



## Effects of composition of grains of debris flow on its impact force

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Debris flows compose of solid material with broad size distribution from fine sand to boulders. Impact force imposed by debris flows is a very important issue for protection engineering design and strongly influenced by their grain composition. However, this issue has not been studied in depth and the effects of grain composition not been considered in the calculation of the impact force. In this present study, the small-scale flume experiments with five kinds of compositions of grains for debris flow were carried out to study the effect of the composition of grains of debris flow on its impact force. The results show that the impact force of debris flow increases with the grain size, the hydrodynamic pressure of debris flow is calibrated based on the normalization parameter  $d_{\max}/d_{50}$ , in which  $d_{\max}$  is the maximum size and  $d_{50}$  is the median size. Furthermore, a log-logistic statistic distribution could be used to describe the distribution of magnitude of impact force of debris flow, where the mean and the variance of the present distribution increase with grain size. This distribution proposed in the present study could be used to the reliability analysis of structures impacted by debris flow.