

西北太平洋颱風壯度變化之研究

A Study on the Change of Tropical Cyclone Strength in the Western North Pacific

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摘 要

本研究利用2007~2018年的ASCAT (The first Advanced Scatterometer)衛星觀測資料、重建西北太平洋地區之颱風近地表風場結構，以分析颱風壯度(strength，定義為100~300公里之平均角動量)之變化。分析時，將颱風壯度變化前10%定義為快速擴張(rapid expansion, RE)。合成分析結果顯示，RE個案位於明顯季風距平環境中；而颱風之西南方則有強烈的低層西南風帶來水氣，增高中層溼度。RE個案之南方有強烈的高層輻散區，而衛星觀測亦顯示，RE颱風之南方有較多的降雨。角動量入流之分析結果顯示，在850百帕高度，RE個案於颱風外核區外，有相較於其他個案更多的角動量入流。另一方面，快速增強(RI)颱風則位於東風距平環境；颱風東北邊之中層溼度較低，可抑制颱風外核區域之降雨，使降雨集中在颱風中心。

分析結果同時顯示，颱風西南側中層溼度、南側高層輻散及西南側降雨和颱風壯度變化之相關性達0.4以上，顯示颱風西南部非軸對稱降雨對颱風結構變化具重大影響。中心西南部環境溼度較低的颱風個案，則需要較高的初始壯度才能到達RE。整體而言，颱風西南象限環境中層溼度，對於颱風是否出現RE的影響，大於其他區域環境溼度。

關鍵字：颱風結構變化、颱風壯度、ASCAT

Abstract

This study uses ASCAT (The first Advanced Scatterometer) data from 2007 to 2018 to reconstruct tropical cyclone (TC) symmetry surface wind structure. The TC strength is defined as the average angular momentum between 100 to 300 km, calculated from the reconstructed dataset. The first 10% of strength change per day is defined as rapid expansion (RE). The composites results using the reanalysis data show that RE cases are embedded in a monsoon environment with stronger low-level southwest wind, higher mid-level humidity, and larger high-level divergence to the southwest of TC. The CMORPH data also shows that RE cases have more precipitation in the southwest quadrant compared to that of other cases. Results also show that the RE cases have significant angular momentum inflow outside the TC outer-core region. In contrast, the rapid intensification (RI) cases are embedded in an easterly environment, with lower humidity in the northeast quadrant and less precipitation in the outer core region.

The correlation coefficient between the TC strength and the mid-level humidity, the high-level divergence, or the precipitation in the southwest or south region are all over 0.4. This result shows that the asymmetric convection, especially in the southwest quadrant, can play important role in affecting TC structure change. On the other hand, TCs with lower humidity in the southwest quadrant need higher strength to have RE occurred.

Key words: Tropical cyclone structure change, TC strength, ASCAT