

# Estimation of Temporal Change of River Bed Elevation Upstream of a Check Dam During Debris Flow

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## INTRODUCTION

A check dam has various functions in the standpoint of sediment related disasters prevention. Sediment control function is one of those. By this function, runoff sediment from upstream during large flood is saved temporarily, and this sediment is transported to downstream by medium or small floods which occur during several years or over decade after that large flood [Nishimoto, 2011].

Effects of the sediment control function have been assessed, in the past, by way of measuring the longitudinal gradient upstream of a check dam or by numerical simulations. However, there is no report showing the process of the function by observation during a debris flow.

The purpose of this study is to clarify the temporal change of the river bed elevation upstream of a check dam during debris flows. The authors estimated the river bed elevation with data continuously measured by the Laser Profiler Scanner (LPS). Together, we estimated sediment concentration.

## METHOD

**1. Observation site:** The study site is Arimura River in southern-east area in Sakurajima, Japan. Arimura River is debris flow prone river. The authors and Osumi office of rivers and highways of MLIT installed the observation system composed of a LPS and a force plate etc. on the spillway of the check dam 'the Arimura No.3 sabo dam'. Catchment area upstream of the dam is 1.55km<sup>2</sup> and slope gradient above the dam is 3.4 degree.

**2. Devices of observations:** To observe the temporal change of the river bed elevation during debris flows, authors installed a LPS (UXM-30LX-EW, Hokuyo Co., Ltd.) approximately 9 m above the dam. The LPS measures continuously longitudinal profiles of the bed within 30 m by radius. Furthermore, the sediment concentration of debris flow is estimated based on unit weight of debris flow measured by the force plate [Osaka 2013].

## RESULT

**Tab. 1** shows the list of measured data since December 2015 when the LPS started to measure longitudinal profiles of the river bed on the check dam. **Fig. 1** shows measured data about the debris flow that occurred June19, 2016. Situations of river bed elevation are focused on start, peak, decay and end phase. In this event, sediment at the end phase decreased compared with the start phase. However, at the decay phase, a larger amount of sediment had been deposited compared with the start phase. The deposited sediment at decay phase decreased due to the subsequent flow continuing over approximately one hour. Similar tendency is shown in most of debris flows listed in **Tab. 1**. **Fig. 2** shows the sediment concentration at the peak phase and the decay phase of debris flows that

the force plate data were obtained on December 10, 2015 and July 19, 2016. The sediment concentration at the decay phase in both cases shows slightly higher value compared with peak.

## CONCLUSIONS

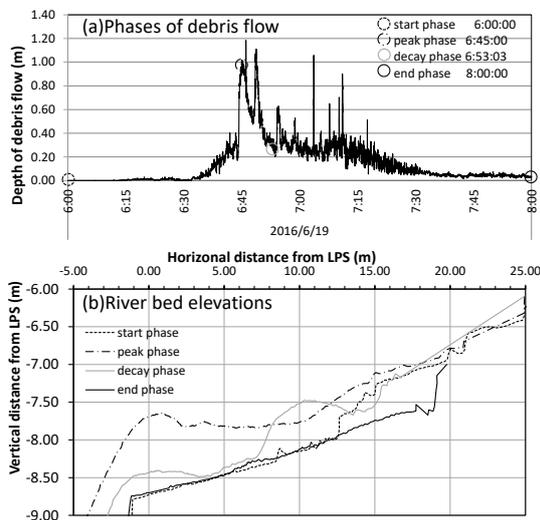
It is clarified that the river bed elevation upstream of the check dam at the decay phase is higher compared with the start phase although the elevation descended with passing of subsequent flow. This implicates that sediment stayed in upstream of the check dam for a while during debris flows. Sediment concentration at the decay phase when sedimentation occurred was slightly higher than peak phase. This implicates sedimentation occurs when debris flow rate decreases with high sediment concentration. From these result, the following is assumed. A larger amount of sediment may be deposited than the cases measured in this report, if debris flow rate decreases with high sediment concentration and if the subsequent flow does not continue a long time. In future, it is necessary to accumulate cases including another observation site and study the condition that sediment control function is expected.

## ACKNOWLEDGEMENT

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## REFERENCES

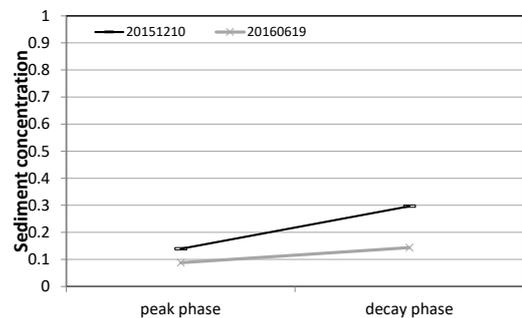
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**Fig. 1** River bed on the check dam during debris flow ((a) Phases of debris flow, (b) River bed elevations of each phase)

**Tab. 1** Measured data of debris flows

Date	Data of LPS	Data of Force plate
2015/12/10	○	○
2016/5/9	○	×
2016/6/19	○	○
2016/9/20	○	×



**Fig. 2** Sediment concentration at the peak phase and the decay phase

**Keywords:** sediment control function, debris flow, Laser profile scanner