in space and time is vital, for instance, for predictions of extreme rainfall events and timing of monsoon onsets but also for agriculture and insurance sector. In this study, the spatial synchronization structure is analyzed at multi-time scales as a teleconnection network constructed from precipitation event series and prominent climate indices such as the El Niño/Southern Oscillation (Nino 3.4), Indian Ocean Dipole (IOD), North Atlantic Oscillation (NAO), Pacific Decadal Oscillation (PDO), Atlantic Multidecadal Oscillation (AMO). We propose a general framework to disentangle the dependency structure between extreme events and climate indices at different temporal scales by introducing the concept of multiscale event synchronization derived from non-linear synchronization measure. We apply our method to Indian precipitation and prominent climate indices at different temporal scales. Our results reveal that there is a significant synchronization of these climate indices at different temporal scales, with diversity in the spatial dependency pattern of the Indian precipitation. Additionally, we compare the results obtained from this study with the state-of-the-art wavelet coherence to show that our method is different from others and highly effective.

**Keywords:** Multiscale event synchronization, global and local climate indices, spatial diversity of Indian rainfall teleconnections, wavelet coherence.