MJO Influence on Philippine Extreme Rainfall Frequency Associated with Spring to Summer South China Sea Climatological Intraseasonal Oscillation Mode and Westerly Monsoon Onset

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Abstract

The East Asian monsoon system shows strong annual cycle with the wet season in summer and dry in winter. Apart from the annual cycle, the monsoon system exhibits distinct climatological intraseasonal oscillations (CISOs) (Wang and Xu 1997), also known as the fast annual cycle (LinHo and Wang 2002). This study focuses on investigating the relationship between CISOs, South China Sea (SCS) westerly summer monsoon onset, and the commencement of Philippine rainy season. The SCS-CISO mode during the spring to summer transition period (March-June) is determined as the intraseasonal (20-73 days) variations of the area (10°-20°N, 110°E-120°E) mean OLR data during the 44 years from 1979-2022. A statistically significant dry (wet) singularity over the SCS is identified with the positive (dry) peak in early May and negative (wet) valley in late May. When an individual-year SCS-CISO mode shows distinct shift from dry to wet during the time window from mid-April to early-June (pentads 22-31) and the wet phase coincides with the wet singularity, the year is identified as a year of normal SCS-CISO. It turns out that 72% of the 22 normal SCS-CISO years show concurrent wet SCS-CISO and westerly monsoon onset, and about one half of the concurrency was influenced by MJO through an intensified southwest-northeast oriented moisture transport path from Indian Ocean extended to northern SCS and extratropical western North Pacific. The extended moisture transport path is associated with a MJO-Rossby wave like anomalous cyclonic circulation. It can enhance the Taiwan-Okinawa Mei-yu front and the extreme rainfall over northern Philippines. However, the fact that only in one half of the normal SCS-CISO years showing MJO influence suggests the spring to summer fast annual cycle and CISO over the SCS cannot be fully explained by MJO.

Keywords: South China Sea summer monsoon, Climatological intraseasonal oscillations, Madden-Julian Oscillation, Extreme rainfall