Tripole precipitation pattern and SST variations linked with extreme zonal activities of the western Pacific subtropical high

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Using the daily variables of NCEP reanalysis 1 from 1981 to 2014, this study first constructs a new index to describe the western Pacific subtropical high (WPSH) zonal activities by the normalized relative vorticity (RV) series averaged over a three-dimensional (3D) core domain (112.5°–142.5°E, 10°–30°N, 925–500 hPa). Its horizontal scope is referred to as core region. Ten positive and six negative extreme episodes lasting from 10 to 17 days were identified based on the new index. They demonstrated prominent variabilities in intraseasonal and interannual timescales. Composite results show a tripole precipitation pattern with a wet (dry) zone over the tropical western Pacific (TWP) separating two dry (wet) zones in the meridional direction. The northern one covers the mei-yu belt while the southern one extends along the tropical Indian Ocean (TIO) and the Maritime Continent (MC). The activities of WPSH and monsoon trough form the height anomalies over the core region, while its northern height anomalies are due to the westerly trough in middle latitudes. Further, the three systems exert joint effects on the tripole dry-wet pattern.
Within the biweekly evolution of positive composite, a weaker WPSH displays first an eastward and then a westward track. Negative composite indicates that a stronger WPSH first retreats eastward, then strides westward, and finally moves northeastward during around two weeks. The sea surface temperature (SST) anomalies over TIO and TWP are crucial for the extreme WPSH episodes. Concretely, the SST anomalies over TIO largely influence the overall intensity and location of WPSH and are especially important in the early stages of WPSH episodes. Locally, the SST anomalies over the core region are passive responses of atmospheric forcing in the early stages of WPSH episodes and then exert effect on the WPSH in their later stage.

Keywords: western Pacifc subtropical high, extreme episode, relative vorticity, geopotential height, precipitation, sea surface temperature

