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Modeling of debris crushing during rock avalanche motion

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Study of numerous rock avalanches (RA) worldwide revealed that most of them are characterized by intensive comminution of debris that forms lower/internal parts of RA deposits and, at the same time, by retention of structure of the source rock massifs in RA debris despite that had passed a long distance from its source zone. The latter results in formation of pseudo-stratified bodies with unmixed 'layers' of debris that can be traced for several kilometers. Such internal structure excludes turbulence during rapid motion of dry granular flow typical of RA. It differs significantly from the style of motion of debris flows, which include significant amount of fluid obligatorily. Since such combination of crushing and of crushed material unmixing is typical, it must be reproduced both by physical and by numerical models of RA motion pretending to be reliable. Simple physical experiments demonstrate that intensive undamped crushing with retention of the initial structure of the material during its crushing can be achieved under repeated static loading with shearing – combination of mechanical processes quite reliable during RA motion, while similar loading without shearing results in crushing that fades much faster. The undamped crushing could be achieved by repeated loading with forced mixing too but in this case the original structure of the affected material can not retain. It allows assumption that mechanism simulated – static loading combined with shearing really act during motion of large-scale rock avalanches.