Numerical Simulation on Debris-Flow Deposition and Erosion Processes Upstream of a Check Dam with Experimental Verification

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1. Introduction

The understanding of behavior and mechanism of debris flow and the study of preventive measures are very important. In this study, the numerical model is developed to reproduce the debris flow deposition and erosion processes upstream of a check dam.

2. Numerical Models and Laboratory Experiments

The numerical simulations and experiments are performed for closed type and grid type check dams. To simulate the debris flow deposition upstream of a closed or a grid type check dam, a deposition model of upstream of a check dam and a model of blockage by large sediment particles in the case of a grid dam, are incorporated in the flow model of the debris flow. The riverbed erosion model under unsaturated bed condition is used to simulate the erosion process of deposited sediment upstream of a check dam by a normal scale flood flow.

A rectangular flume of 5m long, 10cm wide and 13cm deep is set at 18° for the experiments. Check dams are set at 20cm upstream from end of the flume. Sediment bed of mean diameter $d_m = 2.53$mm with 1.9m long and 7cm deep is positioned 2.8m upstream from the outlet of the flume. This sediment bed is saturated by water. Debris flow is produced by supplying a constant water supply 260cm^3/sec for 10sec from upstream end of the flume. In the case of erosion, the water discharge is supplied at a rate of 260cm^3/sec for 15sec after removing some large boulders initially deposited upstream of the check dam.

3. Results and Conclusions

Fig. 1 and **Fig. 2** show the simulated and experimental results of deposition and erosion processes upstream of the check dam at different time steps respectively. The deposition and erosion models could calculate the debris flow deposition and erosion processes upstream of a check dam. The simulated results agree well with the experimental results. The deposited sediment upstream of a grid dam can be flushed out to the downstream effectively due to erosion process by a normal scale flood flow when some initially deposited large boulders are removed.
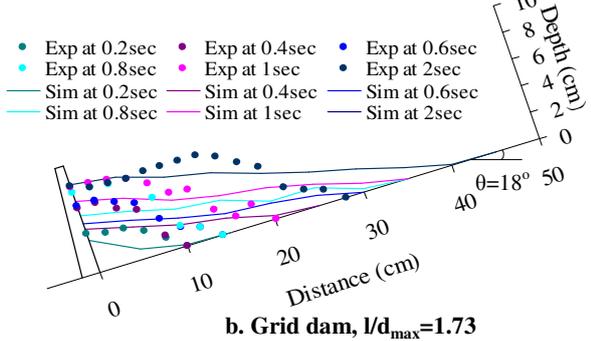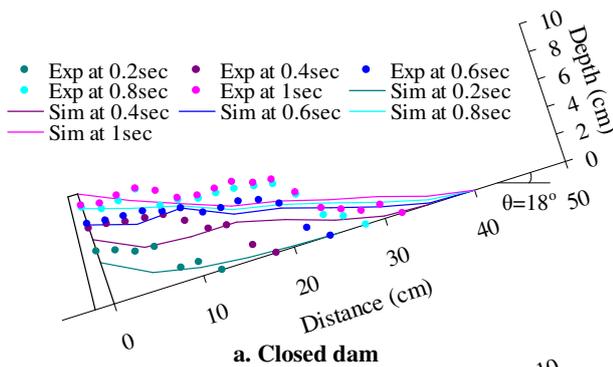

Fig. 1 Simulated and experimental results of debris flow deposition upstream of a check dam.
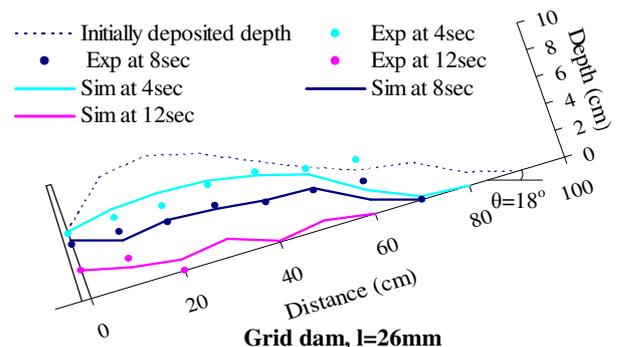

Fig. 2 Simulated and experimental bed variations of deposited sediment due to erosion process.