Geophysical Research Abstracts
Vol. 18, EGU2016-12985-3, 2016
EGU General Assembly 2016

The contribution of air-fluidization to the mobility of rapid flowslides involving fine particles

Frédéric Stilmant, Benjamin Dewals, Pierre Archambeau, Sébastien Erpicum, and Michel Pirotton
Hydraulics in Environmental and Civil Engineering (HECE), ArGEnCo Department, University of Liege, Belgium (b.dewals@ulg.ac.be)

Air-fluidization can be the origin of the long runout of gravitational flows involving fine particles such as ash. An excessive air pore pressure dramatically reduces the friction angle of the material as long as this pressure has not been dissipated, which occurs during the flow. This phenomenon can be modelled thanks to the 2D depth-averaged equations of mass and momentum conservation and an additional transport equation for basal pore pressure evolution (Iverson and Denlinger, 2001).

In this contribution, we discuss the application of this model in relation to recent experimental results on air-fluidized flows by Roche et al. (2008) and Roche (2012). The experimental results were used to set a priori the value of the diffusion coefficient in the model, taking into account the difference of scale between the experiments and real-world applications. We also compare the model predictions against detailed observations of a well-documented historical event, the collapse of a fly-ash heap in Belgium (Stilmant et al., 2015). In particular, we analyse the influence of the different components of the model on the results (pore pressure dissipation vs. pore pressure generation). The diffusion coefficient which characterizes the dissipation of air pore pressure is found sufficiently low for maintaining a fluidized flow over hundreds of meters.

The study concludes that an air-fluidization theory is consistent with the field observations. These findings are particularly interesting as they seem not in line with the mainstream acceptation in landslide modelling that air generally plays a secondary role (e.g., Legros, 2002).

References

Iverson, R.M., Denlinger, R.P., 2001. Flow of variably fluidized granular masses across three-dimensional terrain — 1. Coulomb mixture theory. *J. Geophys. Res*. **106**, 537 552.

Legros, F., 2002. The mobility of long-runout landslides. *Eng. Geol*. **63**, 301–331.

Roche, O., 2012. Depositional processes and gas pore pressure in pyroclastic flows: an experimental perspective. *Bull. Volcanol*. **74**, 1807–1820.

Roche, O., Montserrat, S., Niño, Y., Tamburrino, A., 2008. Experimental observations of water-like behavior of initially fluidized, dam break granular flows and their relevance for the propagation of ash-rich pyroclastic flows. *J. Geophys. Res*. **113**, B12203.

Stilmant, F., Pirotton, M., Archambeau, P., Erpicum, S., & Dewals, B. (2015). Can the collapse of a fly ash heap develop into an air-fluidized flow? - Reanalysis of the Jupille accident (1961). *Geomorphology*, **228**, 746-755.