提升即時淹水模擬效能之研究

The Study on Enhancing Real-Time 2D Flooding Simulation Efficiency

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摘要

為使預報成果與現地情況更加相似，水規所針對系統中運算結構及資料進行盤點，藉由資料分析調整部分系統結構，以提升即時淹水模擬效能。本計畫將持續搜集國內外文獻，以瞭解運算結構及改善方法，藉由歷年的計畫成果中，發現影響即時淹水模擬的主要因素，包含基礎資料來源、模式架構與作業化平台等三大條件，並整理出目前提供即時淹水模預報的方式，其可區分為：「以二維淹水模式進行即時演算」，以及「透過事先演算成果，提供最相似的淹水模擬成果」二種。

針對運算結構部份，除參考 AHPS 的淹水潛勢圖發展案例進行外，另以 Google 為例，其透過 Machine learning (ML) 與遙測影像資料，結合水文與水理模式，提供高解析度洪水預報 (Nevo et al. 2018)之概念，與 JACOBS 公司透過 Flood Cloud 搭配 Parallel Works 平行運算技術提供，作為後續淹水模式效能提升的參考文件。

而在水理模式演算機制部份，影響即時淹水模擬準確性的因素大致上可分為模式演算方法、地文資料以及降雨逕流模組三方面的影響，配合逐步建立智慧河川、智慧防汛等 IoT 設備，預期將有大量即時現地資觀測資料，即時觀測資料在線上做為修正依據，提高淹水模擬結果的準確性，透過既有 Deltares SOBEK 淹水模式，以及新世代整合型淹水模式 DFlow-FM 進行模式比較。

最後則將以臺南地區即時二維淹水模擬作為標的，以近年來在該地區致災的數場颱洪事件進行測試，分析預報結果並檢討改善方法，以期找出提昇即時淹水模擬效能之方向。

關鍵詞：即時淹水預警、IoT、SOBEK、DFlow

Abstract

In recent years, with the improvement of hydrological observation technology, many hydrological observation techniques have been gradually applied to drainage planning. WRPI has verified the hydrological model applicable to Taiwan through the verification of the local observation data. Also, through the establishment of the SOP of building the hydrological model, the accuracy and computational efficiency of the hydrological model was able to improve.

To implement regional flood prevention, since 2015 Water Resources Planning Institute (WRPI) has used the results of the third-generation Flood Inundation Map to build the integrated platform for the application of high-performance 2D inundation simulation called "Flood Early Warning System." It has successfully integrated the FEWS_Taiwan to the Flood Inundation Map. In the system, the SOBEK model for Taichung City and Tainan City in Flood Inundation Map uses the forecast data of the CWB to predict the possible flooding range for the next three hours. After integrating SOBEK 2D flooding mode, FEWS_Taiwan has improved the flooding mode from static situational simulation to dynamic real-time data simulation through immediate and forecasted rainfall information, which is a crucial milestone for early warning of flooding areas. As the computer computing speed increases, the use of FEWS_Taiwan has stabilized the scheduling capability, coupling with a fast parallel computing architecture and the stable update of the basic data that improves the correctness and calculation speed of the model, the goal of instant flood warning can be achieved.

In order to make the forecasting results faster and simulation similar to the local situation, this year WRPI evaluation and analysis the operational system structure and data of the system and adjusts part of the system structure by data analysis to improve the efficiency of the real-time flooding forecasting.

The porject will continue to collect domestic and foreign literature to understand the computing structure and improvement methods, through the previous years' project achievements, found the main factors affecting real-time flood simulation, including the basic data source, model structure and operational platform.

For the computing structure part, there are two suggested directions at this stage: one is the flexible expansion and reduction of computing resources; the other is to remove computing resources for other requirements during non- typhoon flooding.

In the part of the hydraulic model calculation mechanism, the factors affecting the accuracy of real-time flooding simulation can be roughly divided into three aspects: the model calculation method, the geographic data and the rainfall-runoff module. At the same time using new hydraulic model D-Flow FM (base on the opensource model) to testing the possibility of 2D flooding simulation model transfer in the future.

Finally, the real-time 2D flooding simulation in Tainan area will be used as a target to test several flood events in the area in recent years, analyze the forecast results and review the improvement methods to find out the effect of improving the immediate flooding simulation.ed. …….

Keywords：real-time flooding simulation, hydraulic model, SOBEK, DFlow-FM