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Shallow landsliding of pyroclastic soil covers in Campania (Italy): geomorphological characterization for spatial hazard assessment

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In a considerable part of the Campania region of Southern Italy, landslides that originate in pyroclastic soil covers are rather common phenomena after intense and/or prolonged rainstorms. The initiation of such landslides generally occurs with a sliding mechanism, followed by liquefaction of the slid materials. When initial sliding occurs along a channel axis, the landslides can be classified as earth/debris slides – earth/debris flows. When initial sliding occurs on open slopes, it is frequently followed by an avalanche phase: thus, the resulting landslides can be classified as debris slides – debris avalanches. In addition, due primarily to capturing by established channels along their paths, such landslides evolve into debris flows in about 80% of the documented cases. The debris flow phase is responsible for the largest part of their destruction capacity, owing to the travel distances related to channelling.

Analyses of the initiation loci of past landslides of this type, performed by several Authors, point out that the slope gradient, the concave elements (mapped at different scales as *zero order basins* or as *hollows*), and the man made or natural near-vertical discontinuities in the soil covers are the most relevant factors in landslide initiation.

In this paper we focus on the problem of the spatial predictability of this type of landslides, attempting, based on geomorphological analysis, the identification of the slope areas which can be more susceptible to sliding of the volcanic soil cover.

It has been noted that a large percentage (about 60%) of landslides of this type, which occurred in Campania in the last decades, originate close to discontinuities. In these

cases, the average slope gradients of the failed areas were generally lower than those of slides which did not originate close to discontinuities. Moreover, analyses carried out on detailed topographic maps and by means of high resolution DEM, show that slides that did not originate close to discontinuities appear to be related to concave morphologies. This is due to the concurrence between the features of the pyroclastic cover and the morphodynamics which is active within those particular elements, which makes them different from other (less steep and/or planar) hillslope elements. In addition also convex elements, such as noses, can be recognized in the pre-event morphology of the initial sliding zones of some of such landslides.

A correct estimation of the role played in landslide initiation by near-vertical cover discontinuities, as well as by concave (hollows) and convex (noses) elements, together with the possibility of their detection at various scales, is of crucial importance in the outline of criteria aimed at the evaluation of pyroclastic cover sliding susceptibility. Their occurrence, in fact, for a given pyroclastic cover, can locally result in slope angle sliding threshold values which are lower than those regarding continuous and planar sections of the slope. On the other hand, the detection of these elements by aerial photographs or poorly detailed topographic maps may result very difficult, particularly where the canopy cover of the hillslopes is dense. As a consequence, in those cases where the presence of such elements may only be suspected or inferred (for instance, by the lithostructural setting), we suggest that the threshold slope angles should be prudentially lowered, until more detailed representations can be achieved.