Estimation of Sediment Discharge and Trapping Efficiency in Shih-Men Watershed from LiDAR Technology

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Abstract

Presently, enormous sediment discharge induced by sever typhoon events became a series of critical problems for watershed management. Landslide and soil erosion are main sources of sediment. In northern Taiwan, Shih-men Reservoir is an important infrastructure that provides potable water to resident. After the Chi-Chi earthquake, landslides occurred frequently more than in the past. Massive amounts of sediment washed into the river, thus silting up some Sabo dams and reducing the reservoir storage capacity. The reservoir water became more turbid, causing water supply being suspended for half a month. In order to mitigate this situation, governments have paid more attention to watershed management and monitor the landform changes during typhoon season.

This study utilized LiDAR (Laser Detection and Ranging) technology to map landform of the Shih-men watershed for obtaining high resolution DEMs. The total volume of landside and trapped sediment in Sabo dams can be obtained from DEMs. The efficiency for various types of Sabo dams can be evaluated. Then, sediment discharge and trapping efficiency of Sabo dams can be precisely estimated. This technique can also be applied to monitor accumulated volume of sediment on the confluence between tributaries and trunk river, growth of alluvial fan, and large scale wedge of slope failure. Compared the DEMs from different periods, they can show the terrain migration and trace transportation of sediment yield from tributaries especially in extreme typhoon events. Some field tests and site investigations were conducted to validate the results as well. As with sediment concentration, relationship between suspend load and bed load was established for interpreting spatial distribution of sediment of the entire river course. Collection of precipitation data, site investigation on riverbed deformation and cross section measurement can provide information on the changes of river width, which implicate the amounts of erosion and scouring occurred during the typhoon event. The above obtained can provide useful information for more effective watershed management and hydraulic structure retrofitting.

Keyword: sediment discharge, landslides, LiDAR, trapping efficiency.

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