Modeling the coseismic landslide using coupled Eulerian-Lagrangian approach: a case study of 2016 Aso-Bridge landslide, Japan

Chen-Hsun Tang and Guan-Wei Lin
Department of Earth Sciences, National Cheng Kung University, No. 1, University Road, Tainan City, Taiwan
(aid318jp@gmail.com)

An earthquake-induced large-scale landslide could lead to catastrophic disasters. In order to understand the characteristics of a coseismic landslide, the numerical simulation is a method worth using to reconstruct the movement process of the landslide. The study uses the coupled Lagrangian-Eulerian (CEL) method to simulate the processes of the Aso-Bridge landslide triggered by the 2016 Kumamoto Earthquake (ML 6.5) in Japan. Simulation results are consistent with terrain changes after the collapse and can be used to deduce the ground motion caused by the mass movement.

First of all, the mass movement changed from gradual deformation to rapid displacement when the earthquake acceleration exceeded 0.1 g. Second, the maximum velocity of the landslide reached 35 m/s, and the affected area was successfully estimated. Third, the ground motions induced by the simulated landslide at the ground surface revealed that sliding mass impacted the downslope channel at 40 s after the earthquake occurred. The amplitude of simulated landslide-induced ground motions was more significant than that of ambient noise after the main earthquake ended. Because the ground motions caused by the coseismic landslide were hidden in the vibration of the earthquake, it is difficult to distinguish it from the earthquake's shakes. The results in the study indicated that when the earthquake ended, unfinished landslide-induced ground motions may be identified from the records of nearby seismic stations. The CEL simulation provided valuable information to evaluate the impact of a coseismic landslide.

Keywords: coseismic landslide, coupled Eulerian-Lagrangian approach, Aso-bridge landslide