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Two potential cases of earthquake-induced old landslides in Vrancea seismic region (Romania)

Mihai Micu (1), Hans Balder Havenith (2), Dan Balteanu (1), Alexandru Onaca (3), Carmen Cioflan (4), and Anne-Sophie Mreyen (2)

(1) Romanian Academy, Institute of Geography, Bucharest, Romania (mikkutu@yahoo.com), (2) Department of Geology – Georisks and Environment, University of Liege, Liege, Belgium (HB.Havenith@ulg.ac.be), (3) Geography Department, West University of Timisoara, Timisoara, Romania (alexandru.onaca@e-uvt.ro), (4) Engineering Seismology Laboratory, National Institute for Earth Physics, Magurele, Romania (cioflan@infp.ro)

In seismically active regions, earthquakes are representing a major trigger of large, deep-seated landslides. Either as co- or post-seismic failures, these landslides are decisive contributors to slope erosion and may induce significant impacts on fluvial morphology through intense slope-channel coupling. Such cases are abundant in the Vrancea Seismic Region (Curvature sector of the Eastern Romanian Carpathians), where numerous old (relict or dormant) deep-seated landslides caused important changes in river profiles (including temporary or permanent damming) and conditioned the fluvial processes downstream. The purpose of this paper is to outline the morphogenetic framework of such high magnitude and low frequency processes on the basis of two case-studies. The deep-seated Balta rock slump (92 ha, 60-80 m thick) is the prime example of a potential co-seismic landslide while the Paltineni debris flow (22 ha, 30-40 m thick) is most likely the result of post-seismic evolution of a seismically-triggered slump (the source area in the higher parts of the mountain can still be identified but not the originally failed mass). The two processes are discussed in terms of morphology (assessed through digital stereographic interpretation of aerial photos and LiDAR-derived hillshade DEM) and internal structure (based on ERT soundings). The factor of safety has been calculated for those two sites considering the most extreme but possible hydrological conditions. This analysis showed that, at least for the Balta landslide, an additional driving moment from seismic acceleration was necessary to trigger the movement; on the basis of this estimate the minimum shaking level and triggering earthquake magnitude have been determined. Such an approach is important within a multi-hazard risk preparedness and prevention framework as it allows us to define different levels of seismic shaking (in combination with variable climatic background conditions) and the related return periods.