

International Research (Project No.: 29W-01)

Project name: Development of an Integrated Sediment Disaster Simulator and Application to Sediment Disaster Mitigation and Reservoir Sedimentation Management in the Brantas River Basin, Indonesia

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Affiliation: University of Brawijaya

Name of DPRI collaborative researcher: Prof. Masaharu Fujita

Research period: July 1, 2017-March 31, 2019

Research location: Brantas River Basin

Number of participants in the collaborative research: 10 (provide numbers for DPRI and non-DPRI staff)

- Number of graduate students: 2 (provide numbers for Masters and Doctoral students)

- Participation role of graduate students [Development and application of simulator]

Anticipated impact for research and education

Technological innovation in sediment disaster mitigation and reservoir sedimentation management was achieved in Indonesia by introducing an integrated sediment disaster simulator. Young researchers advanced their understanding of simulation and modeling through using the simulator. Through this joint research including a couple of workshops, the collaborative relationship among University of Brawijaya, JASA TIRTA Corporation I and DPRI was much more strengthened.

Research report

(1) Purpose

In general, massive sediment movements take place in steep areas when an external factor such as rainfall, volcanic activity, or seismic motion exceeds some critical level, and can cause sediment disasters of potentially high cost. Secondary disasters such as volcanic debris flows are often triggered by rainfall as massive sediment movement after a volcanic eruption. Finally, if volcanic debris flow being trapped by a dam, severe sedimentation problem will take place in its reservoir. A major impact of reservoir sedimentation is the loss of its capacity. In addition, severe sedimentation in a reservoir will decrease its effective storage for flood control thus will increase flood risk disaster. An Integrated Sediment Disaster Simulator could be very useful to design the sediment disaster mitigation and reservoir sedimentation management. In this study we improve the simulator and apply it to the Brantas River Basin, Indonesia. After that, also we discuss whether the simulator is effective in understanding the situation of the issues on sediment management and finding out the appropriate ideas on sediment management.

(2) Summary of research progress

The selected site of this research project is Wlingi reservoir that is located on the southern skirts of Mt. Kelud. This basin is suffering from severe watershed erosion and heavily loads of volcanic ash ejected from the eruption of Mt. Kelud, the most active volcanoes in Indonesia. We assessed the sediment transport processes in the upstream, analyze its potential sediment disaster, and then formulate adaptation strategies to reduce the loss of reservoir capacity. The methodology and approaches adopted in this model are then discussed with collaborators via project events for prescribing better accuracies of the model. The application of the integrated sediment-runoff model to a mountainous watershed has been successfully providing detailed information on sediment transport processes in Wlingi river basin. The results show Wlingi reservoir to receive higher volcanic

material as bed load and suspended load during high-intensity rainfall from the northern slopes of catchment and sheet erosion material as suspended load from the southern part of remaining basin.

(3) Summary of research findings

Overall, it is found that the simulator is very useful to contribute in establishment of variety options to countermeasures against sediment disasters in the Wlingi dam. However, the data to identify the parameters in the simulator is limited. It is also very important to develop a monitoring system for rainfall, sediment discharge, topographical changes and sediment production. Moreover, the workshops were found to be effective modes of knowledge exchange among collaborator, partner, practitioner and researcher as well as strengthening the network.