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Assessment of Spatially-Distributed Sediment Budget and Potential Shallow Landslide Area for Investment Prioritization in Sediment Control of Ungauged Catchment: A Case Study in Indonesia

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The Upper Citarum River catchment (2,283 km^2), West Java, Indonesia was selected as a study area. At the outlet of the Upper Citarum River, the Saguling Reservoir was constructed in 1986. The main purpose of this construction is to be a main source of hydropower in Java Island, also of water supply to freshwater fisheries and agriculture. Because of its position as the upper reservoir, most of the gross storage has been already filled with the large amount of sediment materials brought by flood events of the Citarum River. If the sedimentation keeps happening without any prevention and controlling actions, it will restrict reservoir functions and its lifetime. Herein, the condition of upper river catchment is an important factor in controlling the water balance, soil erosion, and sedimentation rate. This study analyses hydrological and sediment transport processes at the upland catchment through a modeling system to understand the spatial dynamic sediment yield and transportation, as well to guide decision making in strategic design related to sediment and runoff control. Since there is has the scarcity of gauging stations for sediment yield monitoring, distributed model is most suitable tool for the estimation of sediment-water balance at ungauged locations in the internal catchment.

A physically-based distributed sediment-runoff model has been developed to consider multiple sources of sediment transport, namely soil detachment by raindrops, soil detachment by overland flow, and shallow landslides. The model performance indicates the reliable application of the model to hydrological and sediment yield estimation. The model was in a reasonable way for reproducing observed sediment yield at the catchment outlet (Figure 1), in which the flows brought about 1.0-4.0 million ton per year of suspended sediment. Linking this model and various best management practices (BMPs) scenario algorithms has been intended for design of control strategy in trapping and controlling sediment-runoff and to evaluate the effectiveness of BMPs, which addressed for ungauged sites of internal catchment with high sediment yields. Structural measures of BMPs are employed here: vegetative filter, wet pond, reservoir, and land use scenario.

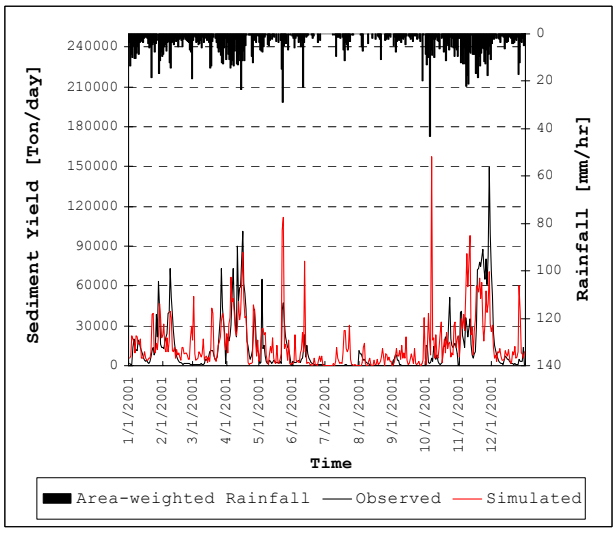

Figure 1. Simulated sediment yields and observed ones at the Saguling Reservoir Inlet.