利用現實參數模型提升台灣暴潮預報準確度

Improving Storm Surge Forecast Accuracy Using a Realistic Parameter Model

吳祚任[1] (Wu T.-R.) Satriana Roguna[1] 林君蔚[1] (Lin C.-W.)

[1]國立中央大學水文與海洋科學研究所

[1] Graduate Institute of Hydrological and Oceanic Sciences, National Central University

摘　要

本研究旨在精進台灣地區風暴潮預報系統，特別針對中央山脈對颱風氣象場的顯著影響所帶來的預報挑戰。台灣的地形特徵對颱風結構及其引發的風暴潮造成複雜影響，導致現有預報模型在台灣西部沿海地區常出現較大誤差。

為解決這一問題，我們提出創新的統計分析方法，開發現實參數化模型 (Realistic Parameter Model, REP)。研究中首先收集近年侵台颱風的ECMWF ERA5再分析資料建立颱風資料庫，並採用特徵縮放統計方法將颱風參數權重標準化。其次，通過計算各項參數之加權平均求得REP模型的氣象場，最後選取典型颱風案例搭配作業用暴潮預報模式（COMCOT-SURGE）進行後報驗證。

初步研究成果顯示，REP模型能夠有效捕捉中央山脈對颱風結構的影響，特別是在颱風穿越台灣期間的不對稱變形。與傳統理想風場模式相比，REP模型生成的風場和氣壓場更接近ECMWF ERA5再分析資料，顯著提高了風暴潮水位預報的準確度。

關鍵字：COMCOT-SURGE、ECMWF ERA5、Realistic Parameter Model

Abstract

This study aims to enhance the storm surge forecasting system in Taiwan, specifically addressing the challenges posed by the significant influence of the Central Mountain Range on typhoon meteorological fields. Taiwan's unique topography complexly affects typhoon structures and the resulting storm surges, often leading to considerable errors in existing forecast models, particularly along Taiwan's western coast.

We propose an innovative statistical analysis method and develop a Realistic Parameterization model (REP) to address this issue. The research first collects ECMWF ERA5 reanalysis data of recent typhoons affecting Taiwan to establish a database, employing feature-scaling statistical methods to normalize the weight distribution of typhoon parameters. Next, we calculate the meteorological field for the REP model through weighted averages of various parameters. Finally, we conduct hindcast verifications using the operational storm surge forecasting model (COMCOT-SURGE) for typical typhoon cases.

Preliminary results indicate that the REP model effectively captures the influence of the Central Mountain Range on typhoon structures, particularly the asymmetric deformation as typhoons cross Taiwan. Compared to traditional ideal wind models, the meteorological fields from the REP model more closely resemble ECMWF ERA5 reanalysis data, significantly improving the accuracy of storm surge level forecasts.

Key words : COMCOT-SURGE、ECMWF ERA5、Realistic Parameter Model