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# Investigating the Global Monsoon by networks of extreme rainfall events

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A defining feature of the Earth's climate is the annual variation of heavy precipitation and convergent wind circulation in the tropics and subtropics. This dominant mode of hemispherically distributed rainfall is often termed the 'global monsoon', comprising of regional monsoon systems on every continent. Monsoon regions are defined using annual precipitation differences and average seasonality rather than by the dynamical similarities of rainfall dynamics**;** they thus fail to (i) consider global patterns of extreme rainfall events (EREs), and (ii) take into account spatio-temporal similarities in timing and intensity of monsoonal circulation.

In this work, we investigate the dynamics of the Global Monsoon using the framework of complex networks derived from extreme rainfall events. In particular, we use time-delayed event synchronization applied to the GPCP rainfall dataset to first extract a network of global ERE teleconnections. We then identify regions with similar ERE patterns by applying on the global ERE network a Bayesian hierarchical clustering approach based on the stochastic block model.

Our work presents evidence to place different monsoon regions in a global context and therefore to describe them as a unified system with common underlying dynamics: Besides known teleconnections, our method captures various differently resolved representations of the global weather system. These range from a description containing two clusters separated by the hemispheric equator to a precise representation of distinguishable but connected monsoon regions. We argue that the global monsoon can be regarded as a hierarchical complex system into which regional monsoons are embedded in intermediate levels of the clustering hierarchy.