Large-scale flume modelling of segregation processes in debris flows

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Debris flows are powerful natural hazards posing risk to life, infrastructure, and property. Understanding the particle scale interactions in these flows is a key component in the development of models to predict the mobility, distal reach, and hazard posed by a given event. In this study we focus on the process of segregation in debris flows, using a large-scale landslide flume to explore segregation in mixtures of 25 mm, 12 mm, 6 mm, and 3 mm diameter particle sizes. Sample volumes, consisting of a multicomponent mixture of materials, up to 1 m$^3$ in size are released at the top of a 6.8 m long, 2.1 m wide slope, inclined at 30 degrees to the horizontal to initiate flow. Subsequent analysis is completed to determine the extent of vertical and longitudinal segregation of the post-landslide deposit morphology. A range of experimental strategies are explored to provide quantitative measures of particle segregation. Particle size is identified via image analysis and various techniques are applied for the longitudinal sectioning of the deposit, using measurements of segregation at the sidewall of the transparent flume, contrasted with planes measured from within the centre of the deposit. Further, replicate experiments are shown to quantify the probabilistic variation in segregation for multicomponent mixtures of dry granular flows, as well as initially saturated granular flows, to explore the effect of pore fluid on segregation processes.