Geophysical Research Abstracts,
Vol. 10, EGU2008-A-00886, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-00886
EGU General Assembly 2008

Controls on landslides size-distribution; relation between area and volume of landslides

B. Kalderon-Asael (1,2), O. Katz (1), E. Aharonov (3) and S. Marco (2)

(1) Geological Survey of Israel, 30 Malke Israel St., Jerusalem 95501, Israel, (2) Department of Geophysics and Planetary Sciences, Tel Aviv University, Tel Aviv 69978, Israel, (3) Weizmann Institute of Science, Rehovot 76100, Israel (borianak@post.tau.ac.il)

A remarkable observation is that landslides of different sizes, from different locations, triggered by different mechanisms, all seem to have self-similar shapes, with their area (A) to volume (V) ratios obeying a power law. The physical basis for this observation is poorly understood. In the presented work we model the relation between surface area (A) and volume (V) of landslides in homogenous slopes, using basic mechanics principles, and find an excellent agreement with field data. Our model uses a simple engineering computer program (slope-stability calculation; Geo-Slope/W) based on the limit equilibrium approach using the Bishop's Simplified method. A total of 790 individual simulations were run, with a range of cohesion values (c = 0-20 kPa), angles of internal friction (ϕ = 0-40°) and slope heights (H = 1-1000m). When analyzing the landslides volume-area relations at different scales, we found model-predicted universal relation: V $\sim$ A$^{1.4}$, independent of slope height and mechanical properties, which agrees very well with the trends shown by field observed landslides around the globe. Our findings suggest that the V vs. A relation is universal, and is the result of very simple mechanical and geometrical principles – captured even by the simplest of slope failure models. Because V vs. A relations are universal, once one of these variable is set, the other must follow suit. The shape and size of the landslide is thus constrained by the size of the slope (which dictates the maximum for A) or the depth of the failure or bedding plane (which constrains V/A). The above findings have implications to hazard analysis, since the size distribution of landslides is of major consideration in both landslide and tsunami hazards evaluation.