洪災減災模式發展與應用策略研擬

Development and Application of High-performance Early Warning System for Flooding Disaster Prevention and Mitigation

主管單位：國家災害防救科技中心

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摘要

本研究計畫於 109 年度災害預警技術研發工作分為兩大主軸，包括「水文水理新模擬技術開發」及「水動力數值模擬技術改進與擴充應用」。在「水文水理新模擬技術開發」方面，本年度將資料驅動技術應用於河川流量與水位模擬，流量部分以橫溪集水區流量站以及大豹、三峽、中正橋及大桶山等雨量站進行模式之訓練及驗證，測試結果顯示，訓練用資料年限愈長模式之表現愈好；但即使資料訓練年限僅 2 年亦可得到可接受之模式驗證結果。水位部分以應用四種機器學習技術，包括：支援向量迴歸(Support Vector Regression, SVR)、隨機森林迴歸(Random Forest Regression, RFR)、多層感知機迴歸(MultiLayer Perceptron Regression, MLPR)、以及決策樹迴歸(Decision Tree Regression, DTR)，已完成三個示範區域(蘭陽溪、濁水溪以及北港溪流域)之河川水位數據驅動模式建置與驗證，整體而言，支援向量迴歸模型 SVR 具有較佳的河川水位模擬表現，有助於未來河川水位數據驅動預報系統之研究發展。在洪水及淹水數值模式改良及擴充方面，除提升模式運算效能外，並增加其應用性，以達到真正科技防災效果，本年度完成建置荖濃溪上游與寶來溪匯流處(寶來社區)高解析度高地洪氾區淹水預警系統。平地淹水預警速算模組也於年度完成開發與初步建置，在高速有限元水動力模式運算下，可於 14-16 分鐘，完成過去 24 小時淹水模擬與未來 24 小時淹水預警，成果可結合 Google Earth 軟體進行地圖式展示。

關鍵詞：資料驅動、水文水理、支援向量迴歸、山區閃洪、淹水預警速算模組

Abstract

This study is composed of two main tasks including “data-driven techniques for hydrology and hydrodynamic” and “improvement of numerical hydrodynamic models”. The data-driven techniques were applied to simulate the river discharges and stages. The recorded rainfall, discharge data in Hengxi watershed was used to construct and train the artificial neural network (ANN). The testing results indicated that the performance of ANN model on river discharge simulation was acceptable even if the ANN model was trained for 2-year recorded data. Four machine learning techniques, the support vector regression (SVR), random forest regression (RFR), multilayer perceptron regression (MLPR) and decision tree regression (DTR), were employed for river stage simulation. The compared results revealed that the SVR owns the best performance on simulation of river stage for the Lanyang,

Choshui and Beigang River. Additionally, the operational high-performance early warning system for fluvial and pluvial flash floods in mountain and city-scale plain areas were implemented. The warnings are finally demonstrated by a map-oriented visualization tool.

Keywords：data driving, hydrology and hydrodynamic, support vector regression, flash floods in mountain area, high-performance computing module