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Multi-hazard risk assessment of extreme weather events in a changing climate

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Extreme weather events are among the most destructive natural hazards, affecting a large number of people and causing significant monetary damage globally each year. The impact of these events is increasing due to climate change and socio-economic development. While traditional approaches to risk assessment have focused on the impacts of single hazards, the combined risk of multiple hazards may be different from their sum. Their spatial and temporal co-occurrence may also be influenced by climate change. In this study, we develop a framework for modelling the combined risk of multiple climatic hazards, where risk is defined as the combination of hazard, exposure and vulnerability. We illustrate this method based on globally consistent river floods and tropical cyclones and their impacts on both population and assets. Both hazards are driven by global climate models to investigate their risk at current and future levels of warming. The combined impacts are evaluated by aggregating single hazard models on an event basis, where events are driven by the same climate model outputs. This allows us to not only consider the average annual impact, but also for example to assess combined extreme events or return periods. Additionally, spatially and temporally compounding events can be analysed. This framework is implemented in the open-source climate risk platform CLIMADA and can be applied to different climate risks, providing a more comprehensive approach to understanding and managing the risks posed by extreme weather events in a changing climate.