

Install of a Movable shutter in Myo-Jyu Sabo Dam and Longitudinal Bedload Monitoring in Jyo-Gan-Ji River

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INTRODUCTION

On the purpose of sediment control in watershed management, information for sediment runoff and water flow has been tried to collect using various sensors by continuous measurement for bed loads and suspended load, turbidity, water level and so on in mountainous torrents in Japan. Relations between bed-load & wash-load and water runoff have been shown by those monitoring, and it is found that there are discontinuous relationship between sediment and water runoff in mountainous region and that direct monitoring for suspended loads is still now quite difficult.

A set of pipe-hydrophone (passive sensor) for bed-loads, pressure sensor for flow depth and turbidity meter for wash load, and electromagnetic velocity meter on the bed for shear velocity is selected for present suitable monitoring tool, and it is installed in several sections along to Jo-gan-ji River to evaluate longitudinal those changes concerning to water and sediment runoff. In addition, pipe-hydrophones and electromagnetic velocity meters are installed vertically on the side of a right hand side' slit of Tsunoura-Karyu sabo dam with two slits, in which watershed area is 139.49 km², bed slope near sabo dam is 1/56 (= 1.02 deg.) in 2007, slit width is 16 m, slit height is 7 m, to evaluated flow discharge and sediment discharge rate passing through a slit by measurement of vertical profile of velocity and the numbers of sediment particles. Those efforts yield one of possibility for suspended load measurements.

SABO DAM WITH MONITORING OF WATER AND SEDIMENT

Open type sabo dam such as slit sabo dam is an effective sabo dam for sediment control in open-type sabo dam, however, it is reported that sediment discharge rapidly increase due to losing water storage capacity in a stage of decreasing discharge in a flood. In order to positively control sediment runoff passing through a open-type dam, sabo dam with a shutter has been proposed. It means that sediment discharge can be controlled by iron structures such as a gate and some iron bars set in opening area of open-type sabo dam. There are five kinds of classifications, which has from "Level 1" to Level 5" for a shutter, based on shutter' type and its usage and structure such as fixed iron bars and movable iron bars and so on. Herein, "Level 1" and "Level 5" mean slit sabo dam with wide slits and open-type sabo dam with movable shutters, which is, for example, controlled by the power of oil pressure and so on.

In Jyo-gan-ji River, in order to control sediment runoff from open-type sabo dam positively, Tateyama sabo office has planned sabo dam with a shutter of “Level 5” (See Fig. 1). In 2012, tentative usage has been started, and several plans for its usage are supposed from 2013. Herein, in Myo-jyu sabo dam, watershed area is 115.2 km², averaged flow width is 60m, bed slope near sabo dam is 1/30 (= 1.91 deg.), 60% diameter of cumulated sieving mass distribution of sediment near the dam is 600 mm and the mean diameter is 326 mm.

ADVANCED MANAGEMENT FOR SEDIMENT IN MOUNTAINOUS AREA

In Jyo-gan-ji River, the monitoring tools and the systems for data collection for evaluating sediment runoff have been tried to prepare, and concentrated management for hydro- and sediment- information can be conducted from a view of sediment control in mountainous region. For example, events caused by rainfall and the others along the River reach could be detected easily, if clear water and sediment-runoff information and data obtained in several monitoring sections are integrated in sabo office. Active sediment control by sabo dam with a shutter could support advanced management, and the effective usage based on monitoring system can be conducted, if the system for hydro- and sediment- information collection can be progressed. Monitoring data obtained by passive sensor and so on along Jyo-gan-ji River are shown as temporal and longitudinal changes of sediment discharge via rainfall intensity for some typical rain fall events. Vertical profiles of velocity and the numbers of sediment particles passing through a slit in Tsunoura-Karyu sabo dam are shown, and construction of movable shutter of “Level 5” in Myo-jyu sabo dam is introduced.



(a) In case of closing a movable shutter

(b) In case of opening a movable shutter

Fig. 1 Myo-jyu sabo dam with a movable shutter

CONCLUSIONS

In Jyo-gan-ji River watershed, applied monitoring system for evaluating water and sediment runoff has been provided by longitudinally installed sensors for hydrologic information and sedimentation, and by data collection system using optical cable and so on. A movable shutter has been installed in Myo-jyu sabo dam. It seems that watching a basin can be conducted by temporal and spatial management. Data collections for water and sediment runoff could support in order to discuss about sediment management in a basin. The monitoring system and the movable shutter show one example of its suitable management for sediment runoff in mountainous basin.

Keywords: Bed-loads monitoring, Movable shutter, advanced management for sediment