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Improving vulnerability models: lessons learned from a comparison between flood and earthquake assessments

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In a cross-discipline study, an extensive literature review has been conducted to increase the understanding of vulnerability indicators used in both earthquake- and flood vulnerability assessments, and to provide insights into potential improvements of earthquake and flood vulnerability assessments. It identifies and compares indicators used to quantitatively assess earthquake and flood vulnerability, and discusses their respective differences and similarities. Indicators have been categorized into Physical- and Social categories, and further subdivided into (when possible) measurable and comparable indicators. Physical vulnerability indicators have been differentiated to exposed assets such as buildings and infrastructure. Social indicators are grouped in subcategories such as demographics, economics and awareness. Next, two different vulnerability model types have been described that use these indicators: index- and curve-based vulnerability models. A selection of these models (e.g. HAZUS) have been described, and compared on several characteristics such as temporal- and spatial aspects. It appears that earthquake vulnerability methods are traditionally strongly developed towards physical attributes at an object scale and used in vulnerability curve models, whereas flood vulnerability studies focus more on indicators applied to aggregated land-use scales. Flood risk studies could be improved using approaches from earthquake studies, such as incorporating more detailed lifeline and building indicators, and developing object-based vulnerability curve assessments of physical vulnerability, for example by defining building material based flood vulnerability curves. Related to this, is the incorporation of time of the day based building occupation patterns (at 2am most people will be at home while at 2pm most people will be in the office). Earthquake assessments could learn from flood studies when it comes to the refined selection of social vulnerability indicators. Based on the lessons obtained in this study, we recommend future studies to further explore cross-hazard studies.