

全球定位系統掩星資料對熱帶氣旋形成 整體預報技術之影響

Influences of Global Positioning System Radio Occultation Data Assimilation on Forecast Skill of Tropical Cyclone Formation in the Western North Pacific

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摘 要

本研究利用區域模式、系統性預報2019年9-10月間西北太平洋內全部的熱帶擾動，包含9個發展擾動(developing cases)與23個不發展擾動(non-developing cases)，計算不同預報技術得分，探討全球定位系統(Global Positioning System)無線電掩星(radio occultation)資料對熱帶氣旋形成預報技術之影響，並分析其中的機制。每個個案進行兩組預報實驗，一組僅同化傳統觀測資料(Global Telecommunication System)，另一組同化傳統觀測資料與掩星資料，後者所同化的資料包含福衛七號(FORMOSAT-7/COSMIC-2)之掩星資料。相較於傳統資料組，掩星資料組可顯著提升模式初始場內擾動附近的中層相對濕度，並增加發展擾動的低層渦度、減少不發展擾動的中層渦度，這些特徵有利於提升熱帶氣旋形成的模式預報表現。統計結果顯示，掩星資料可提升0.21預兆得分與0.19準確度，並降低0.20誤報率，進而改進整體熱帶氣旋形成的預報技術。

關鍵字：熱帶氣旋形成，預報技術，全球定位系統，無線電掩星

Abstract

This study assesses the influence of global positioning system (GPS) radio occultation (RO) data assimilation on the comprehensive forecast skill of tropical cyclone formation over the western North Pacific in September–October 2019. The forecast skills are calculated based on nine developing and 23 non-developing cases. The latest RO data obtained from the Constellation Observing System for Meteorology, Ionosphere, and Climate mission II are applied. Two experiments are performed for each case. One assimilates conventional observations (Global Telecommunication System). The other assimilates GPS RO data in addition to conventional observations. Forecasts assimilating GPS RO data reduce the false alarm ratio by 20% and increase the threat score by 21%, compared to forecasts without GPS RO data. The assimilation of GPS RO data increases mid-level moisture around the disturbance centers at the initial time of forecasts. It also increases low-level vorticity for developing cases but decreases mid-level vorticity for non-developing cases. These changes favor improved forecast performance for tropical cyclone formation.

Keywords: tropical cyclone formation, forecast skill, global positioning system, radio occultation