

## **Forsmark site investigation**

# **Snow depth, snow water content and ice cover during the winter 2007/2008**

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Geosigma AB

December 2008

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*Keywords:* Snow depth, Snow water content, Ice cover, AP PF 400-07-057.

This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the authors and do not necessarily coincide with those of the client.

Data in SKB's database can be changed for different reasons. Minor changes in SKB's database will not necessarily result in a revised report. Data revisions may also be presented as supplements, available at [www.skb.se](http://www.skb.se).

A pdf version of this document can be downloaded from [www.skb.se](http://www.skb.se).

## **Abstract**

During the winter of 2007/2008 snow depth and ice cover have been measured and observed. It is the sixth consecutive year that these measurements and observations have been performed. In addition to these parameters the water content of the snow was calculated from the weight of a snow sample at each measurement.

Measurements and observations were conducted on a regular basis from the beginning of January until April 2008. No observations or measurements were made within this activity during the autumn 2007.

No persistent snow cover was established during the winter 2007/2008. Only at two occasions there was enough snow for measurements.

The period of ice cover was 74 days in Lake Eckarfjärden and the sea bay at SFR was ice-covered for 9 days.

## Sammanfattning

Under vintern 2007/2008 har de meteorologiska parametrarna snödjup och istäcke mätts och observerats. Det är sjätte året i rad som dessa parametrar har registrerats. Under denna aktivitet har även snöns vatteninnehåll beräknats utifrån vikten på en bestämd volym snö.

Regelbundna mätningar och observationer har gjorts från början av januari till april 2008. Inga observationer eller mätningar gjordes inom denna aktivitet under hösten 2007.

Vintern 2007/2008 bildades aldrig något varaktigt snötäcke. Endast vid två observationstillfällen fanns det tillräckligt med snö för mätning.

Istäcket varade 74 dagar i Eckarfjärden och 9 dagar i havsviken vid SFR.

# Contents

|                   |   |    |
|-------------------|---|----|
| <b>1</b>          | <b>Introduction</b>   | 7  |
| <b>2</b>          | <b>Objective and scope</b>  | 9  |
| <b>3</b>          | <b>Equipment</b>  | 11 |
| 3.1               | Description of equipment  | 11 |
| 3.1.1             | Snow depth  | 11 |
| 3.1.2             | Snow weight   | 11 |
| 3.1.3             | Ice cover   | 11 |
| <b>4</b>          | <b>Execution</b>  | 13 |
| 4.1               | General   | 13 |
| 4.2               | Execution of measurements and observations  | 14 |
| 4.2.1             | Measurements of snow depth, snow weight and determination of water content            | 14 |
| 4.2.2             | Observations of ice cover   | 15 |
| 4.3               | Data handling   | 15 |
| 4.4               | Nonconformities   | 15 |
| <b>5</b>          | <b>Results</b>  | 17 |
| 5.1               | Snow depth and water content  | 17 |
| 5.2               | Ice cover   | 18 |
| <b>6</b>          | <b>References</b>   | 19 |
| <b>Appendix 1</b> | Primary data from snow depth and snow weight measurements during the winter 2007/2008 | 21 |

# 1 Introduction

This document reports data obtained from snow measurements and ice cover observations during the winter 2007/2008. These are activities performed within the site investigation at Forsmark. The work was carried out in accordance with activity plan SKB PF 400-07-057. Similar studies were performed during the winters of 2002/2003 /1/, 2003/2004 /2/, 2004/2005 /3/, 2005/2006 /4/ and 2006/2007 /5/ and this activity is to a large extent carried out in the same way.

The three parameters, snow depth, snow weight and duration of ice cover, were measured and registered in the field. The water content of the snow was calculated using the results from the snow weight measurements. The map in Figure 1-1 below shows the positions for the measurements. The activity was performed from January until the beginning of April 2008. No observations or measurements were made within this activity during the autumn 2007.



Figure 1-1. Locations of measurements and registration of meteorological winter parameters.

In Table 1-1 controlling documents for performing this activity are listed. The activity plan is SKB's internal controlling document.

Original data from the reported activity are stored in the primary database Sicada. Data are traceable in Sicada by the Activity Plan number (SKB PF 400-07-057). Only data in databases are accepted for further interpretation and modelling. The data presented in this report are regarded as copies of the original data. Data in the databases may be revised, if needed. Such revisions will not necessarily result in a revision of the P-report, although the normal procedure is that major revisions entail a revision of the P-report. Minor revisions are normally presented as supplements, available at [www.skb.se](http://www.skb.se).

**Table 1-1. Controlling documents for performance of the activity.**

| <b>Activity plan</b>   | <b>Number</b>          | <b>Version</b> |
|--|------------------------|----------------|
| Platsundersökning Forsmark   | AP PF 400-07-057       | 1.0            |
| Registrering av snödjup/-vatteninnehåll och tider för<br>isläggning/islossning, säsongen 2007–2008 |                        |                |
| <b>Other controlling documents</b>   | <b>Number</b>          | <b>Version</b> |
| SMHI, Handbok för observatörer   | SMHI internal document | N/A            |

## 2 Objective and scope

This activity was conducted in order to obtain data about the local climate that, in combination with other meteorological data, will be used in hydrological, hydrogeological and ecological modelling. The activity started in the beginning of January 2008 and was completed when all the snow had melted away in the beginning of April 2008. No observations or measurements were made within this activity during the autumn 2007.

The following parameters were measured:

- Snow depth at three locations.
- Snow weight at three locations.
- Time for ice freeze-up and ice break-up at two locations.

The snow weight was used to calculate the water content of the snow.



## 3 Equipment

### 3.1 Description of equipment

#### 3.1.1 Snow depth

The snow depth was measured according to SMHI's Handbook for observers (In Swedish: SMHI:s handbok för observatörer). A transparent plastic tube graded in centimetres, with 5 centimetres inner diameter, was used for the snow depth measurements, see Figure 3-1.

#### 3.1.2 Snow weight

The snow weight was measured by taking a snow sample with the transparent plastic tube mentioned above. A spatula was used to keep the sample in the tube so it could be transferred to a plastic bag. To measure the weight, a scale was used. The scale could measure up to 200 g and was graded with 2 g increments. The equipment used to take snow samples and measure the snow weight is shown in Figure 3-1.

#### 3.1.3 Ice cover

The observations of ice freeze-up and ice break-up were performed by visual inspections.



*Figure 3-1. Equipment used to measure snow depth and snow weight.*

## 4 Execution

This activity consisted of the following:

1. Measurements of snow depth, snow weight and determination of water content.
2. Observations of ice freeze-up and ice break-up.
3. Documentation.

### 4.1 General

Measurements of snow depth and snow weight were made once a week between January 11 and April 4, 2008. Ice conditions were observed with varying frequency depending on temperature and weather conditions. No observations or measurements were made within this activity during the autumn 2007. Each object for measurements/observations has a specific ID-code according to Table 4-1 (cf. locations in Figure 1-1). The snow depth and snow weight objects as well as the objects where ice conditions were observed were registered as surfaces (AFM-numbers).

**Table 4-1. ID-code numbers and co-ordinates for the objects of this activity. Coordinate system RT 90 2,5 gon V 0:-15.**

| Parameter               | ID-code   | X       | Y       | Type of location     |
|-------------------------|-----------|---------|---------|----------------------|
| Snow                    |           |         |         |                      |
| Depth and water content | AFM000071 |         |         | Ploughed arable land |
|                         | 1         | 6697419 | 1634872 |                      |
|                         | 2         | 6697413 | 1634869 |                      |
|                         | 3         | 6697412 | 1634874 |                      |
| Depth and water content | 4         | 6697416 | 1634877 |                      |
|                         | AFM000072 |         |         | Forest glade         |
|                         | 1         | 6698528 | 1631524 |                      |
|                         | 2         | 6698524 | 1631527 |                      |
| 3                       | 6698529   | 1631527 |         |                      |
| Depth and water content | 4         | 6698534 | 1631523 |                      |
|                         | AFM001172 |         |         | Forest glade         |
|                         | 1         | 6699475 | 1633157 |                      |
|                         | 2         | 6699468 | 1633157 |                      |
| 3                       | 6699473   | 1633160 |         |                      |
| Ice cover               | 4         | 6699480 | 1633160 |                      |
|                         | AFM000010 | 6697230 | 1632050 | Lake                 |
|                         | AFM000075 | 6701371 | 1632303 | Sea bay              |

## 4.2 Execution of measurements and observations

### 4.2.1 Measurements of snow depth, snow weight and determination of water content

Snow depth is in this case defined as the thickness of the snow cover from the snow surface to the ground. The site should have a fairly smooth ground surface and the snow should not fall in drifts or be able to blow away. There were three sample stations, one in an open field at Storskäret, one in a forest glade southwest of Lake Bolundsfjärden, and one in a forest glade close to Jungfruholm. The sample stations were approximately  $4 \times 4$  m and marked with poles.

Measurements were made once a week, starting on January 11 and continuing until the snow was completely melted in spring, which was on April 4. The measurements were made even if no new snow had been falling, since packing, melting and evaporation should be considered as well.

The snow depth was measured at 6 points within each sample station and the average depth of the station was calculated. The depth was measured with a transparent plastic tube which also was used to take snow samples for water content determination. The tube was pressed down through the snow layer until it hit the ground and the depth was measured to the nearest centimetre, see Figure 4-1.



*Figure 4-1. Measurement of snow depth with plastic tube at Storskäret, AFM000071.*

The snow weight was measured at all three sample stations. At each station, 6 snow samples were taken with the plastic tube and transferred to a plastic bag for weight measurements. The weight of the bag, approximately 4 g, was subtracted. If the sample weighed more than 200 g, the sample was divided into two subsamples that were weighed separately. The average snow weight of the station was then calculated. In cases of hard wind, the body of the person performing the measurement and natural objects in the vicinity was used to block the wind to avoid incorrect readings on the scale.

On the basis of average snow depth and snow weight the water content was determined with the following assumptions:

Inner diameter of plastic tube: 50 mm.

Inner area of the plastic tube ( $\pi r^2$ ): 19.635 cm<sup>2</sup>.

Water density: 1 g/cm<sup>3</sup>.

Water content of the snow in mm: snow weight (g)/19.635 (cm<sup>2</sup>) × 10.

#### **4.2.2 Observations of ice cover**

Observations of ice freeze-up/ice break-up were made for a sea bay near SFR and for one of the lakes in the area, Lake Eckarfjärden.

The ice conditions were observed every morning during working days for the sea and approximately once a week for the lake.

It is important to register the times of the first ice freeze-up and the last ice break-up. The time of the first ice freeze-up is defined as the first occasion during the season when a lasting ice cover is established. The last ice break-up is defined as the time when the ice cover from the winter season finally breaks up in spring. Very short periods in early autumn and late spring with only thin ice cover are neglected, as well as ice remains during spring.

### **4.3 Data handling**

The measurements and observations were documented in field notes and then transferred to Excel-files. The primary data of this activity are registered in Sicada and are traceable by the Activity Plan number, SKB PF 400-07-057. Only primary data registered in Sicada should be used for model calculations and other assessments of the site.

### **4.4 Nonconformities**

The activity was conducted without nonconformities. However, due to a miss in communication from SKB no observations or measurements were performed during the autumn 2007. There was no persistent snow cover during the autumn, but a thin snow cover occurred for some single days at some occasions before it melted away.

## 5 Results

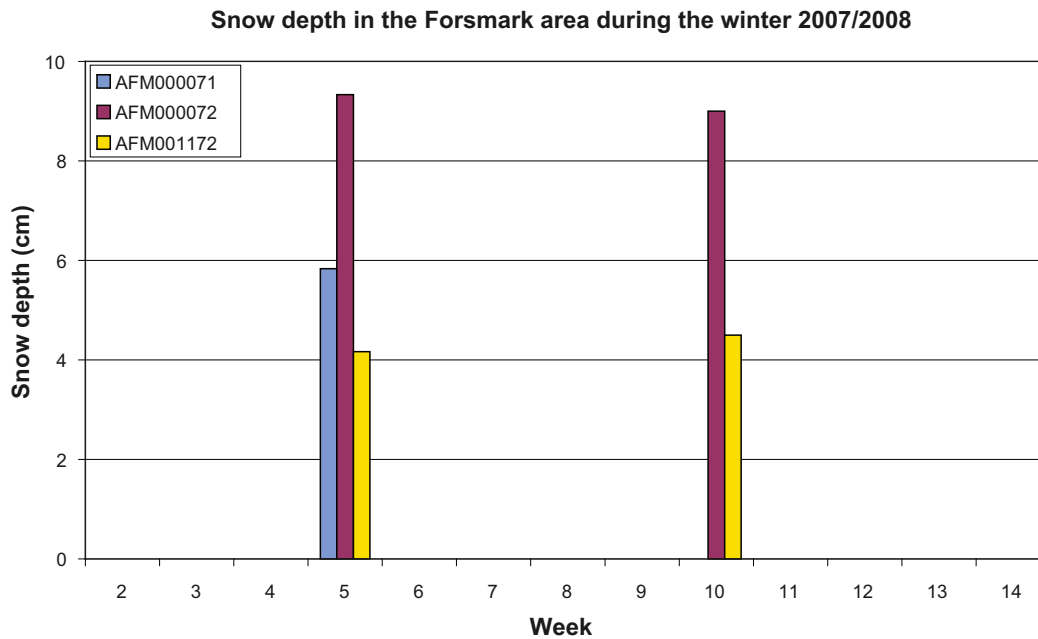
### 5.1 Snow depth and water content

Snow depth was measured at three stations (AFM000071, AFM000072 and AFM001172) from January to April 2008. No measurements were performed during the autumn 2007. The snow weight was measured at these three stations to calculate the water content in the snow.

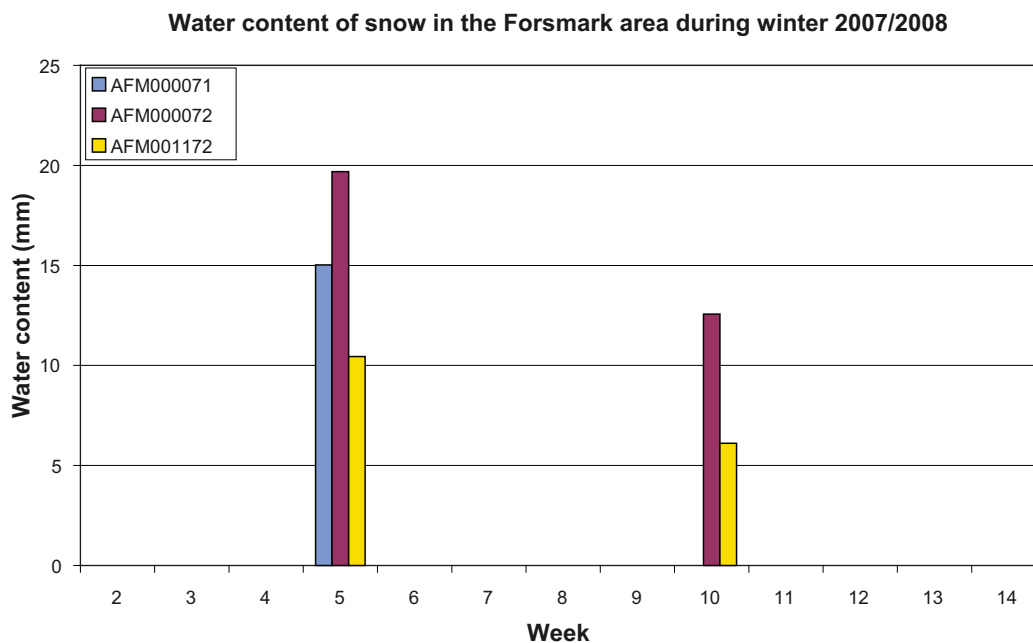
The average snow depth at the three stations is presented in Figure 5-1. The complete set of primary data is presented in Appendix 1.

No persistent snow cover was established during the winter 2007/2008. Only at two occasions, and for Storskåret only once, there was enough snow for measurements. The thickest snow cover was found in the forest glade at AFM000072.

The snow weight was measured to calculate the water content of the snow. The results are presented in Figure 5-2.



*Figure 5-1. Average snow depth during the winter 2007/2008 at three stations in the Forsmark area.*



*Figure 5-2. Snow water content during the winter 2007/2008 at three stations in the Forsmark area.*

## 5.2 Ice cover

Ice conditions observed in the Forsmark area during the winter 2007/2008 are shown in Table 5-1. Since no ice cover observations were conducted within this activity during autumn 2007, observations performed during surface water measurements in October through December 2007 are also presented.

Lake Eckarfjärden was selected as representative for the lakes in the area concerning ice cover. When the ice froze and broke up, the conditions in other lakes in the area were checked and no major deviations were observed.

**Table 5-1. Time for ice freeze-up and ice break-up in Lake Eckarfjärden and in a bay of the Baltic sea at SFR, Forsmark.**

| Station                       | Date for ice freeze-up | Date for ice break-up | Period with ice cover (days) |
|-------------------------------|------------------------|-----------------------|------------------------------|
| Lake Eckarfjärden (AFM000010) | 2007-12-03*            | 2008-03-14            | *                            |
|                               | 2008-01-01             |                       | 74                           |
| Sea bay at SFR (AFM000075)**  | 2008-01-23             | 2008-01-24            | 2                            |
|                               | 2008-02-12             | 2008-02-12            | 1                            |
|                               | 2008-02-18             | 2008-02-21            | 4                            |
|                               | 2008-03-04             | 2008-03-05            | 2                            |

\* From observations performed within other activity (surface water measurements). Observations made 2007-10-08 and 2007-11-05 showed no ice, but 2007-12-03 there was an ice cover.

\*\* Regular observations are performed from 2008-01-01, but observations performed within other activity 2007-10-08, 2007-11-05 and 2007-12-03 showed no ice.

## 6 References

- /1/ **Aquilonius K, Karlsson S, 2003.** Forsmark site investigation. Snow depth, frost in ground and ice cover during the winter 2002/2003. SKB P-03-117, Svensk Kärnbränslehantering AB.
- /2/ **Heneryd N, 2004.** Forsmark site investigation. Snow depth, ground frost and ice cover during the winter 2003/2004. SKB P-04-137, Svensk Kärnbränslehantering AB.
- /3/ **Heneryd N, 2005.** Forsmark site investigation. Snow depth, ground frost and ice cover during the winter 2004/2005. SKB P-05-134, Svensk Kärnbränslehantering AB.
- /4/ **Heneryd N, 2006.** Forsmark site investigation. Snow depth, ground frost and ice cover during the winter 2005/2006. SKB P-06-97, Svensk Kärnbränslehantering AB.
- /5/ **Heneryd N, 2007.** Forsmark site investigation. Snow depth, snow water content and ice cover during the winter 2006/2007. SKB P-07-81, Svensk Kärnbränslehantering AB.

### **Primary data from snow depth and snow weight measurements during the winter 2007/2008**

The data collected during the snow depth and snow weight measurements are presented below as individual measurements as well as calculated average snow depth, snow weight and water content.

For each measurement, a visual estimate of the degree of coverage was made according to the following scale:

S = completely or almost completely snow-covered ground.

SB = more than half of the ground snow-covered but not completely.

BS = more than half of the ground free of snow but not completely.

B = the ground completely or almost completely free of snow.



**Table A-1. Snow depth, snow weight and water content at Storskäret (AFM000071) during the winter 2007/2008.**

| Date       | Depth (cm) |         |         |         |         |         | Weight (g) |         |         |         |         |         | Snow coverage | Average snow depth (cm) | Average snow weight (g) | Water content (mm) |
|------------|------------|---------|---------|---------|---------|---------|------------|---------|---------|---------|---------|---------|---------------|-------------------------|-------------------------|--------------------|
|            | Point 1    | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 1    | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 |               |                         |                         |                    |
| 2008-01-11 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-01-18 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-01-25 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-02-01 | 6.0        | 9.0     | 5.0     | 6.0     | 5.0     | 4.0     | 24.0       | 54.0    | 23.0    | 26.0    | 28.0    | 22.0    | S             | 5.8                     | 29.5                    | 15.0               |
| 2008-02-08 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-02-15 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-02-22 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-02-29 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-03-07 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | BS            | 0.0                     | 0.0                     | 0.0                |
| 2008-03-14 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-03-19 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-03-28 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-04-04 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |

**Table A-2. Snow depth, snow weight and water content at the forest glade (AFM000072) during the winter 2007/2008.**

| Date       | Depth (cm) |         |         |         |         |         | Weight (g) |         |         |         |         |         | Snow coverage | Average snow depth (cm) | Average snow weight (g) | Water content (mm) |
|------------|------------|---------|---------|---------|---------|---------|------------|---------|---------|---------|---------|---------|---------------|-------------------------|-------------------------|--------------------|
|            | Point 1    | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 1    | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 |               |                         |                         |                    |
| 2008-01-11 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-01-18 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-01-25 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-02-01 | 8.0        | 10.0    | 9.0     | 9.0     | 10.0    | 10.0    | 32.0       | 42.0    | 38.0    | 37.0    | 41.0    | 42.0    | S             | 9.3                     | 38.7                    | 19.7               |
| 2008-02-08 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | BS            | 0.0                     | 0.0                     | 0.0                |
| 2008-02-15 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-02-22 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-02-29 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-03-07 | 9.0        | 8.0     | 10.0    | 9.0     | 9.0     | 9.0     | 26.0       | 22.0    | 26.0    | 24.0    | 26.0    | 24.0    | S             | 9.0                     | 24.7                    | 12.6               |
| 2008-03-14 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | BS            | 0.0                     | 0.0                     | 0.0                |
| 2008-03-19 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-03-28 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | BS            | 0.0                     | 0.0                     | 0.0                |
| 2008-04-04 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |

**Table A-3. Snow depth, snow weight and water content at Jungfruholm (AFM001172) during the winter 2007/2008.**

| Date       | Depth (cm) |         |         |         |         |         | Weight (g) |         |         |         |         |         | Snow coverage | Average snow depth (cm) | Average snow weight (g) | Water content (mm) |
|------------|------------|---------|---------|---------|---------|---------|------------|---------|---------|---------|---------|---------|---------------|-------------------------|-------------------------|--------------------|
|            | Point 1    | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 1    | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 |               |                         |                         |                    |
| 2008-01-11 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-01-18 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-01-25 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-02-01 | 4.0        | 4.0     | 4.0     | 4.0     | 5.0     | 4.0     | 19.0       | 21.0    | 22.0    | 18.0    | 23.0    | 20.0    | S             | 4.2                     | 20.5                    | 10.4               |
| 2008-02-08 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | BS            | 0.0                     | 0.0                     | 0.0                |
| 2008-02-15 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-02-22 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-02-29 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-03-07 | 4.0        | 5.0     | 2.0     | 3.0     | 8.0     | 5.0     | 10.0       | 14.0    | 6.0     | 8.0     | 22.0    | 12.0    | S             | 4.5                     | 12.0                    | 6.1                |
| 2008-03-14 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | BS            | 0.0                     | 0.0                     | 0.0                |
| 2008-03-19 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |
| 2008-03-28 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | BS            | 0.0                     | 0.0                     | 0.0                |
| 2008-04-04 | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0        | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | B             | 0.0                     | 0.0                     | 0.0                |