Typhoon activity associated with convectively coupled equatorial waves: Case study of June 2004

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Abstract

Following Wheeler and Kiladis (hereafter WK)'s method, a space-time spectrum analysis for each latitudinal circle between 15°S-15°N is performed using a satellite-observed daily outgoing longwave radiation (OLR) dataset. After removing estimated red nature background spectra, several clusters of significant spectral peaks are found in the wavenumber-frequency domain. Similar to the results of WK, some of the peaks correspond quite well to the dispersion relations of the equatorially trapped wave modes of shallow water equation on equatorial β plane with implied equivalent depths in the range of 12-50 m. Then, wave filtering is performed by choosing several specific region over the wavenumber-frequency domain which corresponds to Madden-Julian Oscillation (MJO) and each equatorially trapped wave modes, such as Rossby waves, mixed Rossby-gravity waves, and Kelvin waves etc. Based on the wave-filtered OLR, we analyzed the period, June 2004 during which typhoon activity was very active. Actually, the occurrence of five typhoons during pre-peak season was historically record-breaking. It is found that westward propagating mixed Rossby-gravity waves and Rossby waves were very active, which are accompanied by strong convective MJO envelope which passed through the western North Pacific region. Therefore, it is possibly hypothesized that enhanced low-tropospheric wave energy accumulation due to eastward energy propagation (eastward group velocity) by mixed Rossby-gravity wave activity and westward energy propagation (westward group velocity) by Rossby wave activity within convective low-frequency basic state provided favorable condition for typhoon formation as well.