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Characterising Natural Hazard Interactions to Support Multi-Hazard Approaches to Hazard Management

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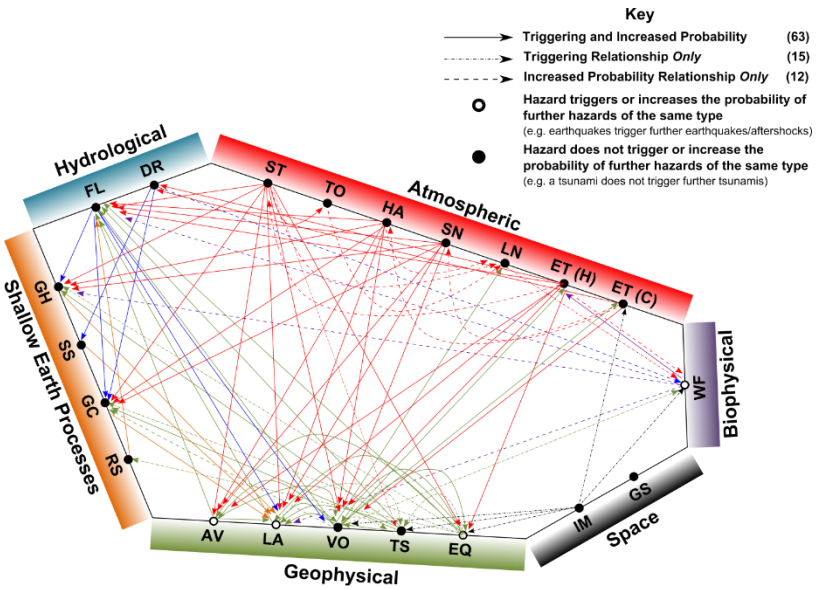
Here we present a characterisation of the interaction relationships between 21 different natural hazards from six hazard groups (geophysical, hydrological, shallow Earth, atmospheric, biophysical, space). Interaction relationships are of global relevance and an important consideration when developing multi-hazard approaches to hazard management. The importance of building multi-hazard approaches is strongly encouraged in the recently agreed Sendai Framework for Disaster Risk Reduction 2015-30 [1].

This characterisation uses a wide-ranging review of 200+ grey and peer-reviewed sources to identify and characterise potential triggering and increased probability relationships between primary and secondary natural hazards. These are presented in visualisation schemes aimed at a global audience and particularly suited to supporting the science-policy-practice interface.



We identify 90 primary-secondary hazard interactions, with case studies noted for 74 of these 90 interactions. Our visualisations also allow the identification of networks of natural hazard interactions (cascades). Additional visualisations characterised: (i) information available on location, timing and magnitude of secondary hazards, (ii) likelihood of the secondary hazard occurring, and (iii) relationships between primary and secondary hazard intensities.

Figure 1: Hazard type linkages (from [2]). A network diagram showing the potential hazard type linkages between 21 natural hazards: ***EQ*** *= earthquake,* ***TS*** *= tsunami,* ***VO*** *= volcanic eruption, LA = landslide, AV = snow avalanche,* ***RS*** *= regional subsidence,* ***GC*** *= ground collapse,* ***SS*** *= soil (local) subsidence,* ***GH*** *= ground heave,* ***FL*** *= flood,* ***DR*** *= drought,* ***ST*** *= storm,* ***TO*** *= tornado,* ***HA*** *= hailstorm,* ***SN*** *= snowstorm,* ***LN*** *= lightning,* ***ET (H)*** *= extreme high temperatures,* ***ET (C)*** *= extreme cold temperatures,* ***WF*** *= wildfires,* ***GS*** *= geomagnetic storms,* ***IM*** *= impact events.*

Interaction visualisations and the consideration of multi-hazard cascade chains allow a more effective analysis of hazard potential by disaster risk policy and practitioner communities. Visualisations also aid those undertaking research into single hazards to place their work within the context of other hazards.

This work challenges the adequacy of multi-hazard approaches that treat hazards as being independent, having implications for defining and developing such approaches. Including hazard interactions can help to better understand management priorities, reduce vulnerability to relevant hazards and better estimate risk.

References:

[1] UNISDR (2015), Sendai Framework for Disaster Risk Reduction.

[2] Gill JC and Malamud BD (2014) Reviews of Geophysics 52(4): 680-722