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Landslides in a changing climate: assessment of hazard and exposure in the Arrábida (Portugal)

José Luís Zêzere^{1,2}, Eusébio Reis^{1,2}, Susana Pereira^{1,2}, Pedro Santos^{1,2}, Sérgio Oliveira^{1,2}, Ricardo Garcia^{1,2}, Raquel Melo^{1,3}, and Ana Rita Morais^{1,2}

¹Universidade de Lisboa, Centro de Estudos Geográficos, IGOT, Lisboa, Portugal (zezere@campus.ul.pt)

²Associate Laboratory TERRA

³Universidade de Évora

This work aims to assess the landslide hazard, nowadays and at the end of the 21st century, considering the SSP2-4.5 and SSP5-8.5 climate change scenarios. The exposure of residential buildings, roads and strategic equipment to landslide hazard is also assessed. The study area is a small alpine orogenic chain – the Arrábida – characterised by a complex geomorphology, developing along 35 km in the southern part of the Lisbon Metropolitan Area.

The landslide susceptibility was assessed using a statistical method (Information Value), using seven landslide predisposing factors: slope, aspect, slope curvature, topographic position index, topographic humidity index, lithology, and land use. These factors were crossed with a landslide inventory containing 4047 rainfall-triggered landslides occurred in 19 municipalities belonging to the Lisbon and Tagus Valley region, which includes the study area.

The obtained susceptibility model was cross-checked with 197 rainfall-triggered landslides that were inventoried in the Arrábida in 2012, based on aerial photo interpretation and fieldwork. The date of occurrence of most landslides is unknown, but we assume that the morphological maintenance of landslides in the landscape is less than 20 years.

The landslide susceptibility map was classified based on the slope breaks of the prediction-rate curve, and the current landslide probability was computed for each grid cell within each landslide susceptibility class.

Landslides in the Arrábida have been typically associated with intense rainfall episodes lasting a few days (5 to 15 days). The estimation of the future landslide probability considered the critical rainfall thresholds established for the Lisbon region by Vaz et al. (2018): (regression threshold, $R = 5.5D + 124.6$; minimum threshold, $R = 4.4D + 56.5$, where R is the critical rainfall, and D is the number of consecutive days).

In a recent work, Araújo (2021) projected the critical rainfall thresholds for landsliding in the Lisbon region for the end of the 21st century, in the context of climate change (SSP2-4.5 and SSP5-8.5 scenarios) and considering 4 accumulated rainfall time scales (1 day, 10 days, 30 days and 60 days). The projections for the duration of 10 days are of special interest for the case study, indicating an increase of 5% in frequency in the case of SSP2-4.5 scenario, and a reduction of 10% in frequency in the case of SSP5-8.5 scenario (Araújo, 2021). These features are considered to compute landslide probability per pixel for the end of the century.

References:

Araújo, J. R. (2021). Impact of extreme rainfall events on landslide events in Portugal under climate change scenarios. Dissertação de Mestrado, Faculdade de Ciências da Universidade de Lisboa.

Vaz, T., Zêzere, J. L., Pereira, S., Oliveira, S. C., Garcia, R. A., & Quaresma, I. (2018). Regional rainfall thresholds for landslide occurrence using a centenary database. *Natural Hazards and Earth System Sciences*, 18(4), 1037-1054.

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