SLIP VELOCITY DURING A GRANULAR MASS FLOW

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Catastrophic granular mass flows form an important natural hazard. In particular, their ability to travel long distances away from the release point remain a challenge to understanding and modelling. The mobility of granular flows is commonly characterised through the definition of rheological properties and effective friction, namely bulk properties. Yet, the flow boundary conditions and the slip velocity they induce may also play a significant role in the overall flow behaviour [1]. Their correct description is crucial in the perspective of continuum modelling.
In this contribution, we aim at disentangling the effect of bulk properties and boundary conditions on the spreading of a granular mass. Applying discrete simulations, we induce increasing slip velocities in different flow configurations. This is achieved by changing the roughness of the substrate over which flow occurs. We first consider a chute flow configuration. Changing the substrate roughness induces changes in the bottom velocity without affecting the flow profile, namely without affecting the bulk properties. The results are interpreted in terms of a Robin-Navier slip condition [2] (see figure 1). A second flow configuration is the column collapse. By changing the substrate roughness, we change the spreading length and dynamics. We reproduce both using a continuum Navier-Stokes solver (Gerris, [3]) in which we have implemented the Robin-Navier condition. In general, our results show that omitting the description of boundary conditions may leads to misinterpretation of granular flow properties.

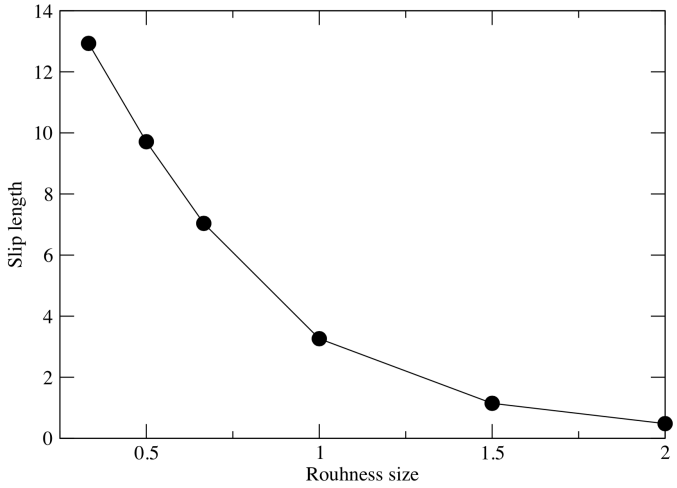

Figure 1. Robin-Navier slip condition: Slip length vs roughness (normalised by the grain size diameter) for chute flows.

References

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