

西北太平洋地區熱帶氣旋發展之合成分析

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摘 要

利用 Colorado State University 21年 (1957~1977) 的西北太平洋地區探空資料做合成，分析強度介於30~60 kts 間之加強型與非加強型的熱帶氣旋 (或輕度颱風)，發現加強型颱風有較明顯的深對流層內流且集中於2度地方；同時4度以內皆有明顯的上升運動，而非加強型颱風卻在2~3度發生了下沉運動。透過水汽場的分析，也發現下沉運動使得非加強型颱風，在靠近颱風中心附近有較低的水汽場分佈，尤其是2~3度間；這顯示出颱風發展需要有大範圍的水汽、能量供應，才能使對流集中於中心以加深熱帶氣旋。

經由計算 Q_1 及 Q_2 對颱風中心附近估計能量收支，結果發現加強型氣旋在 $0\sim 4^\circ$ 的積雲活動 (Cumulus activity) 和加熱作用幾乎和非加強型一樣；但是在 $0\sim 2^\circ$ 間加強型颱風卻遠比非加強型颱風強，也就是說加強型颱風於 4° 內的水汽輻合量大多集中於 2° 以內，而非加強型颱風之集中情形則較不明顯。更重要的是颱風增強乃在中心附近積雲加熱大幅增加之後才發生。

颱風的加強主要是發生於近中心 1° 以內。然而本文只能利用 2° 和 4° 之合成資料，做水平角動量傳送通量的分析，不能完整描述出颱風加強的機制；結果顯示加強型颱風在低層有較大之水平平均角動量內流通量，而渦流角動量的傳送則無較明顯之特徵。綜合結果可知在颱風強度增強之前積雲加熱作用和水平角動量內流已有大幅的增強；此表示了組織性之螺旋狀雲帶 (spiral band) 可能在颱風加強過程中扮演了重要之角色。

關鍵詞：颱風、颱風強度、合成分析

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An Observational Analysis Of Tropical Cyclone Development In The Western North Pacific

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ABSTRACT

This paper discusses the structure, and energy, moisture and angular momentum budgets of the composite developing and non-developing tropical cyclones. The composite data set was obtained from Colorado State University. It contains 21 years of western north Pacific rawinsonde data. Results indicate that there exists a deeper tropospheric inflow at 2 degree (latitude) radius in the developing system. The upward vertical motion is found inside 4 degree radius in developing tropical cyclone, but subsidence occurs at 2-3 degree radius in non-developing system. The moisture field also indicates a dryer region at lower atmosphere between 2-3 degree for the non-developing system. This is possibly due to the downward motion there. These results imply that stronger moisture flux penetrated from outer radii into inner region is conducive to the development of tropical cyclone.

Results also indicate that the developing tropical cyclone has much stronger cumulus activities and cumulus heating (Q_1) than the non-developing system inside 2° radius. However, over the area of $0-4^\circ$ radius, the difference is not much. This increase in cumulus heating inside 2° radius is found to occur before the major intensification process takes place. The angular momentum analysis also reveals an increase in the low level inward mean relative angular momentum flux before the intensification process. These results have highlighted the importance of the existence of the spiral rain band in enhancing the cyclone developing process.

Key words: Typhoon, typhoon strength, composite analysis