Time-varying Functional Climate Networks Capture Emergent Phenomena Prior to the Kerala Floods in 2018 and 2019

Contributed Talk

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In recent years, the frequency and intensity of extreme rainfall events have escalated due to global climate change, often resulting in catastrophic devastation such as flooding, landslides, and mudslides. It is essential to understand and unravel the

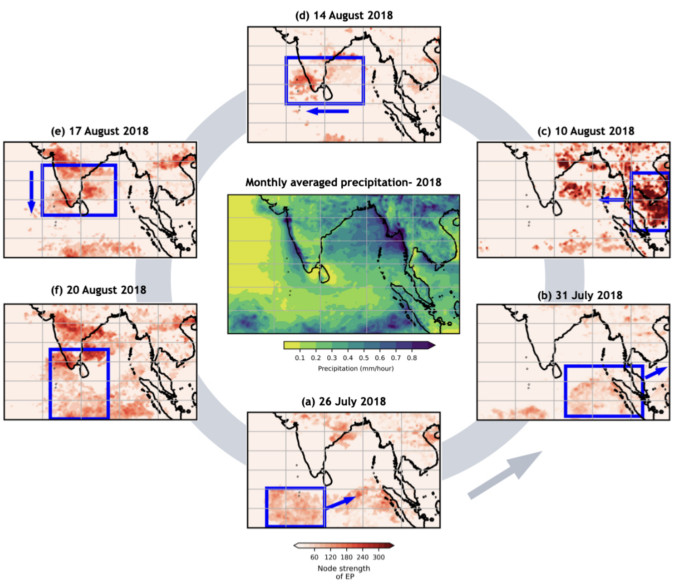

Figure 8: Circulatory movement of synchronized extreme rainfall pattern during 2018.

physics behind extreme rainfall events. The southwest coast of the Indian subcontinent experienced significant anomalous rainfall, leading to catastrophic floods in Kerala during 2018 and 2019. This study investigates these extreme rainfall events through the framework of complex networks. We construct time-varying functional climate networks, wherein nodes are the geographical locations and links represent interactions between nodes based on the statistical similarity of extreme precipitation events, using event synchronization. Analysis of the network topology reveals that the extreme rainfall events observed in 2018 and 2019 are associated with a mesoscale pattern of synchronized rainfall. This pattern originates from the central Indian Ocean and moves eastwards over the Bay of Bengal, stopping over the Maritime Continent. Then, the pattern moves westward towards the Indian peninsula and accumulates over the southwest coast of India, especially over Kerala, which leads to floods. Additionally, our findings indicate that this coherent pattern of synchronized extreme rainfall is accompanied by enhanced convective cloudiness and moisture transport. Identifying these coherent emergent phenomena is crucial for developing predictive precursors for extreme rainfall events.