

Geonor operation with / without heater at Joetsu and Nagaoka.

Sento Nakai

Snow and Ice Research Center, NIED

1. Introduction

Meteorological data in the snowy area of Japan have been collected by the Snow and Ice Research Center (SIRC) of National Research Institute for Earth Science and Disaster Prevention (NIED) for more than 20 years (Shimizu and Abe, 2001; Yamaguchi et al., 2011). A lot of wet snow as well as dry aggregates and graupel fall during winter season in Japan. Wet snow and dry aggregates often cause snow accumulation on the facilities measuring snowfall and other meteorological variables. Avoiding such snow accumulation is important for correct measurement. All gauges operated by SIRC are heated by electric heaters. Heaters are also extended to facility-attached small shields because accumulated snow on the shield also violates the measurement.

2. Geonor heating at Joetsu site

Geonor T-200B-MD-3-W gauges are introduced for winter precipitation measurement by SIRC in early 2013/2014 winter. We selected water-pipe heater for Geonor heating system for it is low-cost and easy in installation and maintenance. The water-pipe heater is thin and flexible (Fig. 1), and does not change the outer shape of the gauge neck significantly (Fig. 2). The heater is simply wound around the orifice and neck of the Geonor gauge, and fixed using vinyl tape. Power cable of the heater was hung down straight and was fixed with some excess length considering maintenance with gauge cover removed. Heater position was slightly below the gauge orifice to reduce the turbulent flow caused by the heater (Fig. 3). The position was determined roughly and empirically. The effect of heater on the flow around the orifice should be examined using computational fluid dynamics model. Heater specifications are given in Table 1.

The water-pipe heater works very well during winter precipitation. We took photographs of Geonor gauge automatically in 30-minute intervals using a time lapse camera (Garden Watch Cam made by Brinno) in 2013/2014 winter. The time lapse camera worked for more than 100 days using size AA lithium battery. Movies of snow

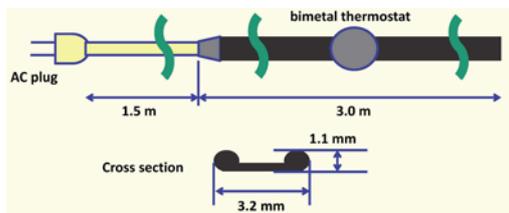


Fig. 1 Heater shape and dimension

Table 1 Heater specifications

manufacturer : Work Co.Ltd.
 manufacturer Web site : http://www.work-todo.co.jp/a_slender.html
 including detailed illustration of examples (Japanese only)
 model : Slender Heater M-type
 installation : very flexible, can be wound around
 price : approximately JPY3,400- (3.0m)
 power consumption : 10 Watts per meter
 power supply : 100VAC
 heating control : bimetal thermostat, turn on/off at 3/10 degree Celcius
 manufacturer recommendation : checking before seasonal operation

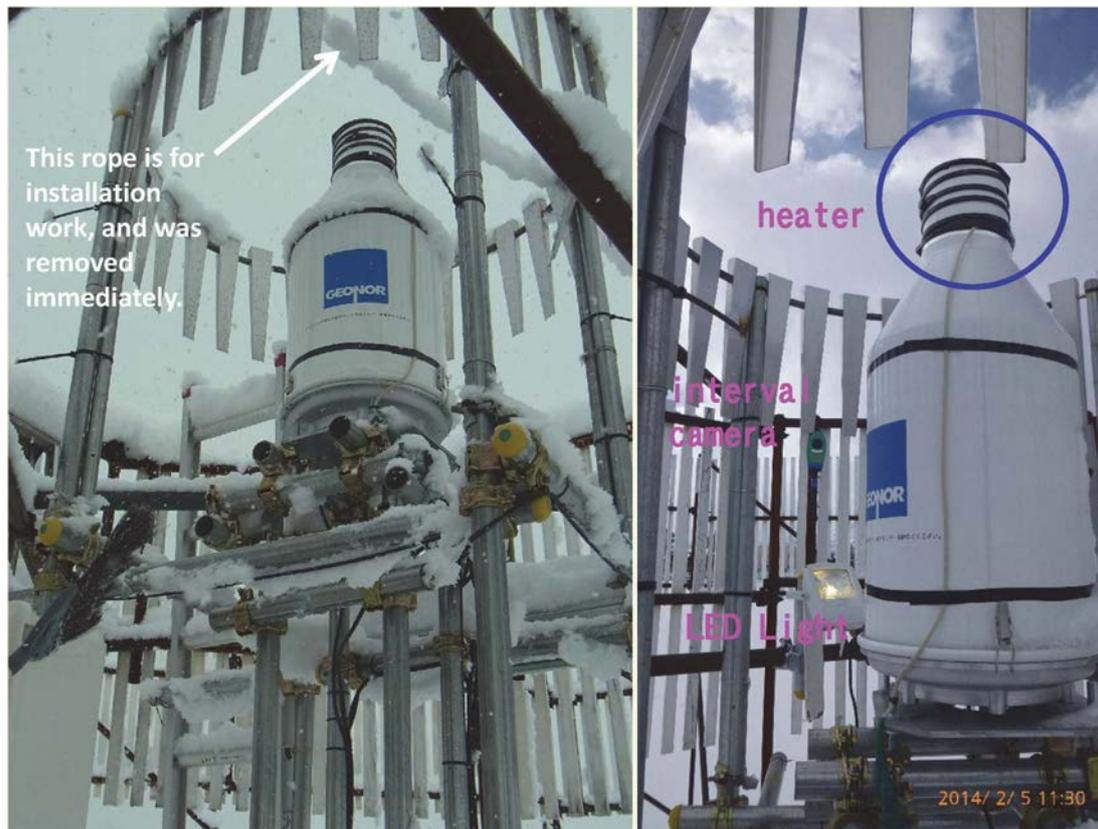


Fig. 2 Heater installation at Joetsu site in 2013/2014 winter

accumulation on Geonor gauge at Nagaoka and Joetsu sites are available online at
http://yukibousai.bosai.go.jp/kaiseki/SPICE/20141105GeonorW-WO-heater/20140425_No5Nagaoka_396-465.wmv (Nagaoka)

and

http://yukibousai.bosai.go.jp/kaiseki/SPICE/20141105GeonorW-WO-heater/GWC20140204_22-14_03_368-423.wmv (Joetsu).

Snow accumulated on the shoulder of Geonor gauge, though, no snow around neck and orifice of the gauge. In the movie of the Geonor at Joetsu site, gauge orifice is hidden by the ring of Alter shield. Snow accumulated on the top of Alter shield during intense snowfall.



Fig. 3 Close view of the heater and orifice of the gauge.

Power consumption of the water-pipe heater is small. Temperature during

winter precipitation at our Nagaoka site (Climate at Nagaoka is similar to that of Joetsu site.) is typically between -5 to 10 degree Celsius (Yamaguchi et al., 2009). We have no experience on this kind of heater in colder environment (e.g. less than -20 degree).

3. Snow accumulation on observation facilities without heating

We made some precipitation observation using Geonor gauge without heater in 2013/2014 winter. After continuous snowfall exceeding 50 cm in 24 hours, a lot of snow accumulated on the Geonor gauge (Fig. 4). It seemed that the gauge was completely capped by snow. Though, removing snow on the near side of the gauge, the gauge orifice was found to be open. Precipitation particle fell into the bucket through additional wall of snow. This situation is worse than complete capping, because we cannot know if the snow accumulated or not by examining gauge data later. At Nagaoka and Joetsu sites, Geonor data without heating cannot be used for analysis.



Fig. 4 Snow accumulation on Geonor gauge at 1010 JST on January 11, 2014.

Removing snow accumulation using this kind of heater is useful for other facilities. We used the same heater to avoid snow accumulation on Y-shaped

frame of Parsivel (OTT Hydromet) (Fig. 5). The accumulated snow on the OTT frame without heater may block the laser beam of Parsivel. Laser beam path kept clear after we wound a heater around Y-frame of Parsivel.

4. Summary

We used water-pipe heaters for gauge orifice heating. It is low-cost and easy to install. The heater well avoided snow accumulation on Geonor gauge orifice and Parsivel Y-shaped frame.

We do not intend to recommend a specific heater that we have been used in this report. Similar heater of other manufacturers might show the same performance. Although it is not a manufacturer-guaranteed usage, we have not experienced a trouble, such as overheating of heater. Selection of similar heater with different power may applicable to the sites in environment different from Joetsu site.

References

- Shimizu, M. and O. Abe. 2001. Recent fluctuation of snow cover on mountainous areas in Japan. *Ann. Glaciol.*, 32, 97-101.
- Yamaguchi, S., S. Nakai, K. Iwamoto and A. Sato, 2009: Influence of anomalous warmer winter upon statistics of measured winter precipitation data. *J. Appl. Meteorol. Climatol.*, 48, 2403–2409.
- Yamaguchi, S., O. Abe, S. Nakai and A. Sato, 2011: Recent fluctuations of meteorological and snow conditions in Japanese mountains. *Ann. Glaciol.*, 52, 209-215.

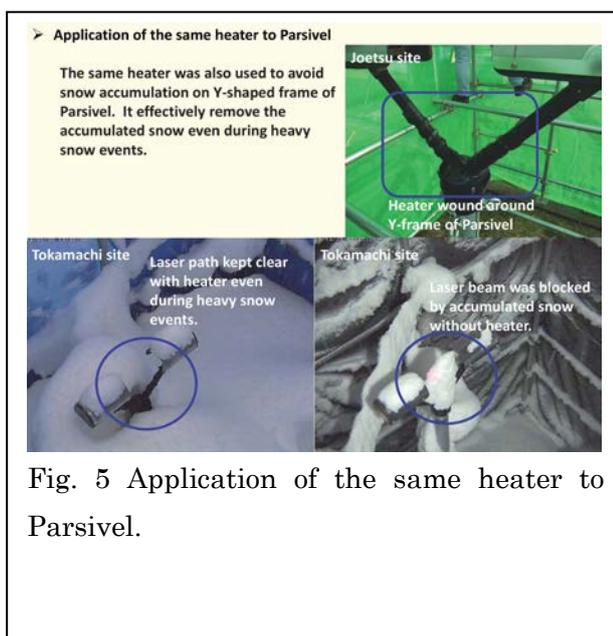


Fig. 5 Application of the same heater to Parsivel.