



## **Analysis of Alpine torrent events to validate existing vulnerability functions**

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Quantitative relationships between the intensity of natural hazard processes and the physical vulnerability of elements at risk are needed to accomplish quantitative risk assessments. Although research on vulnerability to floods and other Alpine natural hazards has increased over the past years, the quantification of appropriate vulnerability functions for the various processes that can occur in populated mountain areas still remains a crucial task. The lack of knowledge is mainly caused by the difficulty of back calculations of process intensity of past loss events and the less frequency of major loss events. The present study aims to fill this gap by presenting first results of quantitative vulnerability analyses for hydrological events in the Alps.

To this end, several events at torrents in Switzerland were analysed with regard to different vulnerability indicators. These indicators were derived from direct monetary losses due to events and the corresponding reinstatement values for single objects. The used data comprised on the one hand information on losses provided by building insurers and on the other hand data on process intensities, which were recorded from past events.

First results of this analysis suggest that losses due to high process intensities show large variances. They indicate that construction type, the location of an object in the affected terrain and protection measures directly at the object are major factors, which have to be regarded. The results confirm that vulnerability analyses at the local scale have to take the individual location and the characteristics of an object into account. A general derivation of vulnerability functions for specific objects inherently includes uncertainties, which have to be adequately addressed in risk assessment.