Implementation and adaptation of a macro-scale methodology to calculate direct economic losses

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As one of the 195 member countries of the United Nations, Germany signed the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR). With this, though voluntary and non-binding, Germany agreed to report on achievements to reduce disaster impacts. Among other targets, the SFDRR aims at reducing direct economic losses in relation to the global gross domestic product by 2030 – but how to measure this without a standardized approach?

The United Nations Office for Disaster Risk Reduction (UNISDR) has hence proposed a methodology to estimate direct economic losses per event and country on the basis of the number of damaged or destroyed items in different sectors. The method bases on experiences from developing countries. However, its applicability in industrial countries has not been investigated so far. Therefore, this study presents the first implementation of this approach in Germany to test its applicability for the costliest natural hazards and suggests adaptations.

The approach proposed by UNISDR considers assets in the sectors agriculture, industry, commerce, housing, and infrastructure by considering roads, medical and educational facilities. The asset values are estimated on the basis of sector and event specific number of affected items, sector specific mean sizes per item, their standardized construction costs per square meter and a loss ratio of 25%.

The methodology was tested for the three costliest natural hazard types in Germany, i.e. floods, storms and hail storms, considering 13 case studies on the federal or state scale between 1984 and 2016. Not any complete calculation of all sectors necessary to describe the total direct economic loss was possible due to incomplete documentation. Therefore, the method was tested sector-wise.

Three new modules were developed to better adapt this methodology to German conditions covering private transport (cars), forestry and paved roads. Unpaved roads in contrast were integrated into the agricultural and forestry sector. Furthermore overheads are proposed to include costs of housing content as well as the overall costs of public infrastructure, one of the most important damage sectors. All constants considering sector specific mean sizes or construction costs were adapted. Loss ratios were adapted for each event.

Whereas the original UNISDR method over- und underestimates the losses of the tested events, the adapted method is able to calculate losses in good accordance for river floods, hail storms and storms. For example, for the 2013-flood economic losses of EUR 6.3 billion were calculated (UNISDR EUR 0.85 billion, documentation EUR 11 billion). For the hail storms in 2013 the calculated EUR 3.6 billion overestimate the documented losses of EUR 2.7 billion less than the original UNISDR approach with EUR 5.2 billion. Only for flash floods, where public infrastructure can account for more than 90% of total losses, the method is absolutely not applicable.

The adapted methodology serves as a good starting point for macro-scale loss estimations by accounting for the most important damage sectors. By implementing this approach into damage and event documentation and reporting standards, a consistent monitoring according to the SFDRR could be achieved.