Modelling of particle size segregation and its applications to geophysical problems

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ABSTRACT

It is important to be able to predict the distance to which a hazardous natural flow (e.g. snow slab avalanches, debris-flows and pyroclastic flows) might travel, as this information is vital for accurate assessment of the risks posed by such events. In the high solids fraction regions of these flows the large particles commonly segregate to the surface, where they are transported to the margins to form bouldery flow fronts (Figure 1 : left, right).

A similar effect can be observed in dry granular experiments, which use a combination of small round and large rough particles. When this mixture is poured down an inclined plane particle size segregation causes the large particles to accumulate near the margins. Being rougher, the large particles experience a greater friction force and this configuration (rougher material in front of smoother) can be unstable (Figure 1 : middle).

Recently, Thornton *et al* [4] coupled a model for particle size-segregation[1], through a particle concentration dependent friction law, with existing avalanche models [3] in an attempt to describe the processes shown in Figure 1. Here, the particle-segregation model is solved using hpGEM [2] and compared to the results of both experiments and molecular dynamics simulations. Thus, allowing calibration and validation of the segregation model and hence increasing the prediction power of the coupled model.

References

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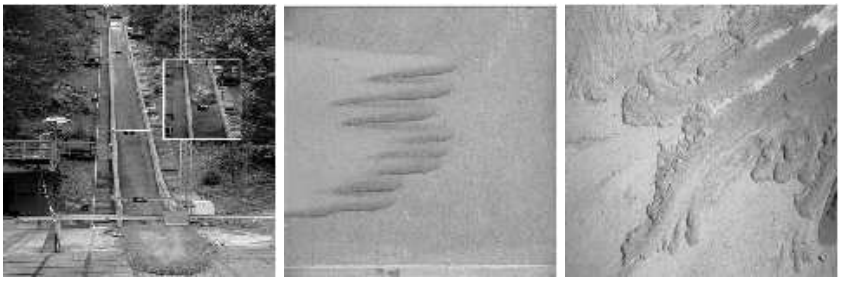

Figure 1: Left: USGS debris-flow flume. Middle : Small scale laboratory experiment showing the formation of fingers. Right : Small volume pyroclastic density current with lobate terminals.