



Multi-hazard assessment of earthquake triggered levee failures and floods along the Rhine River

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Compound and cascading hazardous events have the potential to cause severe losses, even though their probabilities might be very small. However, the small overall likelihood of such scenarios may catch affected communities by surprise, resulting in far reaching adverse consequences. We present a multi-hazard analysis of flood scenarios along a 130 km reach of the Rhine River around Cologne, Germany. The considered inundation events (or higher water levels) are initiated by levee failures induced by liquefaction, which are triggered in turn by earthquakes. Earthquake scenarios were selected based on the results of a disaggregation of a probabilistic seismic hazard assessment along the levees protecting the area from flooding and used in combination with the developed levee fragility curves for liquefaction to drive a fully coupled river-levee-floodplain hydrodynamic model. The resulting inundation extents and levee breach patterns are computed for different combinations of earthquake and flood scenarios, together with their associated probabilities.