Geophysical Research Abstracts
Vol. 18, EGU2016-8271, 2016
EGU General Assembly 2016

Landslide Hazard Probability Derived from Inherent and Dynamic Determinants

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Landslide hazard research has typically been conducted independently from hydroclimate research. We unify these two lines of research to provide regional scale landslide hazard information for risk assessments and resource management decision-making. Our approach combines an empirical inherent landslide probability with a numerical dynamic probability, generated by combining routed recharge from the Variable Infiltration Capacity (VIC) macroscale land surface hydrologic model with a finer resolution probabilistic slope stability model run in a Monte Carlo simulation. Landslide hazard mapping is advanced by adjusting the dynamic model of stability with an empirically-based scalar representing the inherent stability of the landscape, creating a probabilistic quantitative measure of geohazard prediction at a 30-m resolution. Climatology, soil, and topography control the dynamic nature of hillslope stability and the empirical information further improves the discriminating ability of the integrated model. This work will aid resource management decision-making in current and future landscape and climatic conditions. The approach is applied as a case study in North Cascade National Park Complex, a rugged terrain with nearly 2,700 m (9,000 ft) of vertical relief, covering 2757 sq km (1064 sq mi) in northern Washington State, U.S.A.