



Bimodal Variability of East Asian Summer Monsoon Viewed as Atmospheric Hydrological Cycle

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The summer vertically integrated moisture transport (VIMT) flux and its convergence have been estimated by using ECMWF reanalysis (ERA-40) data for the period of 1958-2002. Physical linkages between moisture transport by East Asian summer monsoon (EASM) and summer rainfall anomalies in China have been also investigated. A multivariate EOF (MEOF) analysis reveals that EASM-related VIMT flux anomalies are mainly regulated by two dominant modes, referred to as MEOF1 and MEOF2. These two modes exhibit significant oscillations on decadal time scales. VIMT flux anomalies related to these two modes display different wave-like features in magnitude and location. An anomalous east-west elongated cyclone along 22.5N and an anomalous anticyclonic ridge along 40N are associated with the MEOF1 mode, while an anomalous anticyclone around northern SCS, an anomalous cyclone around the subtropical western North Pacific and an anomalous anticyclone centred at (40N, 170E) correspond to the MEOF2 mode. The low-level circulation anomalies associated with these two modes also display similar wave-like patterns. Regression analyses disclose a close coupling between summer VIMT flux convergence and rainfall anomalies in central and eastern China. Associated with the MEOF1 mode, positive VIMT flux convergence anomalies induce positive rainfall anomalies in South China, while negative VIMT flux convergence anomalies cause negative rainfall anomalies in the middle and lower reaches of the Yangtze River valley and Northeast China. Corresponding to the MEOF2 mode, positive VIMT flux convergence anomalies result in positive rainfall anomalies in the Yellow River valley and most of central China, but negative VIMT flux convergence anomalies. Finally, principal component regression (PCR) based on these two modes detects significant variance ratio of summer rainfall anomalies in China.