Summertime climate anomalies in Asia and the Northwestern Pacific induced by ENSO: Dependence on ENSO's phase transition

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Equatorial Pacific sea surface temperature (SST) anomalies associated with El Niño-Southern Oscillation (ENSO) typically peak in boreal winter and, when composited, dissipate by subsequent boreal summer (June-July-August; hereafter denoted as JJA(1)). Despite the lack of the equatorial Pacific signal, coherent climate anomalies emerge in Asia and the Indo-western Pacific in JJA(1). Studies have identified the so-called capacitor effect of the Indian Ocean for the ENSO's delayed, indirect influence. However, the lack of composited SST anomalies in the equatorial Pacific in JJA(1) does not always apply to individual ENSO events. Specifically, in some events the equatorial Pacific SST anomalies do not disappear in JJA(1) and redevelop toward the subsequent boreal winter (hereafter "multi-year ENSO events"), while in other cases the SST anomalies on average transition to the opposite polarity before JJA(1) ("single-year ENSO events"). We find in a reanalysis dataset and a coupled model pacemaker experiment that the single-year and multi-year ENSOs yield distinct climate anomalies in Asia and the Northwestern Pacific in JJA(1). Our bivariate linear regression analysis shows that the direct teleconnection from the equatorial Pacific interferes differently between single- and multi-year events with the delayed influence through the capacitor effect. The equatorial Pacific SST induces lower-tropospheric circulation anomalies that are spatially orthogonal to those induced by the Indian Ocean capacitor effect, and their different combination leads to the distinct climate anomalies. The distinct influence can explain asymmetry in JJA(1) climate anomalies between El Niño and La Niña. Namely, El Niño tends to decay rapidly while La Niña often persists for two years or more, and this persistence asymmetry is the key to asymmetric climate anomalies between El Niño and La Niña in JJA(1).

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