Suggested Session(s):

a) 2.12 - LANDSLIDE EARLY WARNING SYSTEMS: INNOVATIONS AND APPLICATIONS

b) 4.10: LANDSLIDE RISK MANAGEMENT: THE CHALLENGES OF TRANSDISCIPLINARY RESEARCH IN DATA-SCARCE ENVIRONMENTS

Developing a spatiotemporal model to integrate landslide susceptibility and critical rainfall conditions. A practical model applied to Rio de Janeiro municipality.

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Despite being a landscape evolution element, landslides pose a significant threat to infrastructure, property, and human life around the globe. In Brazil, this has been a major source of concern for many years. Over the last decades, especially in the humid areas of Brazil, landslide occurrences have become more frequent and catastrophic (Pelech et al., 2019). Especially in large and medium-sized cities, poorly-regulated living conditions and a progressing global warming scenario will likely increase the frequency, magnitude, and possibly damage caused by landslides (Marengo et al., 2021). On the other hand, despite the efforts of local authorities to forecast and mitigate the phenomena, not enough is currently being done in terms of preparedness for future events, especially concerning research (Dias et al., 2021).

Due to the geomorphological and climatic settings, the municipality of Rio de Janeiro (~1,200 km²) is often affected by landslides (Coelho Netto et al., 2007; 2009). According to the Brazilian Institute of Geography and Statistics (IBGE, 2021), the municipality has 6.7 million inhabitants, of which circa 20-25% lives in the favelas. These communities, usually located on hill slopes, face diverse challenges such as poor basic infrastructure, lack of sanitation systems, and high criminality, which tend to diminish the inhabitants' awareness of potential landslide hazards. On the other hand, the municipality of Rio de Janeiro has systematically tracked rainfall data for the last decades. Such data comprises 33 stations, recording measurements every 15 minutes. Rainfall data is available for a few decades and comprise 33 stations recording measurements every 15 minutes. Also, the availability of high-resolution DTM and DEM (obtained through LiDAR with a 15 cm resolution), orthoimagery updated quasi-yearly, and a suitable landslide inventory, turns Rio de Janeiro into a promising real-life laboratory for suggesting and enhancing modeling solutions that may provide valuable tools for landslide emergency preparedness, management, and response.

Building upon the findings of Steger et al, 2022, the present research represents a joint effort to suggest a methodological framework to develop a dynamic landslide model that integrates static predisposing factors with dynamic rainfall conditions. Data-driven methods (e.g., Generalized Additive Models) will be used to establish statistical relationships between the static factors, the dynamic rainfall conditions prior to a potential landslide, and the landslide occurrence in space and time. The outcomes may be used by stakeholders to strategically prepare for potential rainfall events leading to landslides and possibly to improve early warning systems. Data collection

and preparation are currently happening, and the analysis will follow. Partial results will be presented at the 6th World Landslide Forum.

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Coelho-Netto AL, Avelar AS, Fernandes MC and Lacerda WA (2007) Landslide susceptibility in a mountainous geoecosystem, Tijuca Massif, Rio de Janeiro: The role of morphometric subdivision of the terrain. Geomorphology 87(3): 120–131. doi: https://doi.org/10.1016/j.geomorph.2006.03.041.

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Marengo JA, Camarinha PI, Alves LM, Diniz F and Betts RA (2021) Extreme Rainfall and Hydro-Geo-Meteorological Disaster Risk in 1.5, 2.0, and 4.0°C Global Warming Scenarios: An Analysis for Brazil. Front. Clim. 3:610433. doi: 10.3389/fclim.2021.610433

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