

Interdecadal variability of the atmospheric circulations at the onset of the western North Pacific summer monsoon

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The low-frequency variability with periods of interdecadal variations or longer was examined for the atmospheric circulations associated with the onset of the western North Pacific summer monsoon (WNPSM). The region of WNPSM, (138°-160°E, 15°-25°N), is first determined in the western North Pacific (WNP) as the region with positive values in precipitation difference between the periods before (mid-July) and after (late July) the WNPSM onset (after - before). The time series analysis is then performed for the areal mean precipitation rate of the region after removing the linear trend. To extract the components with periods longer than 11 years, we employed the harmonic analysis and summed the components of wave numbers 1-3 for the time series of 1979-2010 (32 years). The low-frequency variability clearly shows the interdecadal tendency concurrent with the Pacific decadal oscillation (PDO) in the North Pacific even in boreal summer. In the first positive phase after 1979, i.e., 1985-93, the WNPSM begins in its own region, while the region shifts westward off the Philippines in the following negative phase of 1994-2000. In the next positive phase in 2001-07, the WNPSM is again established in its own region. The positive, negative, and positive SST anomalies in and around the WNPSM region with the PDO induce such interdecadal tendency in atmospheric circulations around the WNPSM onset. The linear trend removed, i.e., the lower-frequency variability, shows a tendency that the precipitation before the WNPSM onset increases, while it after the onset is almost unchanged in and around the WNPSM region. The similar tendency is identified in the tropical cyclone activity: it is stronger before the onset. It is confirmed that the onset of WNPSM has been unclear during the latest few decades.

Keywords: western North Pacific summer monsoon, PDO, accumulated cyclone energy