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How does the South Asian summer monsoon anomaly influence the interannual variations in precipitation over the South-Central Tibetan Plateau

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The South Asian summer monsoon (SASM) system is one of the most energetic regional monsoon systems. Its onset and demise timings determine the propagation, duration, and magnitude of precipitation through thermodynamic and dynamic processes in the SASM-prevailing areas. Particularly, anomalous onsets and demises of the SASM could generate a large anomaly in precipitation and serious water-related disasters over the SASM-prevailing areas.

The South-Central Tibetan Plateau (SCTP), known as the “Asian water tower”, is the origin of several major Asian rivers, including the Yellow River, Yangtze River, Brahmaputra River, Mekong River, and the Indus River, providing a huge amount of freshwater for ecosystems and billions of people in Asia. It is widely known that the SCTP is controlled by the SASM system in summer, accounting for approximately 60% of annual precipitation, but with significant spatiotemporal heterogeneity due to the complex topographic and geographic conditions. Presently, most studies have focused on the effects and physical causes of the linear trend of SASM onset over the SCTP. However, little attention has been paid to the question as to how both anomalous onset and anomalous demise of the SASM influence the interannual precipitation variation in this region. In particular, the spatial manifestation of thermodynamic and dynamic mechanisms for the interannual precipitation variation is largely unknown. Adequate knowledge about these mechanisms is critical for sustainable freshwater management and water disasters control in this region and surrounding areas.

These call a detailed study to investigate the influences of the early and late onset (demise) of the SASM system on the interannual variations in precipitation and their underlying mechanisms over the SCTP. In this study, we mainly clarify the following key questions: (1) How do the onset and demise of the SASM control the interannual variations in precipitation over the SCTP? (2) Is there an asymmetric effect of the SASM on SCTP precipitation between its onset and demise, and between its early and late onset (demise)? and (3) What are the underlying mechanisms that are responsible for the variations in interannual precipitation? The results would help improve our

understanding of the SASM-precipitation relationship over the SCTP and alleviation of water-related disasters in the region.