

長浪分級預警標準與評估

Development and Evaluation of Tiered Warning Criteria for Long Waves

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摘 要

本研究建立臺灣近岸長浪分級警戒方法，並以實測資料檢驗其作業應用性。警戒準則參考日本氣象廳湧浪分級概念，以示性波高為主要指標、尖峰週期為輔，將風險區分為低度、中度與高度；其中，中度警戒為波高2至4公尺且尖峰週期達8秒以上，高度警戒則為波高4公尺以上且尖峰週期達8秒以上。研究採用2024年1月1日至11月24日龍洞、花蓮及鵝鑾鼻浮標資料，分析警戒事件的頻率、持續時間與季節特性，並與現行長浪即時訊息比較。結果顯示，三處海域分別辨識出676、520及345筆警戒資料。花蓮與龍洞冬季事件主要受東北季風、鋒面及大陸冷高壓影響，夏秋季則以颱風湧浪為主；鵝鑾鼻警戒多集中於颱風期間，最長事件達114小時。凱米、山陀兒及康芮等強烈颱風皆造成明顯高度警戒。部分中度警戒事件未被現行即時訊息涵蓋，顯示分級制度可補足單一發布門檻之限制。整體而言，本方法能呈現不同海域及天氣系統下的長浪風險差異，可作為預報作業、防災決策與沿岸活動管理之參考。

關鍵字：長浪、分級警戒、示性波高、尖峰週期

Abstract

This study develops a long wave tiered warning method for coastal waters around Taiwan and evaluates its operational applicability using buoy observations. Following the long wave classification concept of the Japan Meteorological Agency, significant wave height (H_{m0}) is used as the primary indicator and peak wave period (T_p) as a supplementary criterion. Moderate warnings are issued when $2 \leq H_{m0} < 4$ m and $T_p \geq 8$ s, while high warnings apply when $H_{m0} \geq 4$ m and $T_p \geq 8$ s. Data collected at Longdong, Hualien, and Eluanbi from 1 January to 24 November 2024 identified 676, 520, and 345 warning records, respectively. Winter events at Longdong and Hualien were mainly associated with the northeasterly monsoon and cold-air systems, whereas summer and autumn events were dominated by typhoon-generated long wave. At Eluanbi, warnings occurred primarily during typhoons, with the longest event lasting 114 hours. Comparison with existing swell information showed that some moderate-risk events were not captured. The proposed method can complement the current single-threshold system and support marine forecasting, disaster risk reduction, and coastal activity management.

Key words: Long Waves, Tiered Warning, Significant Wave Height, Peak Wave Period