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Methodological framework for the probabilistic risk assessment of multi-hazards at a municipal scale: a case study in the Fella river valley, Eastern Italian Alps

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Local and regional authorities in mountainous areas that deal with hydro-meteorological hazards like landslides and floods try to set aside budgets for emergencies and risk mitigation. However, future losses are often not calculated in a probabilistic manner when allocating budgets or determining how much risk is acceptable. The absence of probabilistic risk estimates can create a lack of preparedness for reconstruction and risk reduction costs and a deficiency in promoting risk mitigation and prevention in an effective way. The probabilistic risk of natural hazards at local scale is usually ignored all together due to the difficulty in acknowledging, processing and incorporating uncertainties in the estimation of losses (e.g. physical damage, fatalities and monetary loss). This study attempts to set up a working framework for a probabilistic risk assessment (PRA) of landslides and floods at a municipal scale using the Fella river valley (Eastern Italian Alps) as a multi-hazard case study area. The emphasis is on the evaluation and determination of the uncertainty in the estimation of losses from multi-hazards. To carry out this framework some steps are needed: (1) by using physically based stochastic landslide and flood models we aim to calculate the probability of the physical impact on individual elements at risk, (2) this is then combined with a statistical analysis of the vulnerability and monetary value of the elements at risk in order to include their uncertainty in the risk assessment, (3) finally the uncertainty from each risk component is propagated into the loss estimation. The combined effect of landslides and floods on the direct risk to communities in narrow alpine valleys is also one of important aspects that needs to be studied.