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A conceptual model for the estimation of flood damage to power grids

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Flood damage assessment is a crucial component of any decision-making process on flood risk management and mitigation; for this reason, reliable tools for flood damage estimation are required, for all the categories of exposed elements. Despite networks can suffer high losses in case of flood, and in comparison with other exposed items, flood damage modelling to infrastructures is still a challenging task. This is due, on the one hand, to the complexity of networks as well as of their interconnections; on the other hand, to the lack of knowledge and data to investigate damage mechanisms and to calibrate and validate damage models. Grounding on the investigation of the state of art, this contribution presents a conceptualization of flood damage to power grids. The ultimate objective of the conceptual model is to be an operative tool in support of more comprehensive and reliable flood damage assessments to power grids, highlighting: (i) the different components of the damage (i.e. direct, indirect, and systemic, meaning damage due to the interdependencies among power grids and residential, commercial, industrial and other infrastructure sectors), (ii) their interconnections, (iii) the hazard, exposure and vulnerability variables on which they depend, (iv) the temporal and spatial scales for their assessment. The development of the model highlighted, on the one hand, the importance of dividing damage assessment in two steps: the estimation of damage in quantitative/physical units and the estimation of the consequent economic losses. On the other hand, the variety of damage mechanisms and cascading effects shaping the final damage figure arises, asking for an interdisciplinary and multi-scale evaluation approach. The development of the conceptual model is the first step of a PhD research on the development of flood damage models for infrastructures. Next steps will validate the model in real case studies and evaluate how the different damage components could be investigated in the Italian context.