Geophysical Research Abstracts
Vol. 14, EGU2012-7010, 2012
EGU General Assembly 2012

Impacts of global change on landslide hazard and risk in Europe in 21st century

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The research done previously in the SafeLand project (www.safeland-fp7.eu) identified the hotspots of landslide hazard and risk in Europe using three different models. All models were, however, based on the same input data. The analyses covered entire Europe, such that differences between regions and countries in Europe could be identified. This homogenous and objective analysis allowed comparing and ranking European countries in absolute or relative numbers of exposed land area, population and infrastructure. All models identified Italy as the country with the highest exposure to landslide risk. However, the small alpine countries had the highest relative exposure compared to their total land area and population. Overall, 4 to 7 million people in Europe, as well as significant amount of infrastructure are exposed to landslide threat.

In the expectation of a changing climate, the question arises on how the level and spatial pattern of landslide hazard and risk in Europe will develop in the 21st century. To answer this question, several factors must be considered. Not only will the climate change in the next 90 years, but also the demography and land cover in Europe will change significantly. Prognosis of landslide risk must take into account a possible reduction in the total population and significant urbanisation in most parts of Europe. This again leads to changes in land cover where for example the amount of forested areas and urban areas may change dramatically.

The paper presents the results of a study in the SafeLand project that explores the possible changes in landslide risk and hazard in Europe. The main objective of the study was to quantify the landslide hazard and risk in Europe now and in the future and see if there will be significant changes. Changing precipitation pattern, land cover and population were used as input to assess the landslide hazard and risk in the years 2030, 2050, 2070 and 2090. The results were then compared to the present situation in 2010. The effect of climate change varies depending on the type of landslide. In this study the focus was on precipitation-induced landslides, which are a direct consequence of the extreme precipitation events and therefore closely coupled to a change in the frequency of extreme events. Other landslides caused by draught or melt-freeze cycles are often followed a complex sequence of weather events that are difficult, if not impossible to forecast into the future.

The study showed that climate change and changes in land cover will only cause minor variations in landslide hazard. The risk associated with landslides, however, is expected to change significantly due to changing patterns of population in Europe.