暴潮耦合波浪模式參數敏感度分析之探討

Investigating the Sensitivity Analysis of Parameters Using Storm Surge-Wave Coupled Model

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摘　要

臺灣屬於海島地形，因此土地面積有限，人口主要集中在河川及沿海地區。臺灣又因為地理環境與氣候條件，在每年的七月至十月期間經常有颱風侵襲臺灣，使得沿海地區容易直接受到颱風造成之風暴潮及波浪衝擊，時常導致沿海地區海堤被破壞，後續海水經由破堤處灌入堤內，進而導致沿海地區發生淹水事件，危害到沿海居民的生命安全。本研究選用 ADCIRC 模式與 SWAN 模式作為暴潮與波浪模擬模式，在完成建置臺灣沿岸及周遭海域之數值網格後，使用歷史颱風事件資料進行 ADCIRC 耦合 SWAN 模式的檢定驗證，結果顯示 ADCIRC 耦合 SWAN 模式可準確模擬歷史颱風事件在臺灣沿岸及周遭海域造成之波高、週期與風暴潮變化。

最後應用完成驗證之 ADCIRC 耦合 SWAN 模式進行參數敏感度分析，其中 ADCIRC 模式選擇的參數分別為 FFACTORMIN、FGAMMA、FTHETA 及 HBREAK 等 4 個參數，SWAN 模式共 6 個參數，分別為白帽(Whitecapping)相關的 5 個參數(分別為 cds2、stpm、powst、delta 及 powk)與底床粗糙長度 KN。其中 ADCIRC 模式中，參數 FFACTORMIN 最為敏感，而於 SWAN 模式中，參數白帽-stpm 最為敏感。

關鍵詞：波浪-暴潮耦合模式、ADCIRC、SWAN、歷史颱風事件、參數敏感度分析

Abstract

Taiwan is an island country, so the land area is limited. People are concentrated in river area and coastal area. However, under the climate and geography condition, typhoons hit Taiwan in July to October yearly, which leads to the phenomenon that storm surges and waves destroy sea wall, then sea water enters inner side of sea wall and make coastal area flooded frequently. Thus, people’s safety is often threatened by flood.

This study has selected storm surge and wave models, which are ADCIRC model and SWAN model, and has constructed numerical grid of Taiwan coastal and around sea area to perform the storm surge-wave model validation (ADCIRC+SWAN) using typhoon event history data. The results indicated that wave-storm surge coupled model satisfactorily simulated the change of wave height, period and storm surge, caused by typhoon event history data, in Taiwan coastal area and seas nearby.

Finally, the validated ADCIRC coupled SWAN mode is utilized to analyze the parameter sensitivity. The parameters selected by ADCIRC model are four parameters such as FFACTORMIN, FGAMMA, FTHETA, and HBREAK. There are six parameters in SWAN model, which are whitecapping (respectively cds2, stpm, powst, delta, and powk) and bed roughness length KN. Among them, in ADCIRC model, the parameter FFACTORMIN is the most sensitive, and in SWAN model, the parameter whitecapping -stpm is the most sensitive.

Keywords: storm surge-wave coupled model, ADCIRC, SWAN, historical typhoon events, parameter sensitivity analysis.