Ballistic ejecta of the phreatic eruption at Kusatsu-Shirane volcano, on 23 Jan 2018

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The joint research team for ballistic ejecta from the Kusatsu-Shirane 2018 eruption

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Mount Moto-Shirane, which is the southern part of Kusatsu-Shirane Volcano in Central Japan, erupted at about 10.00 AM at 23rd of January 2018 with almost no precursor after 1500 years' dormancy. The slope of Mount Moto-Shirane is a popular place for ski. During the eruption, some skiers were struck on the slope by the ballistic blocks. One person was died, and other 11 people were injured by those ballistic blocks. The ballistic blocks also hit the summit station of ropeway and the gondola lifts were in operation at the eastern side of the mountain. When the eruption has started, 50 gondola lifts were still running. A few tens of seconds after, the ropeway has lost power due to the damage of electrical equipment which were attacked by ballistic blocks.

We have conducted the survey of the damage situation of the 28 gondola lifts which were in operation. 15 gondola lifts were covered by ash derived from ash fall and ground-hugging flow, and 9 of them were seriously damaged, such as window breakage and penetration of the ceiling by ballistic impacts. Most of the gondola walls that was facing the crater had cracked and three of the gondola lift also had damages even in the opposite wall. Such kind of damages indicates some of the ballistic blocks fell almost vertically.

We also have carried out a ground-based survey and observational flights using a drone to understand the distribution of ballistic rocks. The maximum size of the ballistic rocks was measured at a total of 191 sites and the number density of the rocks (>64mm) was measured at a total of 64 sites. Ballistic rocks of the eruption are distributed within 500 meters around the main crater and are mainly distributed from north to northeast. The maximum size of ballistic rock was 4.8 m which fell to the western crater rim, and near the main crater was 3.4 m. The flight-distance of ballistic rocks with a major axis of about 20 cm, 50 cm, 100 cm, 200 cm are 400 to 650 m, 400 m, 350 m, 150 m, respectively. It suggests that the initial velocity of ballistic rocks of each size is different.



Fig 1. A. East-southeastern view of new main craters of the eruption taken by A. Terada; B. Photos of ballistic block on the mountain trail 200m away from main crater; C. ballistic block on the ski course 450m away from main crater; D. damaged situation of Gondola 29



Fig.2 Distribution map of maximum block size of ballistic ejecta. Color differentiation indicates block size and star is ab14sent of ballistic ejecta.

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