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Ejection mechanism of the Donghekou landslide triggered by the 2008 Wenchuan Earthquake revealed by discrete element modeling

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In 2008, a huge Donghekou landslide was triggered by the Wenchuan earthquake displacing about 2.3×107 m3 of rock. The kinematic behavior of this landslide is simulated using a two-dimensional (2-D) discrete element model (PFC2D code). Our numerical model is composed of discs bonded together. The initial boundary conditions are applied along the ball-wall contacts by using derived velocities integrated from strong motion data with a duration of 125 s including the peak acceleration near the Donghekou area. The constraints are primarily determined from the final geometry of the landslide and variety of geological structures including local levels of material disruption to account for actual landslide characteristics. Simulated results show that the large local seismic acceleration and a free face under the sliding body caused by the dip difference between the upper slide face and the natural slope originated from the ejection of the landslide. For the lower slide body, its kinetic mechanism is changed during sliding. Initially it was a pushed landslide which then gradually changed to a retrogressive landslide. Based on the characteristics of the Donghekou landslide, our 2-D model describes the kinetic process very well. However, when gauging the influence of geometry with regard to movement directions and the distribution of landslide debris deposits, three-dimensional models are compulsory.