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# Ground surface strain field computation of an unstable slope

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The complete characterization of the kinematics of a landslide is the first step for the assessment and mitigation of its induced risk. In fact, such a characterization can provide useful information about the failure processes. A displacement field can be obtained by means of various techniques, e.g., terrestrial laser scanner (TLS), GPS, total topographical station. In particular, if TLS data are used, the displacement field can be very dense. On the other hand, GPS or total station measurements are particularly accurate, whereas the sampling step cannot reach the TLS' one. The availability of a displacement field allows the computation of the strain field related to the ground surface of the studied landslide. In this way, besides the information about the ground motions with respect to an external reference frame, information about surface deformations can be obtained. If the ground surface of a slope is almost planar, the strain field can be computed using a 2D approach via the modified least square (MLS) method applied on the nodes of a regular grid. In a 3D approach, the MLS computation can be performed on the points of a digital terrain model (DTM) of the slope ground surface. In both cases, the computations take into account the ground displacements, their spatial distribution, as well as the measurement and modelling errors. Moreover, a scale factor can be introduced in order to recognize possible scale depending behaviours. This methodology has been applied to two landslides: Lamosano (2D approach) and Perarolo di Cadore (3D approach), both located in the North-Eastern Italian Alps.