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The joint effects of the boreal summer intraseasonal oscillation and Qinghai-Tibetan Plateau monsoon on the precipitation over Southwestern China

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This study investigates the influence of the boreal summer intraseasonal oscillation (BSISO) on 10-30-day summer rainfall anomalies in Southwestern China (SWC) under the effects of Qinghai-Tibetan Plateau monsoon (QTPM) based on ERA5 reanalysis data and CN05.1 precipitation in 1981-2018. The results show that the 10-30-day rainfall anomalies in SWC have significant and joint feedback to variation of the second component of BSISO (BSISO2) and QTPM at lagging strong (weak) BSISO events by 0-12 days. Their lagged causal linkage and corresponding physical processes have been revealed by causal effect networks and composite analyses, which are most significant at 4-day and 12-day lag. Simultaneously, BSISO2 can induce wetter 10-30-day rainfall over southern SWC by motivating water vapor transport from the Bay of Bengal towards Yunnan province. More importantly, BSISO2 can modulate a northwest-propagating wave train from the western north Pacific towards SWC at the upper troposphere by vertical wave energy transport, which blocks the wave train propagating from the Lake Balkhash to east China–Japan most significantly at a 4-day lag and leads to drier eastern SWC. The process can be influenced by QTPM significantly which leads to the response of 10-30-day rainfall over SWC with lags of 0-12 days. Specifically, same-phase QTPM can trigger more active wave train propagation from high-latitude while opposite-phase QTPM enhances the low-latitude wave energy transport. The interference then facilitates baroclinic structure over eastern SWC at lagging 12 days with positive precipitation anomalies for same-phase events and negative precipitation for opposite-phase events.