Capturing Process of Debris Flow with Driftwood by an Open Type Check Dam

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1. Introduction

In recent years much driftwood has combined with debris flow, due to heavy downpours over mountainous rivers. Therefore, recent attention is required to focus on countermeasures of debris flow with driftwood. In this study, the numerical and experimental works are carried out to predict debris flow characteristics with driftwood and its control.

2. Numerical Models and Laboratory Experiments

A two-dimensional numerical model is developed for computing the behavior of debris flow with driftwood and its capturing process due to jamming of driftwood on a grid or slit type check dam. The numerical simulation is carried out with an interacting combination of Eulerian expression of the debris flow fluid motion and Lagrangian expression of the driftwood, in which the fluctuation components of the position and the rotational angular velocity of the driftwood are dealt with stochastically.

A rectangular flume of 5m long, 10cm wide and 13cm deep is set at slope of 18°. Sediment material of mean diameter d_m =2.39mm with 1.9m long and 7cm deep is positioned 2.8m upstream from the outlet of the flume. Cylindrical pieces of 38 driftwood pieces (ρ_d =0.785g/cm^3) are positioned on the sediment bed at the rate of 10cm c/c spacing in flow direction in two column 2cm apart. Debris flow is produced by supplying a constant water discharge 270cm^3/sec for 10sec from the upstream end of the flume. A check dam is set at 20cm upstream from end of the flume.

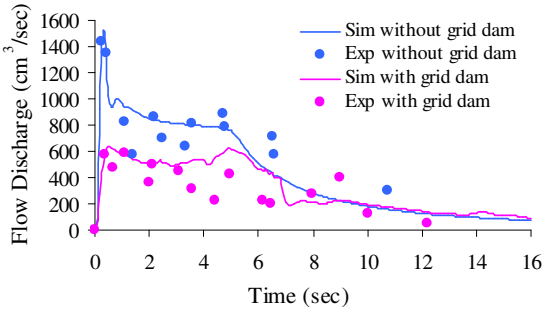

Fig.1 Flow discharge at downstream end, with driftwood, D_d=3mm, L_d =3.5cm.

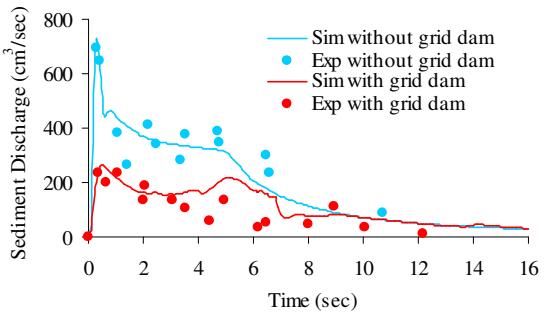

Fig.2 Sediment discharge at downstream end, with driftwood, D_d=3mm, L_d =3.5cm.

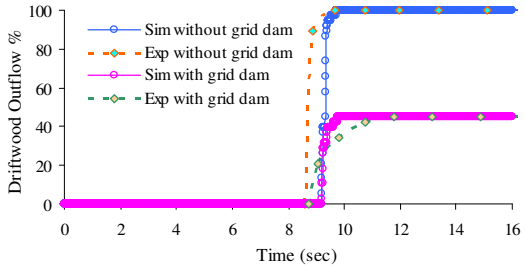

Fig.3 Driftwood outflow at downstream end, with driftwood, D_d=3mm, L_d =3.5cm.

3. Results and Conclusions

Fig.1 and **Fig.2** show the flow and sediment discharge at downstream end of the flume and reduction of flow discharge by grid dam with debris flow capturing due to jamming of driftwood on a grid dam. Debris flow is captured effectively by a grid dam due to the driftwood jamming. **Fig.3** shows the driftwood outflows at the downstream end of the flume. The simulated results of outflow discharge and driftwood are agreeable with experimental results. The driftwood passing through a grid dam is reduced due to the driftwood jamming on grid dam.