Impact of the MJO on the Pacific-Japan mode of the East Asian summer monsoon

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A large fraction of interannual variability of the East Asian Summer Monsoon (EASM) can be described by the first two modes of a multivariate Empirical Orthogonal Functions (MV-EOF) analysis of horizontal wind vectors in the lower and upper troposphere over the East Asian region. The first mode resembles the Pacific-Japan pattern and represents about 20% of the EASM interannual variance. The positive phase of the PJ-pattern is associated with anomalous anticyclonic flow over the tropical western North Pacific in the lower troposphere, leading to enhanced rainfall over the climatological East Asian rain band. Focusing on June/July/August and on the first MV-EOF mode (PJ-mode here) we investigate the relation between tropical intraseasonal variability, namely the Madden-Julian Oscillation (MJO) and the EASM. The second MV-EOF mode had previously been found to be influenced mainly by the Indian Summer Monsoon and is not discussed in this presentation.

First, it is found that the MJO modulates the intraseasonal variability of the PJ-pattern, in that early MJO phases, related to enhanced convective precipitation over the Indian Ocean, favour the positive phase of the PJ-mode and late MJO phases, related to enhanced convective precipitation over the Maritime Continent and the western tropical Pacific, favour the negative phase of the PJ-mode.

Second, using a decomposition method introduced by Yoo, Feldstein and Lee (2011), we show that interannual variability of the MJO contributes about 11% to the interannual variability of the EASM. Thereby, interannual changes in the frequency of occurrence of the eight standard MJO phases are more important to the variability of the EASM than changes in the circulation patterns associated with the different MJO phases.

Some discussion on the involved mechanisms will be given.