Geophysical Research Abstracts
Vol. 20, EGU2018-11644, 2018
EGU General Assembly 2018

Segregation, grain size distributions, and debris flow erosion dynamics

Kimberly Hill
University of Minnesota, Civil Engineering, St. Anthony Falls Laboratory, Minneapolis, United States (kmhill@umn.edu)

Debris flows — massive flows of fluid and particles — shape the landscape in regions of higher slopes and create significant hazard for communities established in or near mountainous regions, both largely influenced by rates at which the flows erode the underlying slopes and subsequently grow or "bulk up". Many of these flows' behaviors are influenced by local and global grain size distributions and, subsequently, by segregation dynamics. In this presentation we discuss experimental data demonstrating the strong influence of grain size distribution in the flow and in an erodible bed on evolving erosion and deposition dynamics. Then we present two mechanistic segregation theories for dense gravity-driven particle flows to predict how local gsd may evolve; these include contrasting forms of two dominant segregation mechanisms – (1) granular temperature (2) effective buoyancy. We discuss how the specific choice of model influences predicted local evolution of grain size distribution and erosion rates. Then, we discuss a framework for generalizing the segregation – grain-size-distribution – erosion relationships: we consider mechanistic relationships that predict when a particular segregation model is more appropriate than the other and how this can be used to understand how segregation dynamics can cause erosion and related "bulking up" behaviors to vary from one flow to the next.