



## **Integrated geological-geophysical models of unstable slopes in seismogenic areas in NW and SE Europe**

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We will present a series of new integrated 3D models of landslide sites that were investigated in distinctive seismo-tectonic and climatic contexts: (1) along the Hockai Fault Zone in Belgium, with the 1692 Verviers Earthquake ( $M \sim 6 - 6.5$ ) as most prominent earthquake that occurred in that fault zone and (2) in the seismic region of Vrancea, Romania, where four earthquakes with  $M_w > 7.4$  have been recorded during the last two centuries. Both sites present deep-seated failures located in more or less seismically active areas. In such areas, slope stability analyses have to take into account the possible contributions to ground failure.

Our investigation methods had to be adapted to capture the deep structure as well as the physico-mechanical characteristics that influence the dynamic behaviour of the landslide body. Field surveys included electrical resistivity tomography profiles, seismic refraction profiles (analysed in terms of both seismic P-wave tomography and surface waves), ambient noise measurements to determine the soil resonance frequencies through H/V analysis, complemented by geological and geomorphic mapping. The H/V method, in particular, is more and more used for landslide investigations or sites marked by topographic relief (in addition to the more classical applications on flat sites). Results of data interpretation were compiled in 3D geological-geophysical models supported by high resolution remote sensing data of the ground surface. Data and results were not only analysed in parallel or successively; to ensure full integration of all inputs-outputs, some data fusion and geostatistical techniques were applied to establish closer links between them. Inside the 3D models, material boundaries were defined in terms of surfaces and volumes. Those models were used as inputs for 2D dynamic numerical simulations completed with the UDEC (Itasca) software. For some sites, a full back-analysis was carried out to assess the possibility of a seismic triggering of the landslides.