Geophysical Research Abstracts,
Vol. 10, EGU2008-A-07242, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-07242
EGU General Assembly 2008

Logistic modelling of landslide rainfall thresholds

S. Peruccacci (1), M. Rossi (1), F. Guzzetti (1), C.P. Stark (2)

(1) Consiglio Nazionale delle Ricerche, Istituto di Ricerca per la Protezione Idrogeologica, via della Madonna Alta 126, 06128 Perugia, Italy (Silvia.Peruccacci@irpi.cnr.it), (2) Lamont-Doherty Earth Observatory, Columbia University, Route 9W, Palisades, NY 10964, USA

We present an attempt to infer a rainfall threshold for landsliding using logistic regression. For the purpose, we have used a global (worldwide) database of 2626 rainfall events that have resulted in shallow landslides and debris flows, and 1185 rainfall events that have not resulted in slope failures. The rainfall conditions that have caused shallow slope failures have been used to determine the minimum rainfall intensity-duration (ID) threshold for the possible initiation of shallow landslides and debris flows. The threshold curve has been obtained using an objective technique that exploits Bayesian inference. To estimate the probability of having or not having a landslide event (the dependent, dichotomic variable), we developed a statistical model based on logistic regression. Each rainfall event is treated using a transformed variable z (explanatory variable) that depends on the mean rainfall intensity and the rainfall duration, linked by the ID threshold. The logistic curve is parameterized by a critical threshold zc, giving the 50% mark of the step function and an uncertainty ó (smoothing of the step function). The most likely values of zc and ó are inferred using a Bayesian inference software package called WinBUGS (http://www.mrc-bsu.cam.ac.uk/bugs/) based on the assumption that the data are Bernoulli coin tosses with probability given by a logistic curve in z. The logistic model is able to classify correctly (73%) the presence or absence of landslide events, and it proves to be statistically reliable and robust. The developed model could be used, e.g. by regional or national Civil Protection Agencies to estimate the occurrence probability of rainfall-induced landslides from numerical precipitation forecasts.