Modulation of the South China Sea and Maritime Continent Subseasonal Peak Precipitation by MJO and Convectively Coupled Equatorial Waves in Boreal Winter

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Tropical South China Sea (SCS)-Maritime Continent (MC) is one of the precipitation centers in the tropics during the boreal winter half year (NDJFMA). The abundant winter rainfall amount over this region involves multiple-scale phenomena such as the annual cycle, monsoon systems, ENSO, Madden-Julian Oscillation (MJO), and convectively coupled equatorial waves (CCEWs). However, it has not been fully documented yet how winter precipitation is modulated by these phenomena. In this study we aim to document the modulation effects of MJO and CCEWs on the subseasonal peak precipitation event over the SCS-MC region. Here, the sub-seasonal peak precipitation event is defined as a period of successive 3 pentads of which the accumulated rainfall amount reaches the maximum of 15-day accumulated rainfall during the four months from November to February. The result suggests that the timing and intensity of the peak precipitation is strongly modulated by the MJO and CCEWs. To illustrate the importance of understanding the multi-scale contribution to the SCS-MC peak precipitation, we analyzed the peak precipitation event in the winters of 2016/17 and 2017/18, during which the South China Sea Two Island Monsoon Experiment (SCSTIMX) were conducted. We found that the seasonal cycle is more dominant over SCS region, while MJO and CCEWs enhanced the intensity. The stronger-than-normal mean precipitation intensity of the 2017/18 peak event, especially over central SCS, Philippines and the western Philippine Sea areas, is strongly modulated by the Equatorial Rossby (ER) wave. On the other hand, the three-week delay of the peak precipitation over western Borneo and the SCS between Sumatra and Borneo in 2016/17 winter can be contributed to the suppression by the dry phase of MJO in the earlier half month of December. Our findings point out understanding the MJO and CCEWs modulation on the SCS-MC precipitation is important for S2S prediction in this region. Further analysis of the influence of monsoon surges and ENSO influence using high-quality reanalysis and observational data is currently under study. The methodology of this study can be applied to, for example, the S2S prediction database to assess multi-scale influence on dynamical model predictability.

Key Words: South China Sea and the Maritime Continent precipitation, rainfall annual cycle, convectively coupled equatorial waves, MJO, South China Sea

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