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The occurrence of fatal, rainfall-induced landslides in Asia in the context of climate change

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Globally, the continent in which landslides have caused the greatest number of fatalities is Asia. This is a region in which large changes are currently occurring, including profound economic restructuring; the development of megacities; alterations of both the size and the distribution of the population; modifications to land-use; diversion of hydrological systems; and of course changes to the climate. It is inevitable that these changes will drive an alteration in the occurrence and distribution of fatal, rainfall-induced landslides as triggering mechanisms, mass movement susceptibility and vulnerability all change. It is therefore surprising that there have been very few attempts to examine potential alterations to the occurrence of fatal landslides in Asia through time. In this research, the Durham Fatal Landslide Database has been used to examine the spatial and temporal distribution of rainfall-induced fatal landslides across Asia. It is shown that there is a strong relationship between the occurrence of fatal landslides and climatic controls. For example, in S. Asia the rainfall-triggered fatal landslides are predominantly controlled by the SW (summer) monsoon, whilst in E. Asia the occurrence of tropical cyclones (typhoons) and La Nina events appear to have a much greater impact. In SE. Asia no clear climatic control has been identified, primarily because the climate is essentially non-seasonal. Thus, it appears that more local scale climatic processes control landslide occurrence. Using these observations for E. and S. Asia, where most of the recorded fatal landslides occur, the likely changes due to climate change-induced modifications to large-scale meteorological systems are examined. Thus, for example, modelling now allows estimates to be made of the likely future occurrence and strength of the SW monsoon and of tropical cyclones. It is shown that the likely response is a comparatively modest increase in landslide occurrence. These impacts are then compared with the effects of population growth and other social changes, based upon an observed strong relationship between population density and fatal landslide density. It is shown that whilst climate change might be expected to increase landslide occurrence, the impacts are comparatively minor compared with the impacts of forecast population and social changes. Of course the social and climate changes will in reality occur simultaneously, suggesting that a substantial increase in landslide occurrence, and in landslide impact, is likely in the future.