大氣模式對臺灣地區致災性降雨個案之預報能力

Prediction skills of Atmospheric Models for Catastrophic Rainfall Cases in Taiwan

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摘 要

過去侵(近)臺的颱風常易因大氣駛流場的影響，使其移動路徑有所變化，從而改變颱風影響臺灣本島的時間與地點，包括各地區降雨的致災程度；有鑑於此，96小時內影響臺灣的颱風路徑，成為預報作業中心關注的預警項目之一。本研究運用海軍大氣海洋局所建置天氣研究暨預報系統(WRF)及中尺度波譜模式(MSM)，相互比對上述兩種大氣模式對颱風24-96小時的預報路徑，分析對應不同預報時間的降雨特性，著重時間及空間的變化差異，以診斷這兩種大氣模式對臺灣地區颱風降雨的預報能力。

本研究針對2019-2021年共5個侵(近)臺颱風個案，分析颱風中心登陸或最接近臺灣的96小時以內的預報路徑及雨量分布。比對實際觀測結果，顯示影響颱風降雨預報能力的關鍵，在於颱風路徑預報的準確度；路徑預報能力為2天，且路徑若能越早預報準確，則降雨越能及早掌握。綜合分析降雨預報顯示，WRF及MSM基本預報能力為1天，某些個案配合準確的預報路徑，則可呈現2-3天的預報能力。

關鍵字：颱風、路徑、降雨、WRF、MSM、可預報度

Abstract

In the past, the tropical cyclones (TC) hitting (or being nearby) Taiwan were mostly affected by the atmospheric steering flow. The variety of TC tracks may alter the location and time for their influence to Taiwan, including the catastrophic levels of rainfall everywhere on this island. Therefore, one of the most important early warnings of the operational centers would be the TC tracks affecting Taiwan within 96 hours. In this study, the forecasting routes from the numerical models, WRF and MSM, developed by Naval Meteorological and Oceanographic Office are used to compare their difference. With the temporal and spatial differences, the forecasting characteristics of the TC rainfall over Taiwan can be diagnosed by comparing the 24-96-hour forecasting TC tracks from the two models.

A total of five TCs that hit (or are nearby) Taiwan during 2019 and 2021 are examined. Their tracks and rainfall amount forecasted by the models are used to analyze by selected period within 96 hours with the closest or equivalent TC center in Taiwan. Comparing the in-situ observation, it reveals that the key to forecast rainfall should be the predictability of TC tracks. Meanwhile, the track predictability can be two days. Thus, the earlier the tracks can be forecasted precisely, the better the rainfall can be predicted. In general, both WRF and MSM essentially have one-day rainfall predictability. With an improved forecasting track, the rainfall predictability can extend to two or three days in certain situations.

Keywords: tropical cyclone, track, rainfall, WRF, MSM, predictability