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Drivers of flood damage on event level

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Flood risk is dynamic and influenced by many processes related to hazard, exposure and vulnerability. Flood damage increased significantly over the past decades, however, resulting overall economic loss per event is an aggregated indicator and it is difficult to attribute causes to this increasing trend. Much has been learned about damaging processes during floods at the micro-scale, e.g. building level. However, little is known about the main factors determining the amount of flood damage on event level. Thus, we analyse and compare paired flood events, i.e. consecutive, similar damaging floods that occurred in the same area. In analogy to 'Paired catchment studies' - a well-established method in hydrology to understand how changes in land use affect streamflow – we will investigate how and why resulting flood damage in a region differed between the first and second consecutive flood events.
One example are the 2002 and 2013 floods in the Elbe and Danube catchments in Germany. The 2002 flood caused the highest economic damage (EUR 11600 million) due to a natural hazard event in Germany. Damage was so high due to extreme flood hazard triggered by extreme precipitation and a high number of resulting dyke breaches. Additionally, exposure hotspots like the city of Dresden at the Elbe river as well as some smaller municipalities at the river Mulde (e.g. Grimma, Eilenburg, Bitterfeld, Dessau) were severely impacted. However, affected parties and authorities learned from the extreme flood in 2002, and many governmental flood risk programs and initiatives were launched. Considerable improvements since 2002 occurred on many levels that deal with flood risk reduction and disaster response, in particular in 1) increased flood prevention by improved spatial planning, 2) an increased number of property-level mitigation measures, 3) more effective early warning and improved coordination of disaster response and 4) a more targeted maintenance of flood defence systems and their deliberate relocation. Thus, despite higher hydrological severity damage due to the 2013 flood was significantly lower than in 2002.
In our international comparative paired event study we investigate under which circumstances similar or contrasting processes occurred and hope to identify common key processes which determine flood damage on event level.