Geophysical Research Abstracts
Vol. 18, EGU2016-10722, 2016
EGU General Assembly 2016

Numerical modeling of debris flow runout for a case in southwestern China with Smooth Particle Hydrodynamics

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Debris flows and landslide dams are a major natural hazard causing high socioeconomic risk in inhabited mountainous areas. This is also true for vast parts of southwestern China, which are highly prone to slope failures due to several factors, such as a humid climate with high precipitation in the summer months, geological predisposing factors with highly weathered sedimentary rocks and a high seismicity. Not only do the landslides and flooding related to landslide dams threaten residents, buildings and transportation structures, but also do flooding conditions endanger power supply, which relies in this region partly on hydropower. In order to assess the potential of landslides to block rivers, it is crucial to understand which factors influence possible run-out distances and how they can be quantified.

In the study we are presenting a numerical modeling analysis for a particular case of a complex landslide in Ningnan county, southwestern China, which transformed into a debris flow and blocked the river and the major road leading through the valley after heavy rainfall. For this purpose a quasi-3D Smooth Particle Hydrodynamics (SPH) model was implemented that can account for geotechnical slope parameters, run-out distance, velocities and deposition heights. A digital terrain model and the geometry information of the landslide were used as input data in order to estimate the relevant geotechnical parameters by back-analysis. The results of the analysis can be used for the prediction of run-out distances for future events at this site and other similar sites.