Un-channelized dam-break flows : effect of the lateral spreading on the flow dynamics.

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In this study, we used a three-dimensional discrete-grain model (Grains3D) to explore the flow and deposit characteristics of un-channelized dam-break collapses. A series of numerical experiments was performed to predict the behaviour of different granular columns (characterized by different initial aspect ratio a, varying from 0.5 to 18). As observed previously in similar channelized dam-break flows and axisymmetric slumps, the phenomenology of the collapse depends strongly on a, revealing different flow regimes. Small collapsing heaps develop shallow cascades that form deposits characterized by a tail extended by a rounded frontal region. Instead, tall avalanching columns generate dense, fast-moving currents that form a circular final deposit that resembles to those obtained from axisymmetric columns. The conversion from vertical to horizontal momentum was observed to be more efficient in these flows. The aggrading inner tapering region of static grains developed during the flow increases the number of final cascades necessary to adjust the slope of the final deposit, extending the total flow duration from 3tc in dam-break flows to 7tc in un-channelized ones. Surprisingly, mean aggradation velocities measured at different locations were observed to be independent of the lateral position, depending primarily on the longitudinal distance from reservoir and the initial aspect ratio. Scaled deposit widths and runouts revealed different power-law dependences on a exposing a non-isotropic behaviour which tends to form a smooth transition from channelized dam-break flows to axisymmetric slumps.