EGU21-13750, updated on 25 Jan 2022
https://doi.org/10.5194/egusphere-egu21-13750
EGU General Assembly 2021

Catastrophic landslide affected by topography: a case study in Guizhou, China

Jian Guo
Chang'an University, College of Geological Engineering and Geomatics, China (chdguojian@163.com)

In mountainous areas, large-scale landslides usually cause serious disasters. A large number of studies have found that complex terrain may affect the landslides dynamic, which may be one of the significant factors in catastrophic events. However, the mechanism is rarely explored. On July 23, 2019, a large-scale landslide occurred in Jichang town, Shuicheng County, Liupanshui City, Guizhou Province in China. The landslide, which moved along two gullies, resulted in strong punching-shear, induced scarping on vegetation and large destruction of houses and finally formed a deposit with a volume of 2×106 m3. This research aims to understand the effect of topography on landslide kinematics. To achieve this aim, a detailed field investigation was first carried out with an unmanned aerial vehicle (UAV) aerial photography survey, resident interviews, and field sampling. The rainfall analysis indicate the effective rainfall within seven days before landslides was 70.14 mm which exceeded the rainfall threshold of 54.3 mm in this region, which finally triggered the landslide. Traditional soil mechanics tests were then performed to identify the soil properties of the source material. Combined with numerical simulation using the nonlinear shallow water equation, the whole process of landslides was divided into four stages: instability stage, acceleration stage, transformation stage and impact and accumulation stage. The simulations results show the landslide block slid with a low velocity of 8 m/s for about 100 m. Then, Froude number of landslide increase from 2 to 3 when passing the high and steep terrain, indicating that landslide change to inertial dominated with potential same Froude behavior of classic debris flow. The rupture mass slid with the peak velocity of 23 m/s and diverged in two gullies and ran out for about 600 m. The maximum velocity is 23 m/s in east gully while only 15 m/s in west gully. Compared with deep and incised valleys in west, shallow and straight valley in east decrease the deposit depth, further increase the velocity of landslide material with increased runout distance. This research may provide a fast flow path of back analyzing geo-hazards on complex terrain and serve as a basis for future research on long runout landslides.