Geophysical Research Abstracts
Vol. 18, EGU2016-17732, 2016
EGU General Assembly 2016

How up- or downslope anchoring affects root reinforcement

Filippo Giadrossich (1), Massimiliano Schwarz (2), Denis Cohen (3), and Marcello Niedda (1)

(1) University of Sassari, P. IVA 00196350904, Dipartimento di Agraria, Sassari, Italy (filippogiadrossich@hotmail.com), (2) Bern University of Applied Sciences (BFH), Langgasse 85, 3052 Zollikofen, Switzerland (massimiliano.schwarz@bfh.ch), (3) Department of Geological and Atmospheric Sciences, Iowa State University, 253 Science I, Ames, IA 50011, USA (denis.cohen@gmail.com)

Root reinforcement is important for slope stability. In addition to the important contribution of roots to shear strength along the slip surface, root networks are also recognized to impart stabilization through lateral (parallel to slope) redistribution of forces under tension. The most common method to measure lateral root reinforcement is a pullout test where one root or a bundle of root is pulled out of the soil matrix. This condition represents the case where roots within the mass of a landslide slip out from the upper stable part of the slope. There is also, however, the situation where roots anchored in the upper stable part of the slope slip out from the sliding mass. In the latter it is difficult to quantify root reinforcement and no study has discussed this mechanism. We carried out a new series of laboratory and field experiments using Douglas fir (Pseudotsuga menziesii) roots to quantify how up- or downslope anchoring affects root reinforcement. In addition, we carried out new field pullout tests on coarse roots (larger that 2 mm in diameter, up to 47 mm). Then, considering the state-of-the-art of root reinforcement modeling (the Root Bundle Model), we integrated results from our measurements into the model to verify the magnitude of this effect on overall root reinforcement at the stand scale.

Results indicate that the ratio between pullout force and force transferred to the root during soil slip ranges between 0.5 and 1. This indicates that measured pullout force always overestimate the contribution of lateral slipping out roots in situations where the soil slide from anchored roots. This is general the case for root with diameter up to 3-4 mm. Root-size distribution is also a key factor influencing root reinforcement at the forest-stand scale. As most coarse roots break along tension cracks while fine roots slip out, the effect discussed in this study on root reinforcement modeling is negligible when coarse-root diameter classes are represented. Our results contribute to improve the quantification of root reinforcement mechanisms and are implemented in the „Root Bundle Model“ approach assuming a modified function fitting the root force-diameter measurements.