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Stability model and risk assessment for the Montescaglioso Landslide (Southern Italy)

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In this paper, we present the final results of a landslide risk assessment evaluation implemented for the recent Montescaglioso landslide emergency occurred on 3rd December 2013 when a large and rapid slope failure, triggered by prolonged and intense rainfall, affected a big portion of the SW slope of the village. The slope failure damaged a main road, private homes and commercial buildings. The Montescaglioso village (Basilicata Region, Italy) is located on the top of a conglomerate hill overlying a gentle slope constituted by Plio-Pleistocene clays. The area has been affected since ancient time by different landslide typologies and mechanism, as determined by a direct geomorphological survey and from mapping and available technical literature. Phenomena such as rock-falls and rock lateral spreading in the upper part of the hill, and rotational/translational slides and earth flows can be recognized in the area. Landslides are mainly promoted by the geological and structural setting of the area as well as by very low mechanical characteristics of sediments outcropping in the area. After the emergency phase, a detailed program of field survey and laboratory campaign has been implemented during the last year. A detailed topographical analysis has been developed by using the LIDAR survey in order to define morphometric conditions and geometry modifications of the slope affected by the landslide. Based on the studies carried out in the area, the research has been aimed to assessing the stability conditions (residual landslide risk) of the SW slope of the hill trough an extended geological, geomorphological and geotechnical campaign linked with numerical study of present instability mechanism. The geological and geotechnical model of the slope has been defined trough the analysis of the past and recent logs obtained from several boreholes and also through the results of many mechanical test performed on samples taken in the area. The numerical study has been carried out using two different commercial codes, the Differences Elements Flac ® and Finite Elements Phase2® in 2-Dimensional plain strain conditions, applied to a typical section extending along the slope. The geotechnical model has been calibrated trough a back analysis procedure of the December 2013 failure event. By adopting a reasonable hypothesis concerning the hydraulic conditions in the slope, this procedure allowed to reduce the mechanical parameter obtained during the geotechnical laboratory characterizations to the site scale. The numerical results stressed the influence of a pre existing deep potential failure surface able to trigger a phenomenon of the investigated magnitude. Monitoring data, which are currently in elaboration, are expected to integrate and enhance the understanding of instability mechanism affecting the Montescaglioso village. The reconstruction and modeling of the landslide evolution can be useful to suggest correct mitigation strategies that may help to prevent social and economic degradation of the territory