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Geophysical data fusion applied to the characterization of the La Valette mudslide

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From numerous studies, geophysical methods such as seismic surveying or electrical resistivity imaging appear to be well-adapted to investigate the structure of landslides and progress in understanding the mechanisms. These methods allow direct and non-intrusive measurements of acoustic (P), shear (S) wave velocity and electrical resistivity, three physical parameters considered as essential to estimate mechanical properties of reworked moving materials. Both of these methods were applied on the La Valette mudslide, in the French South Alps, where a typical example of intra-material slide can be observed. Measurements were taken simultaneously along 2 profiles of 400 m and 300 m in length, respectively perpendicularly to and along the axis of the mudslide. The P and S-wave velocity fields, as well as the electrical resistivity field, were inverted from recorded data according to suitable algorithms. P and S-wave velocity images as well as resistivity tomographies are presented and discussed in term of reliability. Preliminary interpreted results show a correlation between the seismic velocities and electrical resistivity data, confirming that the simultaneous use of both methods gives complementary information on geomechanical behaviour of the landslide. Seismic data provide information on fissure density variations and the presence of shear-bent material, whereas the electrical resistivity ones provide information on water content variations. In order to go deeper into petrophysical interpretation, a data fusion strategy based on fuzzy subsets theory is developed and applied to the geophysical dataset. The resulting cross-sections show the possibility of geomechanical hypotheses to be realized in specific areas of the tomographic cross-section, highlighting the places where mobilization of the loose sediments could occur.