Rapid and long runout landslides triggered by earthquake: motion mechanism and countermeasure

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Abstract

In 2018, because of earthquakes, lot of landslides occurred in Japan. Most of them moved in high speed and for long runout distance. It is very important and urgent to study the seismic performance of the natural slope, and consider the reasonable countermeasures.

In this presentation, we will take some landslides triggered by earthquake in Japan, to examine the motion mechanism and consider the countermeasures.

The 2018 Hokkaido Eastern Iburi Earthquake triggered massive landslides in pyroclastic fall deposits. Fig. 1 shows one example occurred in Atsuma-cho. Most of the landslides are shallow debris slides. Based on the field reconnaissance and long term monitoring, the shallow landslides were investigated in depth through longitudinal sections, vertical stratigraphic sections, in-situ hardness tests, and long term moisture monitoring in trench. All of the shallow landslides were found to initiate from the liquefied failure of the weak Ta-d pumice layer and further evolve to the overall mobilization of the superimposed pyroclastic fall deposits along the liquefied sliding zone. To testify the controlling role and to study the shear behavior as well as the anti-liquefaction strength of the weak Ta-d pumice layer, a series of laboratory tests were conducted on the soils around the sliding zone. The test results indicate that the medium sandy Ta-d pumice MS can be easily liquefied under intense ground motion. After the slope failure and during the landslide motion, the weathered pumice showed high susceptibility for grain crushing, which resulted in high pore-water pressure generation during the motion. The liquefied sliding zone soil was left behind the sliding mass, because of the viscosity and low shear resistance. Fig. 2 shows a concept model of the motion mechanism for rapid and long runout landslide.

Another landslide triggered by 2018.4 earthquake in Shimane will also be presented for comparison. Moreover, for landslide motion prediction, a software was developed, and it can be used as a soft countermeasure to reduce the landslide disasters.

Acknowledgments

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References

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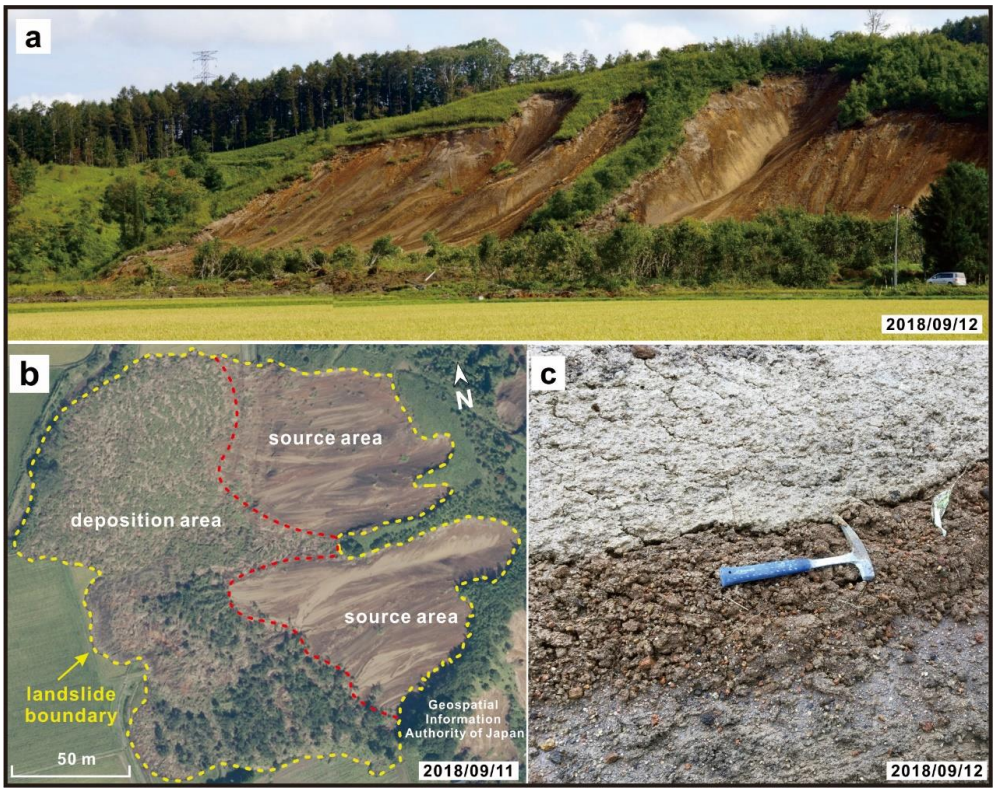

Fig. 1 Shallow slides triggered by 2018.9 Eastern Iburi earthquake in Hokkaido, Japan.
(a) Oblique view; (b) Aerial view; (c) Liquefied sliding zone

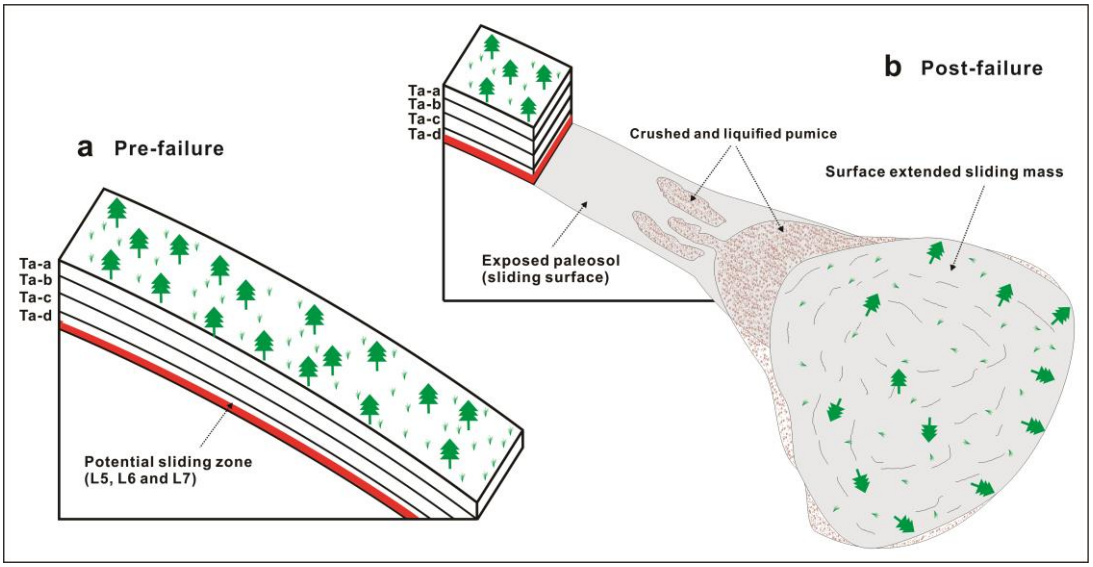

Fig. 2 Concept model of motion mechanism of rapid and long runout landslides