



A preliminary study on the mobility of debris flow in terms of grain-size dependent rheology

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In the stage of failure and post-failure associated with relatively slow-moving or fast-moving landslides, flow transition in fluidization processes can occur due to the strength loss. The key geomechanical quantities such as pore water pressures and failure speeds are very important to depict the catastrophic debris flow events. The physico-chemical characteristics of fine-grained sediments on their rheology is an important element in the mobility of debris flows as well. In terms of debris flow mobilization from landslides, we examined some aspects influencing the motion of large landslides with high mobility with respect to grain-size dependent rheological transition using the Bingham law. The results, along with a compilation of existing data, have been used to show that, as a first approximation, the yield strength/viscosity ratio is about 1000, 100, and less than 10 for clayey, silty, and sandy fine-grained sediment mixtures. However, for sandy and/or gravelly soils, there is almost an order of magnitude increase in the ratio of viscosity to yield stress as a function of the grain size. In such cases, the field-based estimate (e.g., Johnson’s expression) may be helpful. Using a simple approximation and debris flow modelling code, the deposit thickness in the depositional area and the velocities of debris flows can be reproduced. These aspects will provide a better understanding of soil behaviour in terms of flow transformation from slide to flow. In particular, without detailed geotechnical and rheological investigations, this rheological transition can be easily used by engineer to provide a first useful estimate of rheological parameters.