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Influence of large-scale climate modes on dynamical complexity patterns of Indian Summer Monsoon rainfall

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Indian Summer monsoon is one of the most anticipated and important weather events with vast environmental, economical and social effects. Predictability of the Indian Summer Monsoon strength is crucial question for life and prosperity of the Indian population. In this study, we are attempting to uncover the relationship between the spatial complexity of Indian Summer Monsoon rainfall patterns, and the monsoon strength, in an effort to qualitatively determine how spatial organization of the rainfall patterns differs between strong and weak instances of the Indian Summer Monsoon.
Here, we use observational satellite data from 1998 to 2012 from the Tropical Rainfall Measuring Mission (TRMM 3B42V7) and reanalysis gridded daily rainfall data for a time period of 57 years (1951-2007) (Asian Precipitation Highly Resolved Observational Data Integration Towards the Evaluation of Water Resources, APHRODITE). In order to capture different aspects of the system's dynamics, first, we convert rainfall time series to binary symbolic sequences, exploring various thresholding criteria. Second, we apply the Shannon entropy formulation (in a block-entropy sense) using different measures of normalization of the resulting entropy values. Finally, we examine the effect of various large-scale climate modes such as El-Niño-Southern Oscillation, North Atlantic Oscillation, and Indian Ocean Dipole, on the emerging complexity patterns, and discuss the possibility for the utilization of such pattern maps in the forecasting of the spatial variability and strength of the Indian Summer Monsoon.