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# Sensitivity of flood loss estimates to building representation and hazard attribution methods in micro-scale flood modelling

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Thanks to modelling advances and the increase of computational resources in recent years, it is now feasible to perform 2-D urban flood simulations at very high spatial resolutions and to conduct micro-scale flood risk assessments at the scale of single buildings. In these approaches, flood hazard and exposure are estimated by means of spatially detailed models solving the 2D shallow water equations and detailed datasets of the values at risk. For buildings, these datasets include the reconstruction value and the characterization of the vulnerability. A variety of methods can be adopted regarding the estimation of hazard, exposure and vulnerability in micro-scale flood risk assessment. In general, the flow depths computed by the flood model are attributed to the buildings. With these flow depths and a vulnerability function, the loss can be computed. Although a number of studies describe relevant uncertainties in these approaches, the uncertainties regarding the methods for the spatial representation of the buildings and the methods for attributing the flow depths to the buildings have not been analyzed so far.

In this study, we explore the sensitivity of flood loss estimates to building representation and hazard attribution methods in micro-scale flood risk modelling. The main aim is to contribute to the development of consistent frameworks for micro-scale flood risk assessments, with a balanced accuracy and spatial detail of the different steps of the modelling process. To this end, a micro-scale flood risk assessment framework is proposed and tested in a low density residential zone in the canton of Bern in Switzerland. The framework comprises a 2D flood inundation model and a flood loss model, which provide hazard and impact estimates for a given flood event at a high spatial resolution. We analyze the sensitivity of the predicted flood losses to: 1) the building representation in the flood inundation model, comparing the so-called building hole, building block and no-building methods; 2) the attribution method in the flood loss model (i.e. the assignment of flow characteristics to each exposed building), based on the depth values within and around the building footprints. Finally, we compare these sensitivities with those of the loss estimation against the chosen vulnerability functions.

The results show that the building representation has a very limited effect on the exposure values (i.e. the number of elements at risk), but can have a significant impact on the hazard values attributed to the buildings. On the other hand, the two methods tested in this work for hazard attribution result in remarkably different flood damage estimates. The sensitivity of the predicted flood losses to the attribution method is comparable to the one associated with the vulnerability curve. The findings highlight the need for incorporating these sources of uncertainty into micro-scale flood risk prediction methodologies.