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Resilience to Interacting multi-natural hazards

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Conventional analyses of hazard assessment tend to focus on individual hazards in isolation. However, many parts of the world are usually affected by multiple natural hazards with the potential for interacting relationships. The understanding of such interactions, their impacts and the related uncertainties, are an important and topical area of research. Interacting multi-hazards may appear in different forms, including 1) CASCADING HAZARDS (a primary hazard triggering one or more secondary hazards such as an earthquake triggering landslides which may block river channels with dammed lakes and ensued floods), 2) CONCURRING HAZARDS (two or more primary hazards coinciding to trigger or exacerbate secondary hazards such as an earthquake and a rainfall event simultaneously creating landslides), and 3) ALTERING HAZARDS (a primary hazard increasing the probability of a secondary hazard occurring such as major earthquakes disturbing soil/rock materials by violent ground shaking which alter the regional patterns of landslides and debris flows in the subsequent years to come). All three types of interacting multi-hazards may occur in natural hazard prone regions, so it is important that research on hazard resilience should cover all of them.
In the past decades, great progresses have been made in tackling disaster risk around the world. However, there are still many challenging issues to be solved, and the disasters over recent years have clearly demonstrated the inadequate resilience in our highly interconnected and interdependent systems. We have identified the following weaknesses and knowledge gaps in the current disaster risk management: 1) although our understanding in individual hazards has been greatly improved, there is a lack of sound knowledge about mechanisms and processes of interacting multi-hazards. Therefore, the resultant multi-hazard risk is often significantly underestimated with severe consequences. It is also poorly understood about the spatial and temporal changes in hazards and vulnerability during successive hazards; 2) hazard monitoring, forecasting and early warning systems have not fully utilised the domain knowledge of physical processes and the statistical information of the observations; 3) uncertainties have not been well recognised in the current risk management practice, and ignorance of uncertainties could lead to major threat to the society and poor consideration with inefficient or unsustainable preferences of options; 4) there is increasing recognition that the so called ‘natural’ disasters are not just the consequences of nature-related processes alone, but are attributable to various social, economic, historical, political and cultural causes. However, despite this recognition, the current hazard and risk assessments are fragmented with a weakness in holistically combining quantitative and qualitative information from a variety of sources; 5) successful disaster risk management must be relevant and useful to all stakeholders involved. Efforts should enable the essential common purpose, collective learning and entrepreneurial collaborations that underpin effective and efficient resilience. Therefore, there is an urgent need for the systems thinking framework and decision support system tools in adequate scenario assessment and resilience development from a harmonised and transdisciplinary perspective. It is important that the aforementioned issues should be tackled with a joint effort from a multidisciplinary team in social science, natural science, engineering and systems.