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Exploration of resilience assessments for natural hazards

Anna Lo Jacomo (1), Dawei Han (2), and Alan Champneys (3)

(1) Department of Civil Engineering, University of Bristol, 93-95 Woodland Road, BS8 1US, Bristol, UK (anna.lojacomo@bristol.ac.uk), (2) Department of Civil Engineering, University of Bristol, Queen's Building, University Walk, BS8 1TR, Bristol, UK (d.han@bristol.ac.uk), (3) Department of Engineering Mathematics, University of Bristol, Merchant Venturers Building, Woodland Road, BS8 1UB, Bristol, UK (a.r.champneys@bristol.ac.uk)

The occurrence of extreme events due to natural hazards is difficult to predict. Extreme events are stochastic in nature, there is a lack of long term data on their occurrence, and there are still gaps in our understanding of their physical processes. This difficulty in prediction will be exacerbated by climate change and human activities. Yet traditional risk assessments measure risk as the probability of occurrence of a hazard, multiplied by the consequences of the hazard occurring, which ignores the recovery process. In light of the increasing concerns on disaster risks and the related system recovery, resilience assessments are being used as an approach which complements and builds on traditional risk assessments and management.

In mechanical terms, resilience refers to the amount of energy per unit volume that a material can absorb while maintaining its ability to return to its original shape. Resilience was first applied in the fields of psychology and ecology, and more recently has been used in areas such as social sciences, economics, and engineering. A common metaphor for understanding resilience is the stability landscape. The landscape consists of a surface of interconnected basins, where each basin represents different states of a system, which is a point on the stability landscape. The resilience of the system is its capacity and tendency to remain within a particular basin. This depends on the topology of the landscape, on the system's current position, and on its reaction to different shocks and stresses.

In practical terms, resilience assessments have been conducted for various purposes in different sectors. These assessments vary in their required inputs, the methodologies applied, and the output they produce. Some measures used for resilience assessments are hazard independent. These focus on the intrinsic capabilities of a system, for example the insurance coverage of a community, or the buffer capacity of a water storage reservoir. Other measures of resilience are hazard dependent, and require hazard information. In those cases, the type of hazard information required varies from long term information such as the general probability of occurrence of a particular hazard, to short term information such as the observed damage following a specific earthquake occurrence. The required information also varies from national scale, such as census data, to local scale, such as stakeholder perceptions of a threat. This is shown through examples of resilience assessments, along with a discussion of their ability to inform decision making.