

The Impacts of Intraseasonal Oscillations over the Subtropical Pacific on the East Asian Summer Rainfall

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Abstract: The relationships between the precipitation of Eastern Asia (20N-45N, 110E-135E) and the 30-60-day intraseasonal oscillations (ISO) over the Pacific during the boreal summer and its probable mechanism are studied in the paper. The daily wind and height fields of NCEP/NCAR reanalysis data and the 24h precipitation data of China 687 stations during 1958-2002, and the pentad precipitation of CMAP/NOAA from 1979 to 2004, are all analyzed by the Space-time filter analysis (Kao, 1968; Hayashi, 1982; Pratt, 1976). The study results are presented as follows:

(1) The proportion for the meridional wind ISO in the subtropical atmosphere is strikingly bigger than the one in tropics, which is distinct from the ISO of the zonal wind and height(maxima in tropic). The analysis results, from every drought and flood summer for 4 different regions of East Asia separately during 1958-2002, showed that the precipitation amounted in the East Asian summer monsoon region is well correlated to the westward propagation of 30-60-day ISO via the north central-eastern Pacific, and depends little on the intensity changes of the East Asian summer monsoon. And the westward ISO is usually the low-frequency cyclones and anticyclones from the Bay of Alaska in northeastern Pacific and the Okhotsk in the northwestern Pacific of mid-high latitudes, and the ISO evolution in subtropical easterlies. In mid-high latitude the phenomena are related to the westward propagating mid-ocean trough and block high backing off. Therefore the westward propagating ISO from the north central-eastern Pacific to East Asia are indispensable for sufficient rainfall occurring in East Asia in summer, which is resulted from long-wave adjustment process in the mid-high latitudes and ISO evolving in tropical easterlies.

(2) The mainly relative atmospheric angular momentum (AAM) of easterly wind distributes in the low-level troposphere while the main AAM of westerly wind distributes in the mid-high levels troposphere from Eastern Asia to the northeastern Pacific. And the easterly AAM convert into the westerly AAM through the ascending airflow in the subtropical western Pacific while the reverse process takes place by the falling airflow in the northeastern Pacific. Then it is found the summer precipitation anomalies in China are close related with anomalous spatial distribution of AAM in East Asia and the overlapped region in which flood occurring and east-Asian subtropical front staying is always covered with the positive AAM anomalies. Then the paper analyzed and compared completely the 30-60-Day oscillation signals of 850-hPa meridional wind over the western Pacific with East-Asian subtropical summer monsoon index as summer floods and droughts occurring in eastern China from 1958-2002, and the results showed that the low-frequency index as the signal of China summer rainfall anomaly is superiority in most situations. The most important of results is that, by the wavelet cross-spectra method (Torrence and Compo,1998), 30-60-day oscillation phase of AAM lead the one of 850-hPa meridional wind and precipitation for about 20 days as flood occurring in East Asia, that is an applicable significance for the 10-30 days extended prediction from weather forecast.