The effect of typhoon evolution on sea surface characteristics in the Northwestern Pacific by using multi-satellite data

利用多重衛星資料探討颱風的發展過程受海面特徵的影響

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Abstract

As the cumulus clouds get higher, the cloud top temperature would be lower. The structure of cloud system could affect typhoon intensity, the temperature increasing on the cloud top of the typhoon center could weaken typhoon intensisy. Meanwile, the strong convection induced by typhoon will make cumulus clouds reach higher. In this study, we will discuss the transformation of cumulus cloud distribution and the maximal wind speed near the typhoon center in the case of a violent typhoon passing through the sea with existing cold or warm eddy around there. The positive sea surface height anomaly (SSHA), converged water, represents as warm eddy but the negative SSHA, diverged water, represents cold eddy. Therefor, we could identify the sea surface characteristics with SSHA value. The data we use includes the best track from Japan Meteorological Agency (JMA), cloud top temperature data from Moderate Resolution Imaging Spectroradiometer (MODIS), and the SSHA from Topex/Poseidon and Jason-1. According to the best track data of JMA from 1981 to 2009, it is found that the primary typhoon season is from July to October every year. With satellite-based data, we consider the violent typhoons with life period over five days and discuss the effect of sea surface characteristics on the development of typhoons. To understand the effect of sea surface characteristics on the typhoon intensity, we analyzed this issue individually from the maximal wind speed near the typhoon center and development of cumulus cloud. The result shows that the correlation coefficient between eddies and the maximal wind speed near the typhoon center is about 0.5. Moreover, the correlation coefficient between eddies and cloud top temperature is near -0.6. When typhoon passed through a sea surface warm eddy, more heat energy offered from sea surface could enhance atmospheric convection to extend cloud layer to a higher place. This might affect the maximum of wind speed near the typhoon center indirectly. On the other hands, less heat energy offered from sea surface might decrease cumulus convection if typhoon passing through the sea with cold eddy around there. It is concluded that the change of cumulus convection could be one of important factor to influence the typhoon development. Understanding the effect between the eddy and cumulus convection could improve the prediction of typhoon intensity.

keywords: typhoon, cloud top temperature, sea surface height anomaly