

## Long-traveling conditions for the rock-on-snow landslide: insights from the field and lab evidence

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On March 12, 2011, the M 6.6 earthquake hit the typical deep snow area of Niigata and Nagano prefectures. This earthquake (2011 north Nagano Earthquake) induced a lot of landslides, and some of them travelled on snow moving long distance. We are studying that type of landslides which named rock-on-snow landslide by field observations and lab experiments. The rock-on-snow rock avalanche differs from other conventional earthquake-induced landslides because of high mobility, and slash avalanche because water before the event does not drive rocks. Then its high mobility is important to consider earthquake disaster prevention for deep snow area.

The physical properties of snow under the moving mass could affect long-travelling property. We investigated the Tatsunokuchi landslide induced by the earthquake and found temporal liquefaction zone which lay between landsliding mass and autochthonous snow (Yamasaki et al., 2013). The condition of snow getting liquefaction depends on temperature and pressure. Snow also has effect of friction reducing as skiing. However, all rock-on-snow landslides including small rock falls on snow do not travel long-distance, rather most of them stop shorter distance from the origin than normal rock falls. Thus, condition of the long-travelling could be limited. We conducted lab experiments that miniature rock fragments slides on snow slope which tilt angle is 20 degrees, the width is 20 cm and the length is 300 cm, and then we try to understand basic properties of relation between rock and snow and processes during the sliding. The results and our field observations gave us insights to understand larger phenomena.

### Reference

Yamasaki, S. Nagata, H. and Kawaguchi, T., Long-traveling landslides in deep snow conditions induced by the 2011 Nagano Prefecture earthquake, Japan, Landslides, 2013 Online available.

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