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The Aftershock Risk Index – quantification of aftershock impacts during ongoing strong-seismic sequences

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The occurrence and impact of strong earthquakes often triggers the long-lasting impact of a seismic sequence. Strong earthquakes are generally followed by many aftershocks or even strong subsequently triggered ruptures. The Nepal 2015 earthquake sequence is one of the most recent examples where aftershocks significantly contributed to human and economic losses. In addition, rumours about upcoming mega-earthquakes, false predictions and on-going cycles of aftershocks induced a psychological burden on the society, which caused panic, additional casualties and prevented people from returning to normal life.
This study shows the current phase of development of an operationalised aftershock intensity index, which will contribute to the mitigation of aftershock hazard. Hereby, various methods of earthquake forecasting and seismic risk assessments are utilised and an integration of the inherent aftershock intensity is performed. A spatio-temporal analysis of past earthquake clustering provides first-hand data about the nature of aftershock occurrence. Epidemic methods can additionally provide time-dependent variation indices of the cascading effects of aftershock generation.
The aftershock hazard is often combined with the potential for significant losses through the vulnerability of structural systems and population. A historical database of aftershock socioeconomic effects from CATDAT has been used in order to calibrate the index based on observed impacts of historical events and their aftershocks. In addition, analytical analysis of cyclic behaviour and fragility functions of various building typologies are explored.
The integration of many different probabilistic computation methods will provide a combined index parameter which can then be transformed into an easy-to-read spatio-temporal intensity index. The index provides daily updated information about the probability of the inherent seismic risk of aftershocks by providing a scalable scheme fordifferent aftershock intensities. These intensities define spatial locations and the temporal period when aftershocks are either probable or damaging.
Instead of providing a highly scientific probability mesh-up, the aftershock intensity index is an easy-to-communicate system of intensity levels for rescue and relief organizations but also governments and the common people. For this study, the metric is tested retrospectively on the earthquake sequences of Nepal 2015 and Darfield-Christchurch of 2010/2011.