驟發型淹水風暴之災害衝擊研究

Research on the disaster impact of storm induced flash flood

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摘要

台灣受海島型氣候及地形之影響，降雨之時空間分佈不均。除對水資源之開發利用造成困難外，近年來都會區由於城市建設以及人口集中，短時間風暴降雨引致驟發型淹水事件所造成之災害頻傳。本研究之先前研究發現，十分鐘短延時之強降雨與較長延時之六十分鐘之強降雨所標定之空間區位不同，不同氣象因子（颱風、梅雨及午後對流）下之短延時強降雨空間區位亦有所不同。爰此本研究結合過去短延時強降雨之研究成果及歷史災害資料庫，進行短延時降雨與地形之關聯特性分析，並發展短延時強降雨引致驟發型淹水於都會區之空間區位標定方法。研究發現三小時延時之可能致災降雨之氣候因子主要為颱風，其發生次數為梅雨之 11 倍、午後對流之 20 倍；二小時延時之可能致災降雨之氣候因子亦主要為颱風，其發生次數為梅雨之 7 倍、午後對流之 16 倍；相較於三及二小時，一小時延時之可能致災降雨氣候因子雖亦主要為颱風，但數量級相差不大:颱風之發生次數為梅雨之 4 倍、午後對流之 5 倍。研究中以相對地形高程之概念作為區域內水積淹難易程度之衡量指標，並以此指標作為機器學習之模式訓練特徵值之一，建立示範區之驟發型淹水致災之空間區位標定方法。研究最後部分為對象區域內之減災工程方案研擬，透過示範區淹水減災工程方案實施前後之二維淹水模式淹水模擬，可知淹水減災工程方案改善淹水面積及影響人口之情形，此結果可提供相關單位規劃淹水減災工程方案之參考。

關鍵詞：短延時強降雨、減災工程、淹水模擬、機器學習、氣象因子

Abstract

As affected by its sea-island type of climate and complex terrain, the temporal and spatial distribution of precipitation is uneven in Taiwan. Which not only caused issue of water resources allocation and utilization, but also, companion with urbanization and population concentration, the urban flooding disasters induced by sudden rainstorm became severer and more frequently. Previous studies shown that the spatial location of short-term heavy rainfall with a duration of 10 minutes is not the same as that of a longer duration of 60-minute rainfall. The short-term heavy rainfall spatial location under different meteorological factors (typhoon, plum rain and afternoon convection) are also different. So that, the research result of previous

study which related to short-term heavy rainfall and historical disaster database are manipulated in this study to analyze the correlation between short-term heavy rainfall and terrain, and developed a methodology of spatial location for sudden storm induced flood disaster in the metropolitan area. The study shows that typhoon induced disaster rainfall event number is 11 times to plum rain, 20 times to afternoon convective storm for 3 hours of rainfall duration. As for 2 hours of rainfall duration, the number of typhoon induced disaster rainfall event is 7 times to plum rain and 16 times to afternoon convective storm. By comparison to 2 and 3 hours of rainfall duration, 1 hour rainfall, the order of magnitude is smaller than previous two. The number of typhoons induced disaster rainfall event is 4 times of plum rain and 5 times of afternoon convective storm. In the study, the concept of relative topographic elevation was utilized as a measurement of the degree of flooding in the area, and this

index was used as one of the training feature values of the machine learning model to establish a methodology for the locating of the zoning of sudden flooding in the demonstration area. The final part of the study is the development of the disaster reduction project plan in the target area. Through the two-dimensional flood simulation, before and after of the implementation of the flood reduction project plan in the demonstration area, the flood reduction project plan improves the flooded area and affects the population can be acquired. The result of the study could be a reference for flood disaster reduction planning and studying.

Keywords：Short-Time Heavy Rainfall, disaster mitigation, inundation simulation, machine learning, meteorological factor

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