Geophysical Research Abstracts
Vol. 16, EGU2014-8734, 2014
EGU General Assembly 2014

Cascading processes and interactions in torrent catchments and their influence on the damage pattern

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Research on single geomorphological processes during damaging events has a long history; however, comprehensive documentations and analyses of the events have been conducted not until the late 1980s. Thus, for highly damaging events insights about triggering, the evolution and the impacts of processes during an event and the resulting damage were produced. Though, in the majority of cases the processes were studied in a well-defined procedure of one disciplinary focus. These focused studies neglect mutable influences which may alter the sequence of the process or the event. During damaging events multiple geomorphological processes are active which leads to the assumption that they have a certain impact on each other and the course of damaging effect. Consequently, for a comprehensive hazard and risk analysis all processes of a catchment have to be analysed and evaluated quantitatively and qualitatively (MARZOCCHI, 2007). Although the demand for a sophisticated risk management is increasing, the research on interactions as well as on physical vulnerability to multiple hazards, including the different processes impact effects, is still very limited (KAPPES et al., 2010, 2011). The challenges in this field are the quantity of data needed, and furthermore to conduct this kind of analysis is very complex and complicated (KAPPES et al. 2012). Yet, knowledge about possible interactions and resulting impact effects could significantly contribute to the reduction of risk in a region.
The objective of this study is to analyse, i) how geomorphological processes interact with each other and with other factors of the surrounding during a damaging event, ii) what influences those interactions have on the resulting damage of the event and iii) whether or not different events are comparable in terms of those interactions and their impacts. To meet these objectives, 15 damaging torrent events, which occurred between 2000 and 2011 in the Bernese Oberland and the Pennine Alps, Switzerland, were analysed on the basis of event reports and general catchment parameters. The interactions were classified into different categories regarding a process and the interacting counterpart (another process, with structures or disposition) and the temporal and spatial extent in which these interactions occurred. Additionally, positive and negative feedbacks of the processes were considered. First results highlight that some types of interaction can be extracted in several events and that their temporal and spatial extent is comparable. However, the analysis indicates that single interaction exhibits multi-path consequences which are a challenge for general propositions of interactions influencing damage patterns. In the further step of this study, clusters of interactions which could occur in different events in similar ways are analysed in more detail.

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