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Implementation and adaptation of a macro-scale method to assess and monitor 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 the measures undertaken to reduce natural disaster impacts. One target of the SFDRR is to reduce the direct economic losses, due to disaster events, in relation to global gross domestic product by 2030. Therefore, the United Nations Office for Disaster Risk Reduction (UNISDR) has proposed a methodology for estimating direct economic losses for the agriculture, industry, commerce, housing and public infrastructure (education and medical sector as well as roads) sectors per disaster event and country, based on experiences from developing countries. Therefore, this study presents the first implementation of this approach in Germany. The methodology was tested for the three costliest natural hazard types in Germany, i.e. floods, wind and hail storms, considering 12 case studies on the federal or state scale between 1984 and 2016.

Although the event-specific input data requirements are restricted to the number of damaged or destroyed items per sector. This exercise revealed that the post event documentation was incomplete and as such did not allow an assessment of all the sectors required to describe total direct economic losses. Therefore, the UNISDR method was tested sector by sector. Finally, the methodology itself was extended to better adapt this methodology to German conditions because it was discovered that important sources of damage are not included in the UNISDR method. Therefore, three new modules were developed: transportation (cars), forestry and paved roads. Furthermore, it is suggested to include the value of damage as overheads - to housing contents as well as to urban infrastructure as these are often neglected sectors.
Whereas the original UNISDR method both over- and underestimates the losses of the tested events by a wide margin, the adapted method is able to calculate losses well for river floods, hail storms and wind storms. Only for flash floods, where urban infrastructure can account for more than 90% of the total losses, is the adapted method not reasonable. A model's performance is expressed by the mean relative error. Model quality was improved from 1.8 (UNISDR) to 0.66 (adapted parameters) to 0.49 (adapted methodology). For the housing sector the improvement expressed by the mean relative error (from 3.13 (UNISDR) to 0.47 (adapted methodology)) was mainly due to altering the damage ratio, housing sizes, as well as accounting for household contents.

The adapted methodology serves as a good starting point for macro-scale loss estimations by accounting for the most important damage sectors. Generally these adaptations go in line with current developments suggested by UNISDR themselves. In implementing this approach into damage and event documentation and reporting standards, a consistent monitoring according to the SFDRR could be achieved.