

應用數值模擬分析水庫防淤操作對下游河道水砂運移影響之研究

Application of Numerical Simulation on Water-sediment Transportation in Downstream Rivers during Reservoir Desilting Operation

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摘要

水庫集水區上游常因極端降雨事件而發生土壤沖蝕和崩塌，造成大量水砂進入水庫庫區，泥砂淤積問題可能導致水庫有效庫容減少，而透過防淤管理策略可將庫區水砂放流至下游河道以減緩水庫淤積，本研究主要探討石門水庫排砂操作對下游河道水砂運移之影響，依據河道數值高程模型資料建置二維地形網格，研究區域範圍上游自大漢溪新海橋和新店溪光復橋至下游淡水河台北橋和二重疏洪道水位站，以 SRH-2D 動床模式模擬分析 2015 和 2016 年颱風事件排砂操作情境下，石門水庫下游河道水砂運移現象及疏洪道通洪能力。模擬結果顯示水庫洩洪排砂過程會對下游河道及疏洪道造成局部區域冲刷或淤積現象產生，但短期颱風豪雨事件所造成之底床沖淤對於淡水河防洪並不造成影響，另由實測底床沖淤資料可知本研究模式能反映實際底床沖淤分布及變化趨勢，因此，本研究所建立之二維動床數值模式，可作為水庫防淤管理策略之評估工具，探討水庫減淤對於下游河道水環境影響之衝擊。

關鍵詞：水庫排砂操作、下游河道、動床模式、底床沖淤

Abstract

Soil erosion and landslide often occur in the upstream catchment of a reservoir due to extreme rainfall events, which lead to a large amount of sediment flow into the reservoir area. The problem of sediment deposits may result in the decrease of available reservoir storage. However, the sediment in the reservoir can be released to the downstream river using desilting operations during flood events. The influence of Shihmen Reservoir desilting operation on the downstream rivers is mainly discussed in the study. The river terrain in the two-dimensional mesh is built based on the data of the digital elevation model. The study area ranges from Dahan River Xinhai Bridge and Xindian River Guangfu Bridge to Danshui River Taipei Bridge and Erchong Floodway Gauging Station. According to the historical data of the Shihmen Reservoir desilting operation, this study uses a mobile-bed model in SRH-2D to simulate the phenomenon of water-sediment transportation in the downstream rivers and flood diversion capacity of the floodway during typhoon events in 2015 and 2016. The simulation result shows that the process of flood discharge and sediment sluicing could lead to the local bed scouring and silting in downstream rivers and floodways. It could reflect the distribution and trend of the bed were scouring and deposition based on the measured data. In order to achieve the goal of reducing sediment in reservoirs and water environmental protection in downstream channels, the results of this study could provide references for reservoir sedimentation management strategies.

Keywords: reservoir desilting operation, downstream rivers and floodway, two-dimensional mobile bed model, bed scouring and deposition