Sensitivity analysis of multi-variable models of inundation losses: which are the most important aspects to be considered in prompt flood damage assessment?

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When a catastrophic inundation occurs, there is often the need to have a prompt quantification of economic losses (or flood losses); furthermore, damage assessment is required in order to define different flood scenarios and to identify proper risk mitigation strategies. To this aim the scientific literature proposes many flood-damage models. Some of them are uni-variable and typically consider water depth as the only damage explicative variable. Some others are more advanced and take into account a large number of factors that influence hazard and/or vulnerability, and therefore damage process (multi-variable modelling, e.g. water velocity or contamination, building characteristics, duration, sediment transport, etc.). In this contribution, we aim to assess the accuracy of some multi-variable damage models for the residential sector, looking for the optimal degree of detail to be used in post-event flood-damage assessment. We consider a comprehensive flood-loss dataset compiled for a recent flood in Italy, the Secchia river inundation event of January 2014, which includes information on affected private households, to test the sensitivity of two multi-variable models: 1) INSYDE (In-depth Synthetic Model for Flood Damage Estimation -Dottori et al., NHESS, 2016- originally developed for another Italian case study) and 2) SMV (Secchia Multi-Variable -Carisi et al., NHESSD, 2017- developed for the same inundation event). We started from the most general scenario, in which available simplified hazard and exposure variables are those deduced from few observations on the field in the aftermath of the flood event or free online and local sources (most of the time these data are aggregated at census block level). We then upgraded the level of detail on exposure and hazard description by inserting parameters retrieved from micro-scale observations or hydrodynamic simulation, respectively. The outcomes were compared with economic losses observed and predicted by means of a reference uni-variable model developed on the Secchia case study. Results provide important insights on the applicability and sensitivity of the two multi-variable models, giving indications on the most important aspects that should be taken into consideration in case of rapid assessments of flood damages, especially in the immediate post-event.