Geophysical Research Abstracts
Vol. 16, EGU2014-16912, 2014
EGU General Assembly 2014

Energy mechanics of rock and snow avalanches and the role of fragmentation (invited)

Perry Bartelt, Othmar Buser , and James Glover
WSL Institute for Snow and Avalanche Reserarch SLF, Davos, Switzerland

The energy mechanics of rock and snow avalanches are traditionally described using a two-step transformation: potential energy is first converted into kinetic energy; kinetic energy is dissipated to heat by frictional processes. If the frictional processes are known, the energy fluxes of avalanches can be calculated completely. The break-up of the released mass, however, introduces several new energy fluxes into the avalanche problem. The first energy is associated with the fragmentation, which generates random particle motions. This is true kinetic energy. Inter-particle interactions (collisions, abrasion, fracture) cause the energy of the random particle motion to dissipate to heat. A constraint on the random motions is the basal boundary. It is at this interface that the dispersive pressure is created by vertical particle motions that are directed upwards into the flow. The integral of the upward particle motions can induce a change in avalanche flow volume and density, depending on the relationship between the weight of the flow and the dispersive pressure. Interestingly, normal pressures will only diverge from hydrostatic when there are changes in flow density. We are therefore confronted with the problem of calculating not only the vertical acceleration of the dispersive pressure, but also the change in vertical acceleration. In this contribution we discuss a method to calculate random particle motions, dispersive pressure and changes in avalanche flow density. These are dependent not only on the absolute mass, but also on the material properties of the disintegrating mass. This becomes particularly interesting when considering the motion of snow and rock avalanches as it allows the prediction of flow regime changes and therefore extreme avalanche run-out potential.