

Contrasting Interannual Variations between the Indian and the Western North Pacific Summer Monsoons

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ABSTRACT

Using 50 years of NCEP/NCAR reanalysis data and two monsoon indices that represent the dominant modes of the lower tropospheric circulations of the Indian summer monsoon (ISM) and western North Pacific-East Asian summer monsoon (WNP-EASM), we contrasted the variability of the two Asian monsoon subsystems with an emphasis on the variability of the WNP-EA summer monsoon. The most significant spectral peaks of the WNPSM occur around 50 months and 16 months, while the ISM has a dominant spectrum peak at 30 months. A strong WNPSM is characterized by an elongated anomalous low-level cyclone along 20N off coast of East Asia, suppressed rainfall along Meiyu/Baiu front, and intensified upper-level easterlies over the Maritime Continent connecting to the enhanced Australian High. A strong ISM features an enhanced low-level cross-equatorial gyre, intensified South Asian High and Mascarene High, and upper-level easterly anomalies over the tropical East Africa and South Asia. The WNPSM tends to be weak (strong) during the decay phase of an ENSO warm (cold) episode, whereas the ISM tends to be weak (strong) during the development phase of an ENSO warm (cold) episode. Since the late 1970s, the WNPSM and EASM variability has amplified considerably, but the large-scale WNPSM-ENSO relationship has remained steady over the last 50 years, meanwhile, the ISM-ENSO relation has dramatically weakened concurrent with decreasing ISM variability. The possible causes of the above-mentioned contrasting variability between the two monsoon subsystems are discussed. Another novel and unexpected finding of the present study is a teleconnection between a strong (weak) WNPSM and above (below) normal summer rainfall over the Central Plains of the United States. This boreal summer teleconnection appears to be established through a statistically significant wave train pattern emanating from the Philippine Sea and extending to North America.