Geophysical Research Abstracts
Vol. 15, EGU2013-8116, 2013
EGU General Assembly 2013

Slidequake generation versus viscous creep at softrock-landslides

Marco Walter (1,2), Joan Gomberg (3), William Schulz (4), Paul Bodin (5), and Manfred Joswig (1)

(1) Institute for Geophysics, Universität Stuttgart, Stuttgart, Germany (marco.walter@geophys.uni-stuttgart.de), (2) Seismic Solutions, Esslingen, Germany, (3) U.S. Geological Survey, Seattle, Washington, USA, (4) U.S. Geological Survey, Denver, Colorado, USA, (5) Dept. of Earth and Space Science, University of Washington, Seattle, USA

Our study describes the conditions for the generation of initial fracture processes, i.e. slidequakes, at three different creeping softrock-landslides: the Slumgullion landslide in the San Juan Mountains, Colorado, USA, the Heumoes slope in the Austrian Alps, and the mudslide in Super-Sauze, French Alps. From a geomorphologic point of view, all three landslides are classified as creeping landslides with average velocities between cm to m per year. Associating creep with viscous flow, and considering the largely saturated, clayey consistency of the slope body, one would not expect any brittle behaviour. Thus it came as a surprise that impulsive seismic signals indicative of shear fracture could be discovered by sensitive passive monitoring methods at all three slopes. These fracture signals occur in episodes, have similar signatures as small earthquakes, and could be located within the slide bodies, i.e. are evidence of slidequakes.

Our investigations identified seismic and aseismic slip in each slide, with slidequakes focusing at significant bedrock structures or at lateral boundaries. At the Slumgullion landslide, the majority of slidequakes occurred at the lateral boundaries of the landslide, while no events were detected along the planar basal surface. At Heumoes slope, the slidequakes cluster in the slope area with the lowest surface displacement rates. A significant bedrock rise, oriented perpendicular to the direction of slope movement, divides the landslide geometry in two basins, and probably impedes motion, slows the slide, and leads to slidequakes. At the Super-Sauze mudslide, the slidequakes are preferentially generated in its centre where the deformation rates are highest. There, the slidequake generation is directly linked to in-situ bedrock crests that border several gullies oriented in line to direction of the entire slope movement.

The synoptic comparison of these three different environments of slidequake observations at softrock-landslides provides new explanations for slidequake generation. Regardless the specific observation of the respective landslide, the slidequake generation is generally linked to geometric or rheological heterogeneities along the boundaries between the slide material and the bedrock and/or along lateral boundary faults; these barriers seem to play key roles in slope deformations. Synoptic comparison of these three scenarios underlines the importance of landslide-bedrock and landslide-lateral boundary interactions under gravitational loading.