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Storylines and impact chains of multi-hazard risk scenarios in the framework of disaster risk reduction and climate change adaptation

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Storylines are increasingly used in climate science to integrate the physical and socioeconomic components of phenomena, make climate evolution more tangible and provide unity of discourse. This approach has proved successful in describing realistic realizations of complex and uncertain processes, such as those related to climate change, and communicating it to both scientific and praxis-oriented audiences, hence supporting decision making. However, storylines have been applied in single-hazard contexts without addressing complex multi-hazard conditions. For these reasons, here we propose to extend storylines for multi-hazard risk assessments combining both disaster risk reduction and climate change adaptation activities.

In this context we introduce the concept of risk storylines, which refers to a defined, plausible combination of events, their consequences and the factors possibly affecting these elements (e.g., vulnerability or external risk drivers), as well as the physical, socio-ecological and functional elements at risk. Risk storylines are therefore scenario-based and can refer either to past events or to plausible future events, always considering the most relevant direct and indirect drivers of risk. A risk storyline should contain all relevant information necessary to describe the risks of concern, including a comprehensive description of the scope of the storyline (e.g., the purpose and operational context, the related urban configuration and the reference timeframe), the most relevant risks and related factors in play, namely hazards, exposure, vulnerabilities, and the different impacts that are linking together the former elements, as well as a synthetic narrative description of the risk storyline, describing main facts and consequences. Also, any scenario describing one or more current or future environmental conditions should be explicitly indicated, e.g. the Shared Socioeconomic Pathways (SSPs) or any other demographic / socio-economic future scenarios (in the case of storylines developed for future events). Whenever possible, reasoning on the probability of occurrence of such scenarios is also developed.

In order to complement the narrative description of the risk storyline with a more structured conceptual and graphical representation, the integrated use of impact chains has been explored.

This combination provides a flexible and convenient framework to convey actionable information about those dynamic and complex environmental and socio-economic conditions possibly associated with high-impact, multi-hazard events and processes, and to consider in a single consistent framework both climate-driven (e.g., extreme hydrometeorological conditions) and climate-independent (e.g., earthquakes) hazards.

Risk storylines can be developed through participative, desktop-based or partly-analytic approaches and are particularly suitable for co-development activities with stakeholders and domain experts, with a great potential for supporting and improving risk prevention and mitigation decision-making under relevant aleatoric and epistemic uncertainty.

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