



Data assimilation of warm season precipitation variability in China over the past-half millennium

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The change of dominant modes of precipitation in China has an important influence on the national economy and social life. Their fine patterns for several hundreds of years before the industrial revolution are resolved as more proxy records are archived in the public repository. Climate model simulations can be used to study the mechanisms ruling the precipitation dynamics. However, the current climate models can not accurately reproduce the dominant spatial patterns of the reconstructed precipitation variability over the past centuries, which brings difficulties to quantitatively resolve the origins of the dominant modes of precipitation variation. In this study, data assimilation based on particle filtering is applied to combine the empirical information from the May–September precipitation field reconstructions in China over the past 500 years and the physical understanding of the climate system derived from the published climate simulations with the Community Earth System Model (CESM). On this basis, the similarities and differences of the dominant modes of reconstructed and assimilated precipitations over the past 500 years in China are discussed on time and frequency domains. The relationships between the dominant modes of precipitation and atmospheric circulation and water vapor transport are clarified. This provides a natural background reference for understanding the current changes of dominant modes of precipitation in China and projecting potential future shifts.