Geophysical Research Abstracts
Vol. 18, EGU2016-15191, 2016
EGU General Assembly 2016

Hydro-mechanically coupled modelling of deep-seated rock slides in the surroundings of reservoirs

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In order to enhance the understanding of the behaviour of deep-seated rock slides in the surroundings of large dam reservoirs, this study concentrates on failure mechanisms, deformation processes and the ability of self-stabilisation of rock slides influenced by reservoirs. Particular focus is put on internal rock mass deformations, progressive topographical slope changes due to reservoir impoundment and shear displacements along the basal shear zone in relation to its shear strength properties.

In this study, a two-dimensional numerical rock slide model is designed by means of the Universal Distinct Element Code UDEC and investigated concerning different groundwater flow scenarios. These include: (i) a completely drained rock slide model, (ii) a model with fully saturated rock mass below an inclined groundwater table and (iii) a saturated groundwater model with a reservoir at the slope toe. Slope displacements initiate when the shear strength properties of the basal shear zone are at or below the critical parameters for the limit-equilibrium state and continue until a numerical equilibrium is reached due to deformation- and displacement-based geometrical changes. The study focuses on the influence of a reservoir at the toe of a rock slide and tries to evaluate the degree of displacement which is needed for a re-stabilisation in relation to the geometrical characteristics of the rock slide. Besides, challenges and limitations of applied distinct element methods to simulate large strain and displacements of deep-seated rock slides are discussed.

The ongoing study will help to understand the deformation behaviour of deep-seated pre-existing rock slides in fractured rock mass during initial impounding and will be part of a hazard assessment for large reservoirs.