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Identification of landslide hazard and risk "hotspots" in Europe

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Landslide hazard and risk in Europe are in focus usually just after a recent catastrophe such as the widespread flooding and landsliding in Switzerland and Austria in summer 2005, Messina (Italy) in autumn 2009, or the events in Madeira in January 2010 and southern Italy in February 2010, despite the fact that numerous landslides occur all over Europe every year. Experts know to a certain degree which parts of the continent are most exposed to landslide hazard. Nevertheless, neither the geographical location of previous landslide events nor the knowledge about locations with high landslide hazard necessarily point out the areas with highest landslide risk. Often, landslides occur unexpectedly and the decisions on where investments should be done to prevent future events are based on hasty need for showing action and political will. The goal of this study was to do a uniform and objective analysis of landslide risk for Europe. Two independent models, an expert-based or heuristic and a statistical model (logistic regression), were developed to assess the landslide hazard. Both models are based on applying an appropriate combination of the parameters representing susceptibility factors (slope, lithology, soil moisture, vegetation cover, etc.) and triggering factors (extreme precipitation and seismicity). The weights of different susceptibility and triggering factors are calibrated to the information available in landslide inventories and physical processes. The analysis is based on uniform gridded data for Europe with a pixel resolution of roughly 30 m x 30 m. A validation of the two hazard models by organizations in Scotland, Italy and Romania showed good agreement for shallow landslides and rockfalls, but the hazard models fail to cover areas with slow moving landslides. In general, the results from the two models agree well pointing out the same countries with the highest total and relative area exposed to landslides. Landslide risk was quantified by counting the number of exposed people and exposed kilometers of roads and railways in each country. This process was repeated for both models. The results show the highest relative exposure to landslides in small alpine countries such as Lichtenstein. In terms of total values on national level, Italy scores highest in both the extent of exposed area and number of exposed population. Again results agree between the two models, but differences between the models are higher for the risk than for the hazard results. The analysis gives a good overview of the landslide hazard and risk hotspots in Europe and allows a simple ranking of areas where mitigation measures might be most effective.

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