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Quantifying exposure: the influence of value estimation schemes

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The value of tangible assets exposed to natural hazards is commonly estimated based on rather rough data, at least in risk analyses at regional to national scales. Until recently, monetary values per surface area have been the norm and they have been based on aggregated classes of land use and lumped economic data of administrative units. However, more and more risk studies at national scales use data at building level, given the growing availability of high resolution data and increasing computational power. Yet, individual monetary values of assets are usually not available because of data privacy restriction or trade secrets and, thus, need to be estimated. While a few studies investigate the influence of different data sources of exposed assets on the resulting exposure value, up to date, the role of estimation methods has hardly been analysed.

On the example of flood exposure in Switzerland, this contribution compares five different value estimation methods based on commonly available aggregated data. Four of them refer to individual buildings whereas the fifth one is based on monetary values per surface area. The study uses countrywide available data on individual buildings, on land use and on flood-prone areas, in combination with a database of more than half a million building insurance contracts containing monetary building values. This unique database makes it possible to compare the results of different value estimations schemes with one another, and with the values of the individual insurance contracts.

We find that models based on individual buildings produce more reliable results than the model based on surface area, but only when they include the individual building volume. Overall, simpler models underestimate the value of flood-exposed buildings in Switzerland by about 30%. This under¬estimation is even more pronounced in areas with extremely high exposure values. In fact, the spatially aggregated monetary values of exposed buildings are all distributed with a right skew, independent of the applied model. However, the right distribution tails of the more sophisticated models are heavier. With regard to risk management strategies, this underestimation of extremely high values by simple models is particularly relevant, as risk reduction activities generally focus on these areas of extreme exposure. In decision-making processes based on cost-efficiency, the underestimation of the exposed assets' value would result in suboptimal resource allocation for protection measures.