ABSTRACT: Slab avalanches occurred at Mt. Kamihorokamettoku, Tokachi Mountain Range, in Hokkaido Prefecture in November 2007. The first slab avalanche occurred on the western slope of Mt. Kamihorokamettoku on November 13, 2007, and one person was caught in the avalanche. On November 23, 2007, 12 persons were caught in a slab avalanche that occurred on the northern slope of the ridge of Mt. Kamihorokamettoku, and 4 persons were killed. The Hokkaido branch of the Japanese Society of Snow and Ice (JSSI) dispatched an avalanche research team, which had been newly organized during the winter of 2007–2008, to Mt. Kamihorokamettoku. The research team consisted of researchers and mountain guides who ensure the safety of the team. Field investigations were carried out on November 17 and 25 in order to determine the avalanche characteristics and snowpack structures. The existence of weak layers was confirmed by pit observations. The weak layers of both the western slope and northern slope avalanches consisted of depth hoar crystals.

KEYWORDS: slab avalanche, depth hoar, Mt. Kamihorokamettoku, Hokkaido branch of JSSI

1. INTRODUCTION

The Tokachi mountain range, which is located at the center of Hokkaido island (figure 1), is one of the best places to observe snow crystals in Japan. The snow crystals at Tokachi mountain range are ideal for photography; in addition, it is particularly popular with snowboarders and backcountry skiers because of its powder snow. The number of skiers and snowboarders climbing this area has tended to increase in recent years, and there is an increasing risk of occurrence of avalanche. However risk management is entrusted to each party wholly. The Mt. Kamihorokamettoku area is also popular with people interested in mountain climbing in early winters. Many climbers begin training around the Mt. Kamihorokamettoku area in November and early December. It has been reported that slab avalanches occurred twice at Mt. Kamihorokamettoku in November 2007.

Figure 1: Locations of Hokkaido Island and Mt. Kamihorokamettoku. A: avalanche on November 13. B: avalanche on November 23.
the mountain areas in Hokkaido, although the avalanches around national routes are investigated by the Hokkaido Road Management Engineering Center. The Hokkaido branch of JSSI has started building a snow damage research team since the winter of 2007–2008. This team investigates avalanche damages as well as heavy snowfall events, snowdrifts, etc. The research team consists of researchers and mountain guides who ensure the safety of the team. Information on mountain weather conditions during field investigation is provided by the Japan Weather Association. The investigation of avalanches was the first task for the research team.

2. FIELD INVESTIGATIONS

The first slab avalanche occurred on the western slope of Mt. Kamihorokamettoku on November 13, 2007, and one person was caught in the avalanche. Field investigation was carried out on November 17, 2007. Point “A” in figure 1 shows the location of this avalanche, and points “A” and “B” in figure 2 show the locations at which the person was swept away by and buried under the avalanche, respectively.

![Figure 2. Slab avalanche on the western slope of Mt. Kamihorokamettoku on November 13, 2007. A: point at which the person was swept away, B: point at which the person was buried, C: snow pit at crown.](image)

The research team ascended from the debris to the crown and measured the avalanche size and observed a mountain snowpack. The avalanche size is shown in figure 2. The avalanche was released below the ridge, and it moved downward by approximately 440 m (horizontal distance: 390 m, vertical fall: 200 m). The size of the crown was approximately 170 m, and the maximum depth of the crown surface was approximately 0.8 m.

A combined team of researchers, mountain guides, and climbers successfully reached the starting zone and observed the crown (figure 3). The avalanche had a weak layer composed of faceted crystals and a depth hoar, and the grain size was 0.5–1.0 mm. The layer above the weak layer was a hard slab (grain size: 0.5 mm), and the layer below it consisted of faceted crystals and a depth hoar (grain size: 1.0–2.0 mm).

![Figure 3. Crown surface of avalanche on western slope, which occurred on November 13. The photograph was taken on November 17.](image)

On November 23, 2007, 12 people were caught in a slab avalanche that occurred on the northern slope of the western ridge of Mt. Kamihorokamettoku; out of them 4 people were killed by it. Point “B” in figure 1 shows the location of this avalanche.

A field investigation was carried out on November 25, 2007. The visibility was poor due to fog, and snowpack was unstable; therefore, it was difficult to climb up the mountain to reach the starting zone. Hence, we investigated the debris and the natural snowpack on the northern slope near it. The observation of the snow pit at the starting zone of the second slab avalanche was carried out on December 11. A part of the crown surface remained on a low ridge below the western ridge of Mt. Kamihorokamettoku.

The size of the avalanche is shown in figure 4. The avalanche originated from the north
slope below the west ridge and covered a distance of approximately 490 m (horizontal distance: 430 m, vertical fall: 210 m). Figure 5 shows the crown. The weak layer was composed of the depth hoar and the grain size was 1.0–2.0 mm. The length and depth of the crown were estimated to be approximately 70 m and 0.8 m, respectively, using photographic data. The length of the debris was approximately 160 m.

The weak layers of both the avalanches consisted of depth hoar crystals. Fukuzawa and Akitaya (1993) reported that the depth hoar layer grows rapidly; they also pointed out that a large temperature gradient is produced by radiative cooling. We analyzed weather data and discussed the weather conditions before the occurrence of the avalanches. Figure 6 shows a precipitation map analyzed by the Japan Meteorological Agency. Weak precipitation was recorded on November 8, 2007. Then, clear weather and radiative cooling were recorded from November 8 to 10. We inferred that the depth hoar grew below the surface during this period.

4. CONCLUSIONS

Slab avalanches occurred on Mt. Kamihorokamettoku on November 13 and 23, 2007. The Hokkaido branch of the JSSI dispatched an avalanche research team comprising researchers, mountain guides, and climbers, who successfully reached the starting zone and observed the crown. The first and second slab avalanches occurred on the western and northern slopes of the western ridge of Mt. Kamihorokamettoku, respectively. The weak layers of both the avalanches consisted of depth hoar crystals. Weather analysis revealed that a temperature gradient observed between November 8 and 10 might have promoted the rapid growth of the depth hoar below the surface.

5. REFERENCE