Geophysical Research Abstracts
Vol. 12, EGU2010-2461, 2010
EGU General Assembly 2010

Numerical study of interaction between granular flow and obstacles: Continuum versus discrete approach

Markus Wawra (1), Yongqi Wang (2), Harald Teufelsbauer (1), and Wei Wu (1)

(1) Institute of Geotechnical Engineering, Universität für Bodenkultur, Vienna, Austria, (2) Fachgebiet für Strömungsdynamik, Technische Universität Darmstadt, Darmstadt, Germany

Gravity driven flows of geomaterials such as snow avalanches or debris flows are dangerous natural hazards in alpine regions. The estimation of flow velocity, run out distance and impact force on protection structures is of importance. This paper deals with the numerical simulation of granular flows down incline based on continuum and discrete approaches. Both approaches allow the simulation of the flow pattern and computation of impact forces on rigid obstacles.

The continuum modelling of flow-obstacle interaction is based on the depth-averaged, two-dimensional Savage-Hutter theory. The underlying differential equations are solved by finite difference with local grid refinement. The adaptive mesh refinement (AMR) is based on Berger-Colella's framework. The impact force is obtained by calculation the momentum before and after the impact with obstacle.

The discrete modelling is carried out with the commercial code PFC3D. The introduction of a constraint of particle rotation allows realistic description of the flow behavior. The influence of different effect of some model parameters on granular flow is studied, e.g. the run-out distance, deposition pattern, flow pattern and impact forces against obstacle.

The numerical results of the continuum and discrete approach are compared with each other. Their advantage and disadvantage are discussed. Moreover, the numerical results are compared with experimental data in literature. The experiments include for granular flow along an inclined channel and three-dimensional free surface flow along an inclined chute merging into a horizontal run-out region.