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The Relative Severity of Single Hazards within a Multi-Hazard Framework

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Here we present a description of the relative severity of single hazards within a multi-hazard framework, compiled through examining, quantifying and ranking the extent to which individual hazards trigger or increase the probability of other hazards. Hazards are broken up into six major groupings (geophysical, hydrological, shallow earth processes, atmospheric, biophysical and space), with the interactions for 21 different hazard types examined. These interactions include both one primary hazard triggering a secondary hazard, and one primary hazard increasing the probability of a secondary hazard occurring. We identify, through a wide-ranging review of grey- and peer-review literature, >90 interactions. The number of hazard-type linkages are then summed for each hazard in terms of their influence (the number of times one hazard type triggers another type of hazard, or itself) and their sensitivity (the number of times one hazard type is triggered by other hazard types, or itself). The 21 different hazards are then ranked based on (i) influence and (ii) sensitivity. We found, by quantification and ranking of these hazards, that: (i) The strongest influencers (those triggering the most secondary hazards) are volcanic eruptions, earthquakes and storms, which when taken together trigger almost a third of the possible hazard interactions identified; (ii) The most sensitive hazards (those being triggered by the most primary hazards) are identified to be landslides, volcanic eruptions and floods; (iii) When sensitivity rankings are adjusted to take into account the differential likelihoods of different secondary hazards being triggered, the most sensitive hazards are found to be landslides, floods, earthquakes and ground heave. We believe that by determining the strongest influencing and the most sensitive hazards for specific spatial areas, the allocation of resources for mitigation measures might be done more effectively.