Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2018-301-SC1, 2018

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Elasto-plastic-adhesive DEM model for simulating hillslope debris flows: cross comparison with field experiments" *by* Adel Albaba et al.

Cagnoli

bruno.cagnoli@ingv.it

Received and published: 10 December 2018

In granular flow mechanics, grain size is a key quantity since it significantly affects flow mobility as its influence on basal pressure suggests. In this respect, I can confirm the effect of grain size on basal pressure observed by Albaba et al., because we too have obtained in both physical experiments and numerical simulations that the maximum (and mean) basal stresses increase as the mean grain size increases (the values of all other variables being constant).

This is important because it confirms that basal stresses are due to particle collisions and it is so irrespective of the presence of an interstitial mud, which is present in hill-

slope debris flows but absent from our dry granular flow that are meant to study pyroclastic flows and rock avalanches. In our laboratory experiments, we have measured the stresses at the base of dry granular flows that travel down a curved chute by means of a miniature load cell plate flush with the subsurface (Cagnoli and Romano, 2012b). These experimental results have then been generalized and shown to be scale invariant by Discrete Element Method simulations (Cagnoli and Piersanti, 2018).

Albaba et al. illustrate a good set of field experiments and DEM simulations. Therefore, I would like to underline that the collisions of single rock fragments take center stage as far as basal stresses are concerned. Here below a few comments.

1) I would add grain size data about the field slurries in line 16 on pag. 4.

2) Size and shape of the obstacles with the pressure sensors is a piece of information that must be provided. If these obstacles are not too tall with respect to the flow thickness, the recorded pressures can probably still be considered basal stresses. Is this the case? If different words are used in the text ("plate") and in Fig. 2 ("sensor"), it is not clear whether the pressure plates that have recorded the data are flush with the channel subsurface or they are those mounted on the obstacles protruding from the subsurface.

3) Filtering pressure data by replacing the original values with local averages (lines 29-30 pag. 4, line 1 pag. 5, lines 4-6 pag. 14) causes the loss of precious information about particle collisions. The same can be said about disregarding the data set from the smaller pressure plate (lines 14-16, pag. 10).

4) In our laboratory experiments finer grain size flow are faster than coarser ones (Cagnoli and Romano, 2012a). I therefore wonder whether the presence of an interstitial mud reduces the differential between the energy dissipation rates of flows with different grain size since you obtain virtually the same speed for them (lines 8-9, pag. 18). Unless the distance between position 2 and the release location is too small to see any difference.

5) Concerning the negative pressure values visible in Fig. 22 on pag. 23, are they artifacts due to pressure plate oscillations after collisions with the rock fragments?

Bruno Cagnoli, INGV

References

Cagnoli B. and Romano G.P. (2012a), Effects of flow volume and grain size on mobility of dry granular flows of angular rock fragments: A functional relationship of scaling parameters, J. Geophys. Res., 117, B02207, doi:10.1029/2011JB008926

Cagnoli B. and Romano G.P. (2012b), Granular pressure at the base of dry flows of angular rock fragments as a function of grain size and flow volume: A relationship from laboratory experiments, J. Geophys. Res., 117, B10202, doi:10.1029/2012JB009374

Cagnoli B. and Piersanti A. (2018), Stresses at the base of dry and dense flows of angular rock fragments in 3-D discrete element modeling: Scaling of basal stress fluctuations versus grain size, flow volume and channel width. J. Volcanol. Geotherm. Res., 349, 230-239.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-301, 2018.