



Tibetan Plateau Capacitor Effect during the Summer preceding ENSO: from the Yellow River climate perspective

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It is well recognized that El Niño-Southern Oscillation (ENSO) may exert a direct impact on the East Asian summer monsoon rainfall through modulating the Philippine Sea anticyclone variability. Such ENSO associated influence is evident in the monsoon region, i.e. Southeast China, the Yangtze River, Korean Peninsula and Japan. It remains unclear whether and how this ENSO related effect can reach the Yellow River region, a monsoon/arid transition region. In this study, results show that the year-to-year variations of the Yellow River summer rainfall can be indirectly influenced by ENSO, during its developing phase. The western Tibetan Plateau snow cover (WTPSC) may act as a “capacitor”, helping ENSO signal to reach the Yellow River region. During the El Niño developing spring, the associated diabatic heating in Pacific region can excite an anomalous cyclone over the plateau and anomalous upward flows over the western plateau. Such circulation configuration favors an excessive WTPSC anomaly in spring. The more WTPSC may increase the surface albedo, decrease the absorbed net shortwave radiation and in turn intensify the WTPSC. Through such snow-albedo feedback process, the excessive WTPSC anomaly may strengthen and persist through summer, which may induce two noticeable wave trains in the upper and lower troposphere propagating northeastward to the Yellow River region. Associated with the wave trains, a low pressure anomaly prevails over northeast China. To the southwest side of the anomalous low pressure, the abnormal northerly wind may bring large volumes of dry cold air with little moisture to the Yellow River region, leading to the anomalous drought there. During the La Niña developing summer, the situation tends to be opposite. As such, the ENSO associated influence is tied to the interannual variations of the following summer Yellow River precipitation, with the development of ENSO from spring.