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Recent slope stability of an ancient landslide in the Iskar Gorge, Bulgaria

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The Iskar River crosses transversely the tectonic structures of the Balkan Mountains and shapes a deeply incised valley. Different gravitational processes like landslides, rockfalls and taluses are developed on these slopes. The largest landslide in the region is named Ezerishte (Large lake), located on the right bank of the river, northeast of Svoge town, Western Bulgaria. The locals gave the name more than a century ago after another landslide activation, which caused damming of the river as the sliding masses have temporarily blocked the water flow creating a large lake.

The landslide has very significant dimensions: length ≈1250 m, width varying from 350 m to 1200 m. Based on calculation from satellite images the estimated landslide area is approximately 690 000 m2. The sliding surface depth is assumed to be at around 25 m resulting in landslide volume of approximately 15 Mm3. The appearance and activation of the Ezerishte Landslide is mainly governed by the erosional undermining of the foot of the slope and saturation of the landslide body from precipitation. Other destabilizing factors are the regional seismicity and human influence. Geotechnical survey conducted in the period 2002-2009 shows that currently the landslide is not stable. This was concluded from measured displacement velocities of 5-10 cm/year with up to 1.2 m/year in the lower part in 2005. This correlates well with the recorded extreme rainfall and river discharge values not only in Bulgaria but also in most of Central and Eastern Europe.

The current study aims to continue these investigations by using remote photogrammetry and surface measurements in order to establish the recent state of the slope stability and the landslide development. The employed methodology includes monitoring the landslide process based on comparison of available aerial and satellite images, newly obtained high-resolution photographs made by UAV for creating accurate georeferenced map. The location of observable elements like buildings, roads and geomorphological features was compared for the period of available data. Furthermore, displacement measurements of surface points are obtained for calibration of air data and higher accuracy of selected points. The ground survey measurements for relative displacements are made from benchmarks on the opposite stable bank of the river.

The following conclusions are drawn based on the analysed data: a) the landslide continues to be active at present; b) the lower part is more active than the upper one; c) the average displacement velocities correspond to the previously established; d) critical velocities in the landslide process are not observed. The plan for next research includes creating a 3D model of the landslide and hazard assessment of landslide activation. These results could contribute in quantifying the potential risk for the local people of Svoge municipality and related infrastructure passing through the valley.

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