Geophysical Research Abstracts
Vol. 15, EGU2013-8193, 2013
EGU General Assembly 2013
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Integration of landslide hazard maps into probabilistic risk assessment in context of global changes: an alpine test site

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The aim of this work is to develop a methodology to integrate global changes scenarios into quantitative risk assessment. This paper describes a methodology to take into account effects of changing climate on landslides activity and impacts of social changes on exposure to provide a complete evaluation of risk for given scenarios. This approach is applied for demonstration purpose on a southern alpine test site.

Mechanical approaches represent a solution to quantify landslide susceptibility and to model hazard on unprecedented conditions, as it is likely to occur. However, as the quantity and the quality of data are generally very heterogeneous at a regional scale, it is necessary to take into account their uncertainty in the analysis. In this perspective, a new hazard modeling method has been developed and integrated in a GIS-based software called ALICE®. To go further, climate change scenarios have been computed for the alpine test site (Barcelonnette area, France) using the REMO-COSMO-LM. From the precipitation time series, a daily index of the soil water content has been computed thanks to a reservoir-based model (GARDENIA®). Hence, the program classifies hazard zones depending on the several spatial data (lithological, DEM, etc. . .) and different hydrological contexts varying in time. The probabilistically initiated landslides are then propagated thank to a semi-empirical model (BORA) to provide real hazard maps.

Different scenarios of land-use have been developed using an automate cellular model to cover the probable range of development of potential elements at risks in the future. These exposure maps are then combined with the aforementioned hazard maps to obtain risk maps for the different periods and the different land-use development scenarios. Potential evolutions of landslide risks are then evaluated, with a general increase in the 7 communes. This methodology also allows the analysis of the contributions of both considered global changes (climate and land-use) to the evolution of risk.

This communication, realized within the framework of Safeland project, is supported by the European Commission under the 7th Framework Programme for Research and Technological Development, Area “Environment”, Activity 1.3.3.1 “Prediction of triggering and risk assessment for landslides” (grant agreement n°226479).