

Estimation and Application of tropical cyclone heat potential from satellite remote sensing data

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Abstract

Recent studies have shown that sudden tropical cyclone intensification is linked with warm oceanic features. Tropical Cyclone Heat Potential (TCHP) data instead of sea surface temperature (SST) data is used to investigate tropical cyclone intensity changes. TCHP is defined as the integrated heat content from the depth of 26 °C isotherm to the sea surface. The primary purpose of this paper is to estimate TCHP of northwestern Pacific Ocean from the equator to 40°N and from 120°E to 180°E, as well as to explore the influence of TCHP on the genesis and intensification of tropical cyclone in this region. Sea surface height anomalies (SSHA) derived from TOPEX/POSEIDON (T/P) and Jason-1 satellite altimeter data, and sea surface temperature (SST) obtained from TRMM/TMI and AMSR-E radiometer data are used to estimate TCHP based on two-layer reduced gravity model. According to spatial distribution of TCHP, typhoon is dramatically stronger when it underwent the area with more TCHP than surroundings. From the result of regression analysis, it can be more intensified with higher and continued energy over typhoon duration. For further understanding of the relationship between tropical cyclone intensity changes and accumulated tropical cyclone heat potential (ATCHP) that affect by tropical cyclone genesis region. The three zones in the northwestern Pacific are the left side of Southern North Pacific Gyre (SNPG-L; 8-18°N, 130-150°E); the right side of Southern North Pacific Gyre (SNPG-R; 8-18°N, 150-180°E) and Eddy-Rich Zone (ERZ; 18-30°N, 120-180°E). It is found that the TCHP in the SNPG-L region is higher than the other two, and as well ATCHP. The TCHP field is complex in the ERZ region, in where the changes of tropical cyclone intensity are the least, and the accumulation of TCHP is fewer than the other two zones. It is shown the intensity changes might control by the TCHP conditions of tropical cyclone formation region. However, TCHP plays an important role to modify the change of intensity of tropical cyclone. It is helpful to estimate TCHP using satellite remote sensing with the two-layer ocean model. And there is no doubt that TCHP have proven to be useful for identifying the regions where the ocean thermal condition is favorable for typhoon intensification. Key word: Tropical Cyclone Heat Potential, Sea surface height anomalies, Sea surface temperature, Satellite remote sensing, Northwestern Pacific.