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Identification of Nonlinear Coupled Intraseasonal Phases in the East Asian Summer Monsoon

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The nonlinear characteristics of summer monsoon intraseasonal oscillation (ISO), which is manifested as fluctuations in convection and circulation, is one of the major difficulty on the prediction of East Asian summer monsoon (EASM). The isolation of fundamental large scale spatial pattern and evolutionary history of nonlinear phases of monsoon ISO provides the optimism for extended-range prediction of summer precipitation. The present study aims to identify the nonlinear phases of monsoon ISO and figure out the relationship between ISO and relatively slowly varying components such as El Nino/Southern Oscillation (ENSO), Indian Ocean thermal state and Arctic oscillation using six daily large-scale circulation indices representative for EASM. In order to classify the different phases of monsoon ISO, we use a nonlinear pattern recognition technique known as self-organizing map (SOM) which has a great attractiveness detecting self-similarity among data elements by grouping/clustering such self-similar components, while EOFs produce the physically unrealistic space-time orthogonality.
It was found that SOM well captured the formation of East Asian monsoon trough during early summer and its northward migration together with enhanced convection over subtropical western Pacific and regionally intensive precipitation including Meiyu, Changma and Baiu. The summertime main monsoon trough node tends to be modulated more (less) frequently and persistently by the preceding wintertime El Nino (La Nina). It is related to the Pacific-Japan pattern which is a meridional dipole-like vorticity anomalies over East Asia in response to convective activity over the tropical western Pacific in the form of teleconnection. Except for major ENSO related nodes, the other nodes may be linked to different external elements.
Furthermore, the changes in relationships between East Asia and other external components will be discussed in order to find out that phases are triggered by diverse external forcings and particular nodes responsible for the changes in their relationship.