Structural damage grade classifier for residential buildings based on the July 2021 flood event in Belgium

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The adequate implementation of flood risk reduction measures depends on our ability to quantify flood losses robustly and accurately. Existing flood loss models have been constructed using data or experience from past flood events. Frequently, in the existing datasets, extreme damage mechanisms, such as severe structural damage to buildings, are underrepresented, and the corresponding losses are often overlooked. New datasets collected after the European flood of 2021 provide an opportunity to improve existing tools for predicting the degree of flood-induced structural damage to buildings. In this study, a classification model for severe structural damages to residential buildings is developed using data on building damage during the 2021 flood in Belgium. A new damage grade typology was created on the basis of 197 engineering reports investigating the stability of individual buildings. Moreover, building and hazard characteristics were extracted from these reports and complemented with additional data, obtained from hydrodynamic simulations, field surveys, and cadastral data. A logistic classifier using hazard and building features was built to predict whether or not buildings suffered severe structural damage. This final model can be used for a preliminary post-event assessment of structural damage to support the allocation of resources and to prioritise interventions to buildings. It can also be included into existing flood loss models to improve the representation of extreme damage mechanisms.