Impact of the MJO on the Diurnal Cycle of the Precipitation over the Western Maritime Continent during Northern Hemisphere Winter

Ji-hyun Oh, Kwang-Yul Kim and Gyu-Ho Lim
SEES, Seoul National University (noon20@snu.ac.kr)

The Maritime Continent, which has a complex topography and distinct land-sea contrast, has a prominent diurnal cycle of rainfall. The Maritime Continent is one of the regions which receive much of rainfall, and the rainfall is mainly concentrated in northern hemisphere winter. In winter, the Madden-Julian Oscillation (MJO) which is dominant tropical variability with 45 to 60 days of period is known to be closely related to various atmospheric phenomena such as Asian/Australian monsoon, tropical cyclone and ENSO. The MJO is initiated from Indian Ocean and propagates eastward passing the Maritime Continent. When a MJO passes through the Maritime Continent, the deep convection tends to become weaker. After passing through the Maritime Continent, the convective area is reinforced again and continues migrating eastward up to near 180°E. In this study, the impact of the MJO on the diurnal cycle of the rainfall over the western Maritime Continent in winter is examined using cyclostationary EOF (hereafter CSEOF) analysis of TRMM 3B42 V6 rain rate and JRA-25 data for 10 winters (DJF) from 1998/99 to 2007/08 (Kim et al., 1996; Seo and Kim 2003). In CSEOF analysis, space-time data T(r,t) are written as a linear combination of CSEOFs,

$$T(r,t) = \sum_n LV_n(r,t)PC_n(t)$$

where $LV_n(r,t)$ and $PC_n(t)$ are cyclostationary loading vector and principal component time series. The loading vectors are time dependent and periodic, and it describes temporally evolving physical processes (here diurnal variation) whereas the PC time series represent the amplitude modulation of the physical processes at longer timescale.

In the result of CSEOF analysis of TRMM rain rate, distinct land-sea contrast in phase of the diurnal cycle of the rainfall is revealed. While the precipitation reaches its maximum over the continents in the late afternoon and evening, oceanic rainfall tends to be enhanced in nighttime and morning. In addition to the rainfall, the CSEOF analysis of the other associated physical variables is also conducted to understand the mechanism of the diurnal variation of the rainfall.

We adopted Real-time Multivariate MJO Index (Wheeler and Hendon, 2004) to select dates when the convection of MJO is located over the Maritime Continent, and we conducted CSEOF analysis for active MJO days.