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Regional landslide hazard assessment in a deep uncertain future

Susana Almeida, Liz Holcombe, Francesca Pianosi, and Thorsten Wagener
University of Bristol, Department of Civil Engineering, Bristol, United Kingdom (susana.almeida@bristol.ac.uk)

Landslides have many negative economic and societal impacts, including the potential for significant loss of life and damage to infrastructure. These risks are likely to be exacerbated in the future by a combination of climatic and socio-economic factors. Climate change, for example, is expected to increase the occurrence of rainfall-triggered landslides, because a warmer atmosphere tends to produce more high intensity rainfall events. Prediction of future changes in rainfall, however, is subject to high levels of uncertainty, making it challenging for decision-makers to identify the areas and populations that are most vulnerable to landslide hazards.
In this study, we demonstrate how a physically-based model - the Combined Hydrology and Stability Model (CHASM) – can be used together with Global Sensitivity Analysis (GSA) to explore the underlying factors controlling the spatial distribution of landslide risks across a regional landscape, while also accounting for deep uncertainty around future rainfall conditions. We demonstrate how GSA can used to analyse CHASM which in turn represents the spatial variability of hillslope characteristics in the study region, while accounting for other uncertainties. Results are presented in the form of landslide hazard maps, utilising high-resolution digital elevation datasets for a case study in St Lucia in the Caribbean. Our findings about spatial landslide hazard drivers have important implications for data collection approaches and for long-term decision-making about land management practices.