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# On uncertainty quantification with different availability of data – the case of flood damage estimation for the 2002 flood in Lodi (Northern Italy) with the INSYDE model

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Flood damage assessment is presently affected by significant levels of uncertainty, mainly due to a limited capability of modelling complex damage processes and to the lack of data for models' calibration and validation. Uncertainty assessment of flood damage models is a key issue for effective flood risk management, as for decision makers the choice of the most suitable damage model (to be trust) is driven by the need to minimize this uncertainty to the level required to satisfy their objectives.
In this study, three approaches are considered to analyse uncertainty of flood damage assessments. The approaches are implemented for the case study of the 2002 flood in the city of Lodi (Northern Italy). Damage estimation to the residential sector is performed with INSYDE (IN-depth SYnthetic Model for Flood Damage Estimation, Dottori et al., Nat Hazards Earth Syst Sci, 2016), a micro-scale damage model allowing for the consideration of several damage explicative variables, both related to the hazard and to the vulnerability of affected items.
The three approaches, which mainly vary according to data availability for the analysis, consist respectively of: 1) the comparison between the simulated and the observed damage, in the presence of a micro-scale assessment of both hazard and vulnerability features of affected items, 2) the comparison between the simulated and the observed damage, in the presence of a micro-scale assessment of hazard features and a meso-scale assessment (i.e. at the census level) of vulnerability features, and 3) the comparison between the damage simulated by INSYDE and the damage simulated by other existing models.
The analysis provides crucial information for effective flood risk management: on the one hand, insights into the uncertainty band width; on the other hand, it allows investigating the increase in model uncertainty due to different level of knowledge of model input variables.