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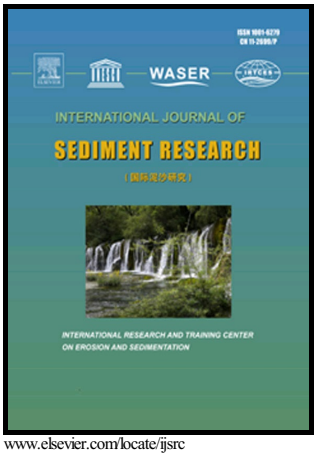

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Study on hydraulic characteristics of sabo dam with a flap structure for debris flow

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Abstract

The front part of the flow is very important and complex in the case of debris flow where there is an accumulation of large boulders. It is important to control or dampen the energy of the frontal part of a debris flow for the safety of the downstream area because the impact pressure of debris flow is much greater than that of clear fluid. The main objective of this study is to analyze the hydraulic characteristics of the proposed dam (i.e. closed-type dam with flap). The vertical pressure distribution of this type is compared with conventional dam types. In the experiments, the total pressure associated with major debris flows was recorded in real time by a system consisting of four dynamic pressure sensors installed on different types of dam. The results from experimental data clearly show that the dam with the flap has advantages of capturing the debris flow with large boulders and controls the total pressure by flow circulation due to presence of the flap structure compared to a closed-type dam without flap. Furthermore, the empirical coefficients of hydrodynamic and solid collision models were proposed and compared with available coefficients.

Keywords: Debris flow, Flap structure, Empirical coefficient, Total pressure

1 Introduction

The phenomenon of debris flow as the agent forming alluvial cones in the mouths of mountain ravines has attracted the attention of physiography for more than a century. Debris flows are also of concern to engineers who are responsible for human life and property. Although various countermeasures have been devised, debris flow is still one of the most threatening natural phenomena in some regions in the world (Takahashi, 1981).

Debris flows, which contain varying amounts of mud, sand, gravel, boulders, and water, are common in mountainous areas throughout the world. As these flows cause significant morphological changes along riverbeds and mountain slopes, they are frequently reported to produce extensive property damage and loss of life (Nakagawa et al., 2002). In addition, Kim et al. (2012) reported that the incidence of occurrence of debris flow disaster is relatively very small in comparison to other sediment-related disasters, but once the debris flow occurs, the potential of damage is huge.