Geophysical Research Abstracts
Vol. 17, EGU2015-6555, 2015
EGU General Assembly 2015

Robustness for slope stability modelling under deep uncertainty

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Landslides can have large negative societal and economic impacts, such as loss of life and damage to infrastructure. However, the ability of slope stability assessment to guide management is limited by high levels of uncertainty in model predictions. Many of these uncertainties cannot be easily quantified, such as those linked to climate change and other future socio-economic conditions, restricting the usefulness of traditional decision analysis tools. Deep uncertainty can be managed more effectively by developing robust, but not necessarily optimal, policies that are expected to perform adequately under a wide range of future conditions. Robust strategies are particularly valuable when the consequences of taking a wrong decision are high as is often the case of when managing natural hazard risks such as landslides.
In our work a physically based numerical model of hydrologically induced slope instability (the Combined Hydrology and Stability Model - CHASM) is applied together with robust decision making to evaluate the most important uncertainties (storm events, groundwater conditions, surface cover, slope geometry, material strata and geotechnical properties) affecting slope stability. Specifically, impacts of climate change on long-term slope stability are incorporated, accounting for the deep uncertainty in future climate projections. Our findings highlight the potential of robust decision making to aid decision support for landslide hazard reduction and risk management under conditions of deep uncertainty.