2023年卡努颱風引發台灣西南地區海水倒灌事件之數值模擬研究

Numerical Simulation Study of Coastal Inundation Induced by Typhoon Khanun along Taiwan's Southwest Region in 2023

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摘　要

2023年8月，中度颱風卡努雖未登陸台灣，卻在西南沿海引發嚴重海水倒灌，尤以雲林低窪地區災情最重。本研究運用COMCOT-SURGE多重網格風暴潮模式，結合TPXO全球天文潮模式，深入探討此次異常事件的成因。

研究中採用理想風場模型與大氣模式TWRF氣象場作為輸入條件，比較不同情境下的模擬結果。初步發現揭示，觀測到的極端潮位並非主要由颱風核心結構直接引起，而是多重因素共同作用的結果：首先，事件適逢年度大潮；且由颱風引導形成的穩定西南氣流對沿海水位持續抬升造成關鍵影響。

大氣動力模式模擬結果清晰展示了卡努颱風外圍環流與西南氣流的輻合現象。這種特殊氣流結構不僅增強了對台灣西南部的影響，還導致台灣沿海普遍水位抬升，解釋了為何颱風中心距離尚遠卻能引發如此嚴重災情。

關鍵字：COMCOT-SURGE、TWRF、理想風場、卡努颱風、海水倒灌

Abstract

In August 2023, although moderate Typhoon Khanun did not make landfall in Taiwan, it caused severe seawater inundation along the southwest coast, with the low-lying areas of Yunlin County suffering the most damage. This study employs the COMCOT-SURGE multi-grid storm surge model, combined with the TPXO global astronomical tide model, to investigate the causes of this unusual event in depth.

The study uses an idealized wind field model and the atmospheric model TWRF meteorological field as input conditions to compare simulation results under different scenarios. Preliminary findings reveal that the observed extreme tidal levels were not primarily caused by the typhoon's core structure directly, but rather resulted from multiple factors acting in concert: firstly, the event coincided with the annual spring tide; moreover, the stable southwesterly flow guided by the typhoon had a crucial impact on the sustained coastal water level rise.

The atmospheric dynamic model simulation results clearly demonstrate the convergence phenomenon between Typhoon Khanun's peripheral circulation and the southwesterly flow. This unique airflow structure not only intensified the impact on southwestern Taiwan but also led to a general rise in water levels along Taiwan's coast, explaining why such severe damage could occur despite the typhoon center being relatively distant.

Key words : COMCOT-SURGE, TWRF, idealized wind field, Typhoon Khanun, Coastal inundation