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## Extreme IOD induced IOB warming and its impacts on western North Pacific anomalous anticyclonic circulation transport in early summer 2020: without significant El Niño influence

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The tropical Indian Ocean (TIO) basin-wide warming occurred in 2020, following an extreme positive Indian Ocean Dipole (IOD) event instead of an El Niño event, which is the first record since the 1960s. The extreme 2019 IOD induced the oceanic downwelling Rossby waves and thermocline warming in the southwest TIO, leading to sea surface warming via thermocline-SST feedback during late 2019 to early 2020. The southwest TIO warming triggered equatorially antisymmetric SST, precipitation, and surface wind patterns from spring to early summer. Subsequently, the cross-equatorial “C-shaped” wind anomaly, with northeasterly–northwesterly wind anomaly north–south of the equator, led to basin-wide warming through wind-evaporation-SST feedback in summer.

The TIO warming excited a strong and westward extend anomalous anticyclone on the western North Pacific (WNPAC). The WNPAC is usually associated with strong El Niño-Southern Oscillation (ENSO), except for the 2020 case. In 2020, the anomalous winds in the northwestern flank of the WNPAC bring excess water vapor into central China. The water vapor, mainly carried from the western tropical Pacific, converges in central China and result in heavy rainfall. Unlike extreme events in 1983, 1998, and 2016, the extreme rainfall in 2020 was the first and only event during 1979-2020 that followed an extreme positive IOD rather than a strong El Niño. A theory of regional ocean-atmosphere interaction can well explain the processes, called the Indo-Western Pacific Ocean Capacitor (IPOC) effect. This study reveals the importance of IOD in the IPOC effect, which can dramatically influence the East Asian climate even without involving the ENSO in the Pacific.