Dominant Large-scale Atmospheric Circulation Systems for the Extreme Precipitation over the Western Sichuan Basin in Summer 2013

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Previous studies suggested that quite different weather systems could contribute to precipitations in the western Sichuan Basin (WSB). To extract coherent weather patterns, this study applies multivariable empirical orthogonal function (MV-EOF) technique for the four extreme precipitation processes (EPPs) over WSB from mid-June to mid-July in 2013. Results indicate that the first two leading modes are characterized by “Saddle” and “Sandwich” structures, which account for 35.5% and 18.3% of the total variance, respectively. In these two modes, both the tropical cyclone (TC) and the West Pacific Subtropical High (WPSH) play different roles. In the first mode, a TC from the South China Sea (SCS) converts into the inverted trough and steers the warm moist airflow northward into the WSB. Over the Yangtze River, WPSH extends vapor convergence zone further-westward and conveys a southeasterly warm humid flow. In the second mode, WPSH is pushed westward by TC in the Western Pacific(WP) and then merge with an anomalous anticyclone over SCS. Then the WPSH and the anomalous anticyclone form a conjunction belt and convey the warm moist southwesterly airflow to merge with the cold flow over the WSB. These results demonstrate that the WPSH, the TC in the tropic, the blocking and the trough in the mid-high latitude play important roles during the EPPs over the WSB. Most notably, these circulation systems should match up with each other. Further analyses elucidate that the persistence of EPPs depends on the long-lived large-scale circulation configuration steady over the suitable positions.

Key words: the Sichuan Basin, extreme precipitation processes (EPPs), multivariable empirical orthogonal function (MV-EOF), the Saddle field, the Sandwich structure