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QUANTIFICATION OF EARTHQUAKE INDUCED LANDSLIDES

Bruce D. Malamud (1), Donald L. Turcotte (2), Fausto Guzzetti (3), Paola Reichenbach (3)

(1) Environmental Monitoring and Modeling Group, Dept of Geography, Kings College London (bruce@malamud.com) (2) Dept of Geology, University of California at Davis (Turcotte@geology.ucdavis.edu) (3) CNR–IRPI Perugia (F.Guzzetti@irpi.cnr.it, P.Reichenbach@irpi.cnr.it).

This paper's objective is to quantify volumes of landslides triggered by earthquakes and thus determine associated erosion rates. We do this by combining the concept of a 'universal' landslide probability distribution with an empirical relationship between landslide volumes and earthquakes. Using the frequency-area statistics of three recent, well-documented and 'complete' landslide event inventories, we define a 'universal' landslide probability distribution, a three-parameter inverse gamma probability distribution. Based on this distribution, the mean area of landslides in a triggered landslide event inventory is 3,070 m^2, independent of the event's size. To quantify landslide events, the magnitude scale $M_L = \log N_{LT}$, which can be determined from both 'complete' inventories and also partial inventories of the largest landslides in the event. We relate our landslide magnitude to earthquake magnitude, convert landslide areas to volumes using an empirical relationship, and determine the associated total landslide volume. We then use the empirical relationship between total landslide volume and earthquake moment magnitude given by Keefer (1994) to determine analytic relationships between earthquake moment magnitude and the associated landslide event magnitude, area and volume of the largest landslide triggered, and total area of all landslides triggered. Using the Gutenberg–Richter frequency-magnitude relation for regional seismicity, we analytically relate the seismically-induced erosion rate to the regional seismic intensity and the moment magnitude of the largest regional earthquake. We find that typical seismically-induced erosion rates in very active subduction zones is $\approx$ 0.2–2 mm yr^{-1} and adjacent to plate boundary strike-slip zones $\approx$ 0.01–0.2

mm yr^{-1}.