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Large-scale Flume Tests on Rock Avalanche

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Rock avalanches pose significant hazards in many parts of the world especially in mountainous areas. Rock avalanches also are among the most threatening flow-like landslides because of their large volumes and spreading, which make them potentially very costly in terms of human lives and engineering structures. Many rock avalanches were triggered by the Wenchuan Earthquake in Sichuan province, China, on May 2008.

A series of large-scale flume experiments for basic research has been performed to make clear the mechanism of earthquake-induced rock avalanches. The two-stage large-scale flume was 18m long, 7.4m high, 1m wide, and 1m deep. The upper section was 8m long, inclined at 45°, which connected with a 10m long section inclined at 10°. A gate was arranged at the top of upper section to control the release of sample. The parameters varied during the experimental series are the follows. (1) Initial arrangement of blocks: high and narrow, or low and wide; (2) Type of released materials: gravel and two kinds of blocks; (3) Pouring method of blocks in the release container: poured in randomly or piled orderly; (4) Release order: blocks then gravel, or gravel then blocks;

(5) A small convex bi-plane located at the joint between the upper and lower inclined portions; (6) Model forest; (7) Roughness of the slope surface; and (8) water flow.

Based on the results, it is found that the deposit could be divided into two parts and its reason is suggested in this paper. The rock blocks in the front of the release container travelled a longer distance than other blocks. The initial arrangement of block had influence on the travelling distance. Sands mixed into the released materials prevented the travel of the blocks and thus made the travelling distance of blocks shorter. A small convex bi-plane fixed at the joint between the upper and lower inclined portions increased the travelling distance. The model forest clearly decreased the travelling distance. Because the blocks moved in the type of rolling and bounding, the roughness of slope surface had almost not influence on the travelling distance of the blocks. The water flow on the slope surface prevented the travelling of the blocks.

Additionally, a prediction method for the longest travelling distance and its distribution is proposed; and a new relationship between moving velocity and travelling distance is derived. However, the causes of so long travelling distance has not been found yet, and further work needs to be carried out in the future to confirm this observation.