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Understanding how volume affects the mobility of dry debris flows

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The prediction of the runout length L of large dry debris flows has long been the subject of a considerable research effort, primarily due to the obvious concern caused by their destructive power. One seemingly well established feature is the increase of the mobility $\mathcal{M}$ of a rock avalanche, defined as the ratio of the runout distance to the fall height, with its volume V. The physical nature of this lubrication mechanism remains however controversial. In this paper, we analyse field data and discrete numerical simulations of granular flows and discuss the geometrical origin of the apparent enhancement of the mobility with the volume. We evidence the intertwined role of volume and topography and show the existence of two contributions in the runout, defining two flow regimes: one dominated by sliding, in which the runout is independent of V, and another dominated by spreading, in which the runout is strongly dependent on V. In the light of these results, we discuss the search of a volume dependent lubrication mechanism as an ill-posed problem.