

Meteorological observations at Åsgårdfonna, Spitsbergen, 1987

Kaoru IZUMI¹, Kazuhide SATOW², Yoshiyuki FUJII³ and Sadao KAWAGUCHI³

- 1 Research Institute for Hazards in Snowy Areas, Niigata University, Niigata 950–21 Japan
- 2 Nagaoka College of Technology, Nagaoka 940 Japan
- 3 National Institute of Polar Research, Itabashi, Tokyo 173 Japan

(Received December 23, 1987; Revised manuscript received January 31, 1988)

Abstract

Meteorological observations were carried out on a dome, the top of the glacier called Åsgårdfonna, Spitsbergen, from May 26 to June 13, 1987. A remarkable contrast of weather conditions was found: high air temperature with low relative humidity in the sunny period, and low air temperature with high relative humidity in the cloudy period. In the latter period, we observed occasional riming on vertical obstacles.

1. Introduction

A shallow ice coring was made on the dome called Høghetta, the top of the glacier called Åsgårdfonna, northern part of Spitsbergen by Japanese Arctic Glaciological Expedition 1987 (JAGE '87) to study climatic and environmental changes during last few hundred years (Watanabe and Fujii, 1988). Some meteorological observations which would be used in the ice core studies were made at the coring site from May 26 to June 13, 1987. As there have been few meteorological observations in this district, we report the general meteorological conditions obtained there in the early summer.

2. Method of observations

Location and altitude of the observation site were 79° 16' N, 16° 52' E and 1,200 m a.s.l. (Fig. 1). The surface condition around the site is characterized by a flat snowfield.

Measured meteorological elements and instruments are summarized in Table 1. Air temperature

and relative humidity were measured at a height of 1.0 m in a ventilated shelter. Wind speed was measured at a height of 1.9 m. Vertical profiles of wind speed were occasionally measured for the heat balance study. The local time GMT plus 2 hours is used in this report.

Table 1. Meteorological elements observed at Høghetta, Åsgårdfonna.

Items	Instrument
Atmospheric pressure	Aneroid barometer
Air temperature	Thermister thermometer
Relative humidity	Electric hygrometer
Wind speed	3-cup anemometer
Wind direction	Eye observation
Global radiation	Pyranometer
Net all-wave radiation	Net radiometer
Precipitation	Rain gauge
Cloud amount	Eye observation

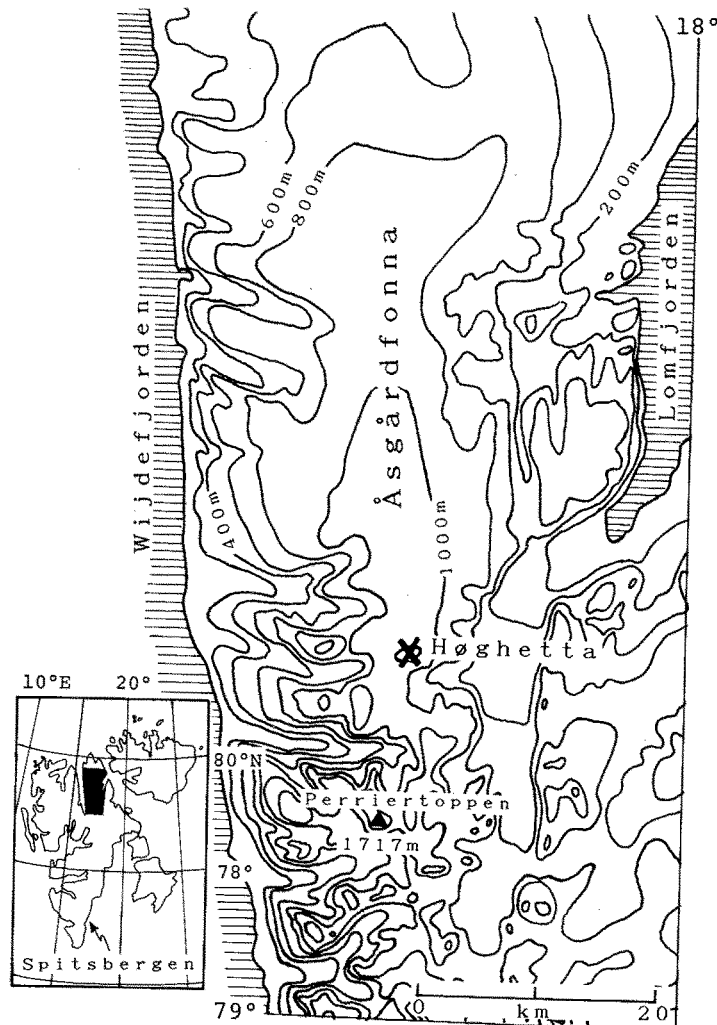


Fig. 1. Location of the observation site (X).

3. Results of observations

Variations in meteorological elements measured during 19 days are shown in Fig. 2. Atmospheric pressure, air temperature and relative humidity indicate instantaneous values for every hour; global radiation instantaneous value for every 30 minutes; wind speed 30 minutes mean value. Precipitation indicates one day total value measured at 08 h. Wind direction and cloud amount were measured three times a day (08 h, 12 h and 20 h). Mean, maximum and minimum values of meteorological elements observed during the period are listed in Table 2.

It is found from Fig. 2 that there was a remarkable contrast of weather conditions between warm/sunny period at the beginning of the observation and cold/cloudy period after that. In the former period, air temperature rose up to about 4°C with low relative humidity. On the other hand, in the latter period, air temperature kept low values of about -8°C with high relative humidity more than 90%. From pit observations of the surface snow layers, it was found that snow-melting was scarcely occurred throughout both periods.

In the cold period, there was occasional light

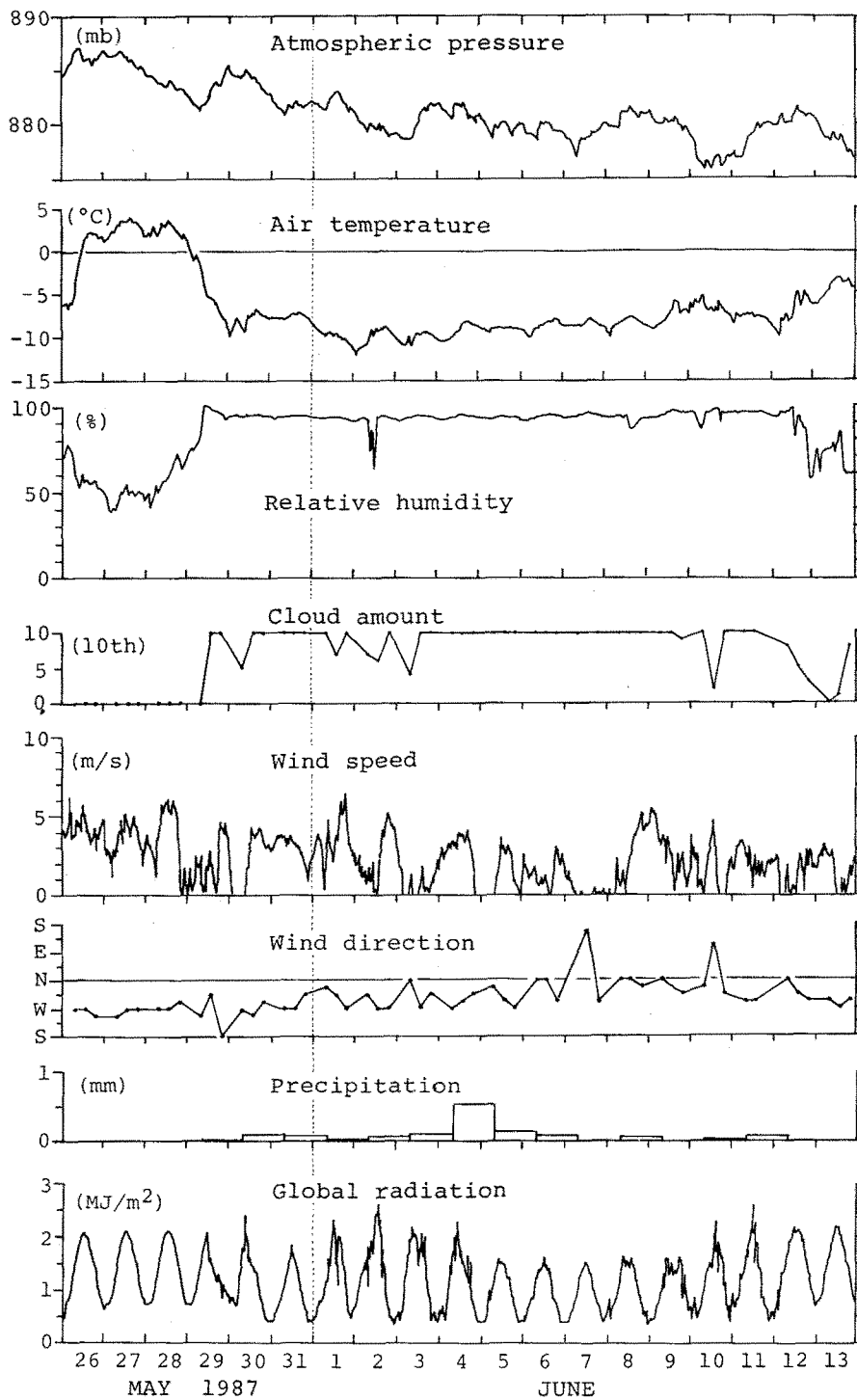


Fig. 2. Meteorological conditions at Høghetta, Åsgårdfonna from May 26 to June 13, 1987.

Table 2. Mean and extreme values of meteorological elements at Høghetta, Åsgårdfonna during May 26 to June 13, 1987.

Item	Mean	Maximum	Minimum
Atmospheric pressure (mb)	881	887	876
Air temperature (°C)	-6.5	3.9	-12.3
Relative humidity (%)	85	100	30
Wind speed (m/s)	2.2	6.5	0
Global radiation (MJ/m ² ·day)	27.8	34.8	20.9
Cloud amount (10th)	7	10	0

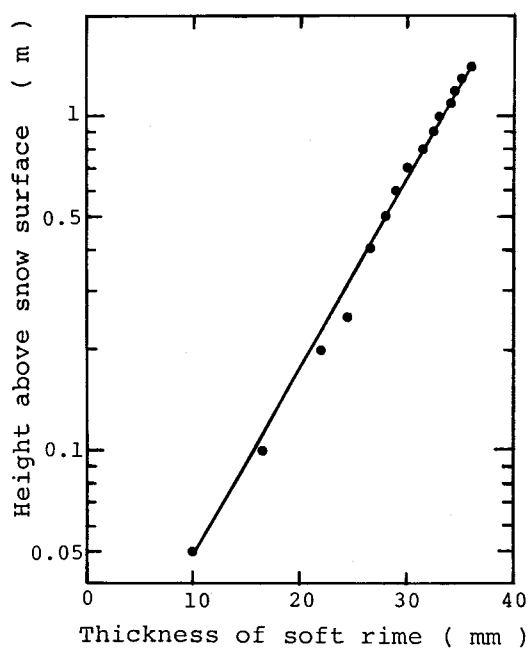


Fig. 3. Vertical profile of the thickness of soft rime developed on a bamboo stake for half a day on June 5.

precipitation less than 1 mm per day which was composed of soft rime or hoarfrost in addition to snowfall. Total precipitation was only 1.3 mm, so accumulation on the horizontal snow surface was small. On the other hand, on vertical obstacles, we occasionally

observed a rapid formation of soft rime in the cold period. As an example, Figure 3 shows a vertical profile of the thickness of soft rime which developed on a 150 cm high bamboo stake of 9 mm in diameter for half a day on June 5. It is found that this diagram is similar to the logarithmic vertical profile of wind speed, which is important factor controlling the formation of soft rime.

The change in atmospheric pressure during the observation period was in the range of about 10 mb. Prevailing wind directions were NW–W (64 % of all data). Though the observation site was on a open snowfield, wind speed was relatively small: the mean value during the period was 2.2 m/s.

Global radiation more than 0.30 MJ/m² was measured even at night because of the midnight sun near the summer solstice. Daily global radiation in the cold period was large despite high cloud amount: minimum value during the period was 20.9 MJ/m²·day. This is because of frequent foggy weather conditions the and midnight sun.

Acknowledgments

We would like to express our appreciation to the members of JAGE '87 for their laborious assistance to our field work. We are indebted to Professor Shun'ichi Kobayashi of Niigata University for valuable suggestion and advice on the field measurements.

Reference

- Watanabe, O. and Fujii, Y (1988): Outlines of Japanese Arctic Glaciological Expedition 1987. *Bulletin of Glacier Research*, **6**, 47–50.