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Landslide hazard assessment for climate change adaptation of linear infrastructure: From the global scale to the Nordic scale

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Rainfall-induced landslides represent an important hazard in mountainous regions worldwide. Landslides commonly impact the functioning of infrastructure assets such as roads and railways and occasionally damage buildings or result in fatalities. In the Nordic region, rainfall-induced landslides constitute a significant hazard, accounting for a considerable amount of Norway's national landslide database entries.

Because of climate change, the frequency of rainfall and soil moisture conditions that usually trigger landslides will become more variable. This leads to weaker predictions for the location and frequency of future landslide events from current models. Understanding how the landslide hazard will change can help plan mitigation along linear infrastructure and reduce the risk to the population.

Here, we report the findings from the NordicLink project, financed by Nordforsk, where a methodology to characterise landslide hazard at a global scale has been adopted to develop Nordic hazard maps.

The methodology to characterise the landslide hazard at a global scale has been developed within the activities of the "Global Infrastructure Resilience Index" (GIRI) project, funded by the Coalition for Disaster Resilient Infrastructure (CDRI). The method combines landslide susceptibility and rainfall to compute landslide probability at a global scale. The susceptibility map classifies terrains into five susceptibility classes by combining slope, vegetation, lithology, and soil moisture information from global datasets. Rainfall information has been obtained from the W5E5 dataset for the period 1979-2016 and the IPSL-CM6A-LR climate model from ISIMIP3b dataset SSP126 and SSP585 scenarios for the period 2061-2100. To characterise the rainfall triggering potential, the 24 h rainfall intensities have been used to distinguish between five rainfall hazard classes. Finally, a hazard matrix has been employed to combine landslide susceptibility and rainfall. The output is a probabilistic hazard map covering the world with a resolution of three arc seconds (approximately 90 m at the equator).

In the NordicLink project, higher-quality Nordic-scale data and landslide inventories are used as

input to the above-mentioned procedure to obtain probabilistic hazard maps covering Norway, Sweden, and Finland. The study concludes with a comparison between the NordicLink hazard maps and the (global) GIRI model. As expected, landslide hazard is higher in western Norway and decreases towards the East. Finland is the country with the lowest landslide hazard.