

Characterization of Snow Avalanches on Mt. Fuji based on Seismic Analysis and Numerical Simulations

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Snow avalanches and slush flows occur everywhere on the slope of Mt. Fuji during the winter and spring. These avalanches are sometimes wet and dry depending on the snow and weather conditions. However, it is very rare to observe them visually and we do not have enough information to obtain the whole feature of avalanches on Mt. Fuji. In order to investigate features of these avalanches, we applied a method based on the spatial distribution of the avalanche seismic amplitudes to estimate their precise locations in time and space. The origin, speed and run-out area obtained from the seismic data are compared with numerical simulations to discuss the flow behavior and the precision of seismic analysis on such flows.

On March 14th, 2014, at least one avalanche hit the shop building at the Osawa parking lot on 4th station along the Subaru line toll road. This disaster led us to take mitigation measures for preventing the snow avalanche on this road. Yamanashi prefecture started to build concrete dams to deflect the flow path of avalanches to the west part where there is no road. Just under these dams, a weather monitoring station was installed in November 2015. A seismometer and a microphone were installed at the Osawa parking lot at the same time. On February 14th, 2016, our camera of weather monitoring station died around 5:30 am. We went to the monitoring site and found that our weather monitoring station was destroyed by the impact of a wet snow avalanche.

In this study, we applied seismic analysis on these two avalanches; the dry avalanches on March 14th, 2014 and the wet avalanches on February, 2016. Seismic analysis revealed that four flows went westward along the Osawa and Namesawa valleys on March, 2014 and at least one flow went down to the northeast direction along the Yoshida-Osawa valley and another flow went along the Namesawa valley again on February, 2016. In fact, our ground truth observation found several sediment runoffs along the Subaru line from west to northeast, and a strong hit of snow avalanche was reported near the Satogoya hut which is on the slope of the Yoshida-Osawa after the 2016 event.

Mean avalanche speed estimated by seismic analysis is approximately 32 m/s to 45 m/s. These avalanches are reproducible using numerical simulations assuming that the slower avalanches are dense flows and the faster avalanches are two phase flow including dense and dilute part. The accuracy of the seismic locations is limited in order to capture the detail of the flow dynamics due to the error of the residuals can be up to the order of magnitude of kilometers and sometimes, the flow tracked seismically go up the valley. On the contrary, it is precise enough to detect the avalanches up to 15 km away, to determine the valley where snow avalanches occurred and to estimate the approximate flow speed.

Keywords: Snow Avalanche, Seismic analysis, Numerical simulation, Mt. Fuji