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Morphology-due uncertainties in gravity-driven mass movements on the Earth surface

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The gravitational force drives a large variety of mass movements over the Earth surface. As a first approximation, these movements are driven along the steepest descent path of the considered surface. Nevertheless, local morphologies, combined with the nature of the gravity-driven mass movements under examination, originate a variable discrepancy with respect to this approximation. The probabilistic code DOWNFLOW is an ideal tool to quantify this discrepancy. This code has been already extensively applied to simulate lava flows at several basaltic volcanoes, and is used here to calculate if a given mass movement flowing downhill will propagate by spreading over the topography or elsewhere constrained in narrow channels (or in between). We expressed this property in a channelization index which can be calculated by using DOWNFLOW at each point over a studied area to obtain a channelization map. As test case, we analyzed a 10 m-cell-size DEM of Mount Etna volcano (Italy), and DOWNFLOW runs are processed on-the-fly to obtain the relative channelization map. This map is of use for mass movements-related hazard and risk assessment, since it indicates, point by point, the uncertainty in the expected path followed by possible future flows.