ETH zürich

Institute of Environmental Engineering

Prof. Paolo Burlando

Chair of Hydrology and Water Resources Management

SEMINAR

Tuesday, November 8th, 2016, 15:45 h, ETH Hönggerberg HCP E47.1

Dr Jeff Prancevic

Institute of Terrestrial Ecosystems, ETH Zürich

THE EFFECT OF LANDSLIDE SIZE AND TOPOGRAPHIC SLOPE ON HILLSLOPE STABILITY

Abstract

The initiation of shallow landslides by seepage flow is important for both landscape evolution and natural hazards. Force-balance models, beginning with those developed by Taylor [1948], have been used for seven decades to predict the stability of slopes, but they generally underpredict the degree of saturation required to destabilize sediment and have never been tested under controlled laboratory conditions. To address this gap in data, we performed dozens of experiments in a 5 m laboratory flume with various grain sizes and a wide range in bed angles, spanning Darcian and turbulent subsurface flow regimes, and the subsaturated and supersaturated failure regimes. Near-saturated conditions were required to initiate landslides in almost all of our experiments, indicating that sediment is far more stable than predicted by the infinite-slope model. A comparison against a three-dimensional model that considers frictional stresses at the edges of the failure does a much better job at predicting landslide occurrence and indicates that landslide size exerts a fundamental control on slope stability. Because all slopes require near-saturated conditions to fail and steep slopes tend to drain faster, we find that steeper slopes can be less prone to failure in some cases. However, we also observe that steeper failures tend to occur at deeper failure planes, potentially making them more destructive. On-going field work in the Swiss Alps is aimed at verifying these observations in natural terrain.