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Towards a quantitative spatiotemporal assessment of probabilistic landslide risk for large-area applications: challenges and perspectives.

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The probabilistic assessment of risk due to landslides for Disaster Risk Reduction (DRR) purposes in terms of absolute and quantitative metrics (e.g., number of expected fatalities, economic damage) is still quite challenging. If, on the one side, landslide susceptibility models based on the combined statistical analysis of observed events and geomorphological predisposing factors can be efficiently implemented, they must be integrated by further hypothesis and information to capture the complexity of landslides hazard and be efficiently used for the assessment of risk. For instance, most susceptibility models are static and do not formally account for main triggering conditions (e.g., rainfall or seismic activity). Furthermore, they do not include any probabilistic information on the frequency/magnitude relationships of the related events, hence conveying relative and partial information. In this contribution, a simplified framework for probabilistic landslides risk assessment is presented and its application for multi-hazard risk assessment in Burundi is discussed. The proposed approach is based on the integration of multi-temporal susceptibility models accounting for monthly average precipitation patterns into a heterogeneous Poisson point process model. The occurrence process model is used to generate a large portfolio of events, each associated with a feature representing its magnitude whose distribution is modelled by a simple power law. These events can be combined with exposure and fragility/vulnerability information to obtain a probabilistic assessment of risk of different adverse consequences on people, assets and infrastructure.

The proposed approach has been exemplified in the context of a multi-hazard risk assessment at national scale for Burundi and has proved successful in providing spatialised absolute and relative risk estimates that could be compared and combined with risk assessments related to other hazards (e.g., earthquakes and floods) with different characteristics and return periods.

The practical implementation was based on the available data for the targeted region, which is limited, and relies on several assumptions and hypothesis that are accompanied by a significant level of uncertainty. The results have been preliminarily assessed using the data provided by the IOM Emergency Tracking Tool (ETT) from the period 2018-2021. The results indicate that the framework is flexible and can be used to obtain actionable information on risk due to landslides at different temporal and spatial scales. Our findings further highlight the importance of addressing landslide risk from a larger, interdisciplinary perspective, fostering the systematic collection of risk-oriented data (e.g., event inventories including information on damage and loss) and the synergies among different actors involved in DRR and Climate Change Adaptation. The potential and limitations of the proposed approach for regional landslide risk and for multi-hazard risk assessment will be discussed. The described research activities have been carried out within the framework of an international project funded by the European Union, implemented by the International Organization of Migration (IOM) and coordinated by IDOM (Spain).