Impact of the Madden-Julian Oscillation on Summer Rainfall in Southeast China

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Abstract

Influences of the Madden-Julian Oscillation (MJO) on summer rainfall in Southeast China are investigated using in situ rainfall data and a real-time MJO index proposed by Wheeler and Hendon. A marked transition of rainfall patterns from enhanced to suppressed is found in Southeast China (east of 105° E and south of 35° N) on intraseasonal timescales as the MJO convective center moves from the Indian to western Pacific Oceans. The maximum positive anomaly and negative anomaly of regional mean rainfall occupy 12% and 8% relative to the climatic regional mean respectively. Associated with different rainfall characters, the corresponding large-scale background fields such as subtropical high, water vapor transport and vertical velocity also take on reverse changes. The transition of rainfall patterns can be ascribed to the intraseasonal variation of vertical velocity during the MJO convective center moving eastward, which affects the vertical motion in Southeast China directly and the water vapor transport there indirectly through changing the local meridional circulation between tropics and subtropics. When the MJO convective center is mainly over the Indian Ocean, there are abnormal ascending motions in Southeast China. Meanwhile, there are abnormal ascending motions over equatorial western Pacific and descending motions around the subtropical western North Pacific, which result in abnormal westward shift of the western North Pacific subtropical high and the corresponding anticyclonic circulation. Southwesterlies at the northwestern part of anticyclone carry more moisture and converge at Southeast China. Considering the large-scale convective instability in Southeast China in boreal summer, the enhanced local rising motions and increased water vapor are in favor of the enhancement of deep convective cloud and rainfall. It is just opposite after the MJO moves to the western Pacific Ocean.