

Longitudinal bed load and wash load monitoring in Jo-Gan-Ji river

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MONITORING OF WATER AND SEDIMENT

On the purpose of sediment control in watershed management, we tried to collect information for sediment runoff and water flow using various sensors by continuous measurement for bed loads and suspended load, turbidity and water level 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 relationships between sediment and water runoff in mountainous region and that direct monitoring for suspended loads is still now quite difficult.

Authors reviewed passive and direct sediment monitoring methods in mountainous region in Japan and abroad, and tried to develop those previous methods referring to examples proposed by Kyoto University, in which monitoring tools were reviewed and developed before around forty years (e.g., Mikami et al., 2014). Those results conclude that 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 for the bed for shear velocity can be present preferable monitoring tool, and it is installed in several sections along to Jo-gan-ji river to evaluate longitudinal changes concerning to water and sediment runoff, as shown in Fig. 1.

In addition, pipe-hydrophones and electromagnetic velocity meters are installed vertically on the side wall of a right hand sid slit of Tsunoura-Karyu sabo dam (Gray, J. R. et al, 2010) 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 evaluate flow discharge and sediment discharge rate passing through a slit by measurement of vertical profile of velocity and the numbers of sediment particles (See Fig. 1). Those efforts become one of possibility for suspended load measurements, because sediment concentration and velocity profiles on the side wall can be known vertically.

ADVANCED SEDIMENT MANAGEMENT IN MOUNTAINOUS BASIN

In Jo-Gan-ji River, the monitoring tools and the systems for data collection for evaluating sediment runoff were prepared since continuous monitoring in a section was started from 2001, and an advanced management for hydro- and sediment- information can be conducted from a view of sediment control and detection of sediment movements in mountainous basin.

For example, events caused by rainfall along the river reach could be detected easily, if clear water and sediment-runoff information and data obtained in several monitoring sections are accumulated in sabo office. Active sediment control by sabo dam with a shutter, which is located at (B) in Fig. 1, could support advanced management, and the effective usage can be conducted based on monitoring system, if the system for hydro- and sediment-information collection can be progressed.

In present study, monitoring data obtained by passive sensor and so on along Jo-Gan-ji River are shown as temporal and longitudinal changes of sediment discharge via rainfall intensity for some typical rainfall events. Figures 2 show one example of bed loads impulses and fine sediment discharge obtained by pipe-hydrophone and turbidity meter.

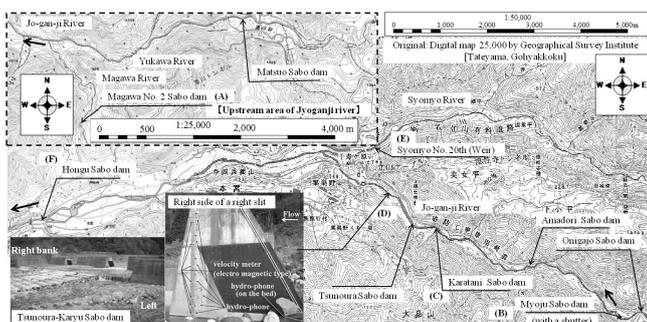


Figure 1. Sabo dams and monitoring sections in upstream reach of Jo-gan-ji River

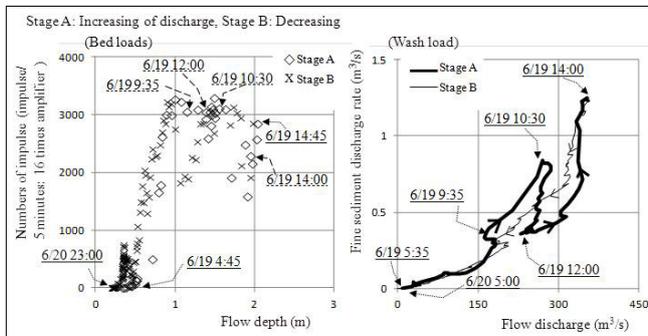


Figure 2. Temporal changes of bed load and fine sediment discharge observed at Tsunoura-Karyu sabo dam in flood events on 19th June, 2013

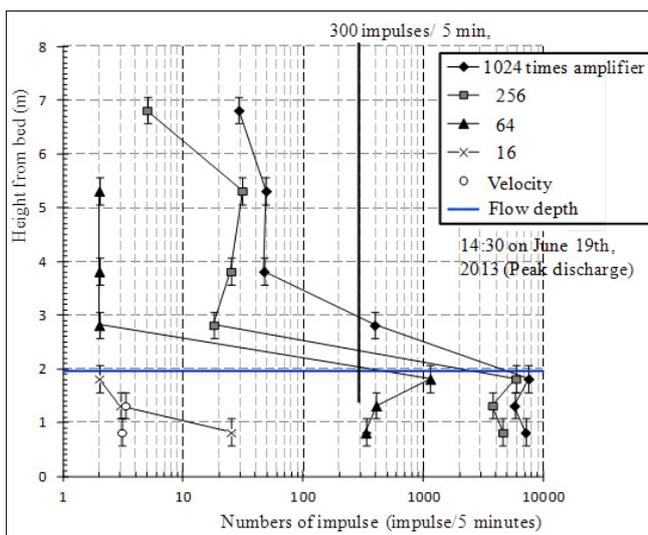


Figure 3. Vertical profiles of velocity and impulses of sediment observed at Tsunoura-Karyu sabo dam in flood events (19th June, 2013)

As shown in Fig. 3, vertical profiles of velocity and the numbers of sediment particles passing through a slit in Tsunoura-Karyu sabo dam are shown for suspended sediment concentration as one example of vertical profile of suspended loads. Those data could yield sediment discharge rate and the volume passing through the monitoring sections in every flood event.

REFERENCES

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KEYWORDS

Bed loads; wash load; monitoring; advanced sediment management; Jo-gan-ji River
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