Landslide dam failure investigation by 3D image analysis in field experiment

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In an uncontrolled field experiment, the quantification of dam breach process remains a challenge, due to complicated interaction of soil and water. In this study, 3D image analysis of coordinate mapping and 3D-PTV is applied to measure the dam subside and surface velocity. At storage stage, dam subside reflects the situation of dam failure caused by seepage, piping, tension crack and slope sliding. At breach stage, the inertial force and gravity dominate the breach flow process. This means that LSPIV and 2D-PTV cannot present the flow field completely as both methods neglect the gravity effect. Therefore, 3D flow field analysis is necessary. The purpose of this study is to discuss the advantages and difficulties of 3D image analysis in field experiments. In the 3D method, 2D pixel coordinates of several images are mapped to 3D coordinates, and the movement of points are measured to observe dam failure. Comparing with 2D method, 3D method relies on calibrated tool instead of gridlines. Calibrated tool provides three planes of space and characteristic points to map. Gridlines on the field dam are crooked, which provide uncertain coordinates and make errors. Due to measurement in three dimension, dam failure can be easily observe. The result presents that different dam subside has the same horizontal displacement of downstream slope, and dramatic dam subside have large change of downstream slope. In 3D-PTV analysis, the velocity of z direction affects breach flow about 32%. This suggests that 2D-PTV is not suitable to measure breach flow. In addition to compare with hydrograph and velocity distribution, the breach cross section is estimated with different erosion stage. Moreover, this method requires complex devise setup and intensive computational times. Further, research is needed to simplify the process.

Keywords: Dam breach, 3D image analysis, Particle tracking velocimetry (PTV)

