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New approaches to modelling global patterns of landslide hazard and risk

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Landslides are one of the most destructive geological processes, being a major cause of loss of life and economic damage. There is also evidence that their impact is increasing with time. Most landslides are triggered by either intense and/or prolonged rainfall, or seismic activity. Recent examples have highlighted the damage potential of multi-landslide events. For instance, the 12th May 2008 Wenchuan Earthquake (Sichuan, China) resulted in over 80,000 fatalities, with direct losses to buildings and infrastructure of over US$150 billion. Over 20,000 fatalities and much of the economic losses sustained in this event were caused by the direct impact of landslides. Similarly, nearly all of the over 600 fatalities associated with the passage of Typhoon Morakot across Taiwan were caused by landslides.

In recent years, there have been a number of global initiatives attempting to provide an assessment of the spatial distribution of landslide hazard and risk on a regional or global basis. However, to date the results have been somewhat unsatisfactory, failing to properly account for the real distribution of losses, notably limited by the completeness of the impact inventories upon which these models are based.

This paper has two key aims. First, we use data from the Durham University fatal landslide database to demonstrate that existing global scale models do not effectively evaluate global landslide mortality risk. The fatal landslide database includes over 2,000 individual fatal landslide events over the period from September 2002 to the present, and gives insight into the potential underrepresentation of landslide impacts worldwide. Second, based upon this analysis, we develop a new first order spatial model for the distribution of fatal landslides on a global basis, using freely available global datasets. This resulting model, which for the first time properly accounts for the distribution of landslide hazard associated with seismically-triggered events in addition to rainfall driven landslide impacts, can provide the basis for a proper analysis of potential global landslide losses. This type of analysis is a vital component for comparative risk analysis of natural hazards, whilst providing a more detailed understanding of loss and impact at the global scale.