P-11-11

Monitoring Forsmark

Meteorological monitoring at Forsmark, January–December 2010

Cari Andersson, Jörgen Jones
SMHI

January 2011

Svensk Kärnbränslehantering AB
Swedish Nuclear Fuel
and Waste Management Co

Box 250, SE-101 24 Stockholm
Phone +46 8 459 84 00

ISSN 1651-4416
SKB P-11-11

Monitoring Forsmark

Meteorological monitoring at Forsmark, January–December 2010

Cari Andersson, Jörgen Jones
SMHI

January 2011

Keywords: AP PF 400-09-005, Meteorological stations, Precipitation, Air temperature, Barometric pressure, Wind speed, Wind direction, Air humidity, Global radiation, Calculated potential evapotranspiration.

Abstract

In the Forsmark area, SKB's meteorological monitoring started in 2003 at the sites Storskäret and Högmasten. However, since July 1, 2007 measurements are only performed at Högmasten. Measured and calculated parameters at Högmasten are precipitation and corrected precipitation, air temperature, barometric pressure, wind speed and direction, air humidity, global radiation and potential evapotranspiration. The Swedish Meteorological and Hydrological Institute, SMHI, has been responsible for planning and design, as well as for the operation of the stations used for meteorological monitoring.

In general, the quality of the meteorological measurements during the period concerned, starting January 1, 2010, and ending December 31, 2010, has shown to be good.

Sammanfattning

I Forsmarksområdet påbörjades SKB:s meteorologiska mätningar 2003 på platserna Storskäret och Högmasten. Mätningarna vid Storskäret upphörde 2007-06-30, och sedan 2007-07-01 sker mätningar endast vid Högmasten. De meteorologiska parametrar som mäts och beräknas är nederbörd, korrigerad nederbörd, lufttemperatur, lufttryck, vindhastighet och -riktning, luftfuktighet, globalstrålning och potentiell evapotranspiration. Sveriges Meteorologiska och Hydrologiska Institut, SMHI, har varit ansvarig för såväl utformandet som driften av de meteorologiska mätstationerna.

Kvaliteten hos de meteorologiska mätningarna utförda under perioden 2010-01-01 till och med 2010-12-31 har generellt varit god.

Contents

1 Introduction

This document reports the results of meteorological measurements made at Forsmark during the period January–December 2010. The activity is performed within the programme for long-term monitoring after completed site investigations /SKB 2007/, and is carried out in accordance to activity plan SKB AP PF 400-09-005 and the method description SKB MD 364.007 (SKB's internal controlling documents). The controlling documents used in the activity are presented in Table 1-1.

In order to characterise the investigation area regarding meteorological conditions, SMHI originally (2003) placed two stations with meteorological measuring equipment in the Forsmark site investigation area; Högmasten (Forsmark's Nuclear Power Plant) and Storskäret. The results of the meteorological monitoring at these two stations are presented in /Wern and Jones 2006/, /Wern and Jones 2007a/, and /Wern and Jones 2007b/. The measurements at Storskäret were completed in June 30, 2007. After that date the meteorological monitoring has continued only at Högmasten, /Wern and Jones 2008/, /Andersson and Jones 2009/, and /Andersson and Jones 2010/. The results of the meteorological monitoring are used for general site characterisation, water balance calculations and as input data for hydrological and hydrogeological modelling.

The geographical locations of the meteorological monitoring stations are displayed in Figure 1-1 together with nearby SMHI stations and MESAN-points referred to in the present report. MESAN is an automatic system for mesoscale analysis of meteorological parameters built on manual as well as automatic observations, including satellite and radar information. Figure 1-2 shows a detailed map of the location of the two SKB stations, and the coordinates of the two stations are presented in Table 1-2. Only the station at Högmasten was active during the monitoring period presented in this report.

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

Activity plan	Number	Version
Meteorologisk monitering 2010	SKB AP PF 400-09-005	1.0
Method description	**Number**	**Version**
Metodbeskrivning för meteorologiska mätningar	SKB MD 364.007	1.0

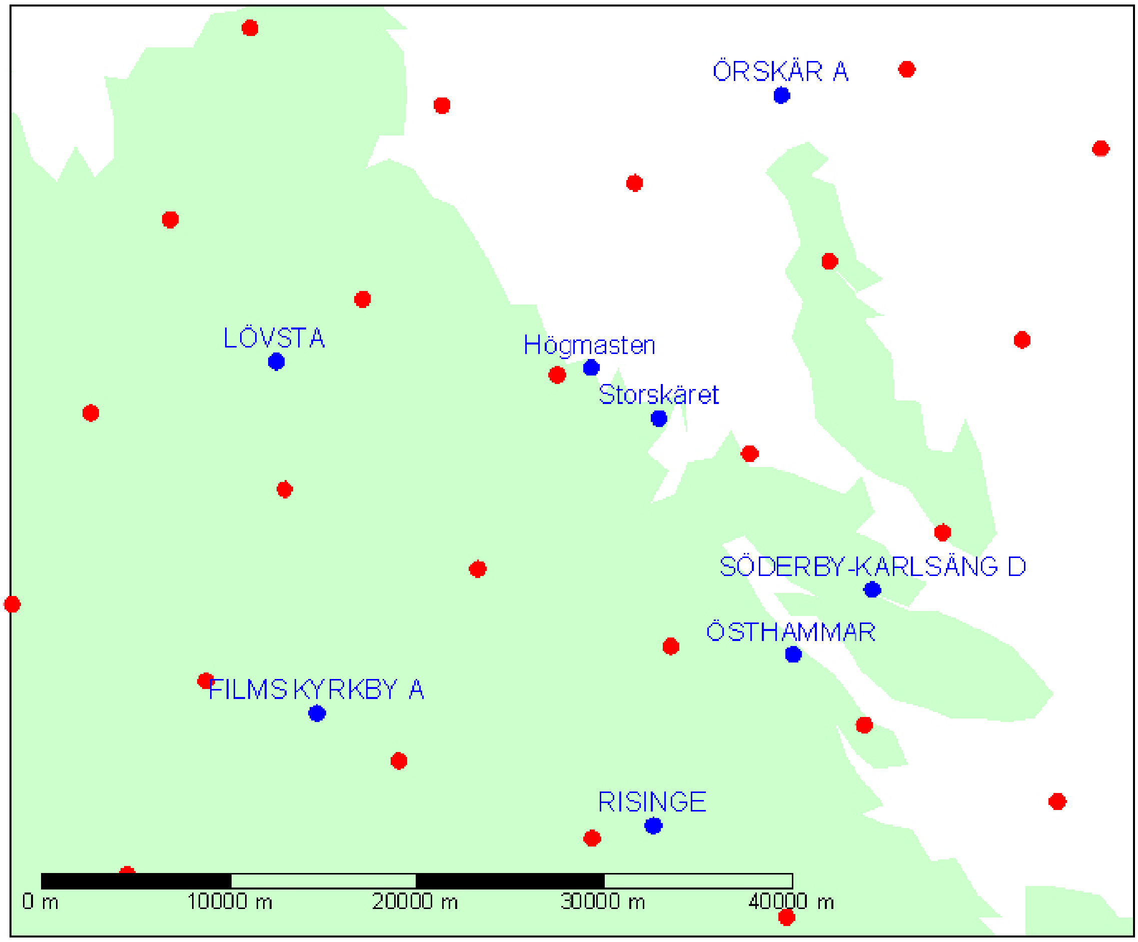

Figure 1-1. *Map showing the location of SMHI's monitoring stations (capital letters), SKB's stations (lower-case letters), and the MESAN-points (red points). Of the two SKB stations, only the one at Högmasten is active since July 1, 2007. (For the SMHI stations A stands for automatic station, D stands for manual station when both automatic and manual stations exist with the same name, while no added letter means that there is only a manual station.)*

Figure 1-2. *A detailed map showing the locations the meteorological stations Högmasten (Forsmark) and Storskäret.*

Table 1-2. SKB's monitoring stations. Coordinates in "RT 90 2,5 gon W 0:-15".

Identity	X	Y	Type	Name
PFM010700	6700525	1631046	Meteorological station	Högmasten (Forsmark)
PFM010701	6697827	1634659	Meteorological station	Storskäret (not active since July 1, 2007)

2 Objective and scope

SKB carried out site investigations at the Forsmark area during the period 2002–2007. SMHI, commissioned by SKB, installed two stations with meteorological measuring equipment at the site to monitor and characterise the meteorological conditions. Monitoring has continued after completion of the site investigations and is now performed within Project "Kärnbränsleförvaret". Since July 2007 only the station at Högmasten is active. The monitoring results are, besides for meteorological characterisation, used for water balance calculations and as input data for hydrological and hydrogeological modelling.

The objective of this report is to present quality checked results from the meteorological monitoring at Högmasten during the period from January 1, 2010, until December 31, 2010.

3 Equipment

3.1 Meteorological measuring station

Table 3-1 gives technical information about the equipment. A polycarbonate cupboard houses a data logger (type Campbell CR10X), and modems (Siemens TC35 and COM200E). The equipment is earthed for lightning protection.

Table 3-1. Measuring equipment for collecting meteorological data at Högmasten.

Parameters	Equipment
Precipitation	Geonor T200 complete with pedestal and wind shield
Air temperature	Pt100 sensor with radiation shield and ventilated Young 41004
Barometric pressure	PTB200
Wind speed and direction	RM Young Wind monitor
Air humidity	Rotronic HygroClip MP 100H
Global radiation	Kipp & Zonen CM21 with warming and fan

The equipment measures wind speed and direction at 10 m above ground level and the other parameters at 2 m height.

3.1.1 Calibration of equipment used at meteorological measuring station

FDS Mätteknik calibrated the instruments using data submitted by the manufacturers in connection with the instrument installations.

FDS Mätteknik made a service and calibration of the instruments at Högmasten on September 7, 2010. The service report showed that the instruments are in good condition.

4 Execution

4.1 General

This execution chapter describes the complete course of events, from measuring at Högmasten, via quality check and data handling to the storage in the Sicada database.

Two abbreviations are frequently used in this context; HMS and Sicada. HMS (Hydro Monitoring System) is SKB's network for the monitoring of meteorological, hydrological and hydrogeological parameters. This is a system for collection, calculation, data check up and presentation. Sicada is the database that contains all of SKB's quality assured data. Original data from the reported activity are stored in the primary database Sicada. Data are traceable in Sicada by the activity plan number (AP PF 400-09-005). 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.

4.2 Meteorological measurements

Data are measured every half-hour. The different parameters are valid for the following time periods:

- Precipitation: Accumulated sum of precipitation every 30 minutes. The 30-minutes precipitation value is the difference between two adjacent accumulated precipitation sums.
- Air temperature: 30-minutes mean of one-second values.
- Barometric pressure: 30-minutes mean of one-second values.
- Wind speed and wind direction: The latest 10-minutes mean value for the actual 30 minutes. Hence, for the 10:00 data the measurement is from 09:51 to 10:00.
- Relative humidity: 30-minutes mean of one-second values.
- Global radiation: 30-minutes mean of one-second values.

4.2.1 Quality check of meteorological data

Before data finally are stored in SKB's database Sicada, they are checked and approved of by SMHI. Every week, SMHI performs a primary check for missing and incorrect values, and every third month a check is made by a meteorologist at SMHI who approves data, calculates potential evapotranspiration and estimates the true (corrected) precipitation before delivery for final storage in SKB's database Sicada.

4.2.2 Data handling/post processing

Data that have not been checked were transferred from SMHI to SKB daily via FTP (File Transfer Protocol), while quality checked data were transferred every third month.

The data logger at the station has an internal memory to secure the data in case of communication disturbances. The system is called upon every three hours through SMHI's air quality system AIRVIRO, where data are stored and the quality assurance and check is done. After this check has been performed, data are delivered to SKB's HMS-database.

SMHI has, commissioned by SKB, constructed a homepage where the results of the measurements are shown as graphs and from which data can be extracted. The address is http://www.airviro.smhi.se/forsmark/.

4.3 Analyses and interpretations

4.3.1 Meteorological measurements

SMHI has continuously checked the collected data, i.e. checked that data are within the limits of reason for each parameter. Data have also been compared with data from SMHI's analysing system MESAN. The MESAN-values were interpolated from the nearest grid points in MESAN. The resolution of MESAN is 11×11 km and an analysis was made every hour. Corrected data have been stored in a special database. The coordinates of the nearest MESAN grid points are presented in Table 4-1, and in Figure 1-1 they are shown on a map.

Table 4-1. MESAN grid points.

Latitude	Longitude
60.40	18.15
60.36	18.34
60.45	18.42
60.49	18.24

4.4 Nonconformities

There are no nonconformities that affect the results or nonconformities with respect to the activity plan or the method description.

5 Results

5.1 Meteorological monitoring

The meteorological measurements have turned out to work very well during the period for all parameters. However, the 30-minutes values of precipitation showed too high values, a fact that was observed already in 2003 /Wern and Jones 2006/. This is due to the high sensitivity of the instrument and to the high frequency of the precipitation measurements. However, the software in the data logger is improving the quality of the data afterwards at the station.

The locations of all monitoring stations, from which results are presented below, are shown in Figures 1-1 and 1-2. In Appendix 1, daily values from Högmasten are displayed together with MESAN-values for all parameters except for precipitation and wind direction. As an example of the high-resolution variations during a month, data from January 2010 are also presented for all parameters, including precipitation and wind direction.

5.1.1 Precipitation

Table 5-1 and Figure 5-1 below, present the monthly precipitation for the SMHI stations situated at different distances and directions from Forsmark (see Figure 1-1). "Film's Kyrkby A" and "Örskär A" are automatic stations whereas the others are manual stations. The precipitation differs substantially between stations and between months. SMHI has checked and approved all the presented precipitation values. However, the values are not corrected for wind, wetting and evaporation losses. The correction factors are listed in Table 5-2.

Table 5-1. Monthly measured precipitation in mm at SMHI's stations. The values are not corrected for wind, wetting and evaporation losses.

Precipitation (mm)	1	2	3	4	5	6	7	8	9	10	11	12	2010
Film's Kyrkby D	39.7	44.2	55.3	52.5	57.8	53.7	41.1	102.9	56.1	24.5	127.6	59.5	714.9
Film's Kyrkby A	39.6	39.2	49.1	47.1	57.4	51.2	39.8	103.2	54.6	24.9	95.8	49.3	651.2
Lövsta	58.3	51.4	51.6	50.3	74.6	58.2	44.9	123.9	49.0	23.7	104.1	65.1	755.1
Risinge	36.6	37.0	39.5	40.5	45.2	44.1	36.9	89.4	53.8	27.3	93.0	57.3	600.6
Östhammar	41.6	35.5	48.6	38.5	31.5	65.8	40.1	105.8	57.5	22.0	88.8	53.3	629.0
Söderby-Karlsäng	49.8	40.4	50.3	33.6	32.1	56.8	41.4	118.6	50.3	25.5	106.4	71.7	676.9
Örskär A	27.3	36.8	28.5	20.9	39.3	46.6	40.0	135.6	33.1	15.2	69.1	41.9	534.3

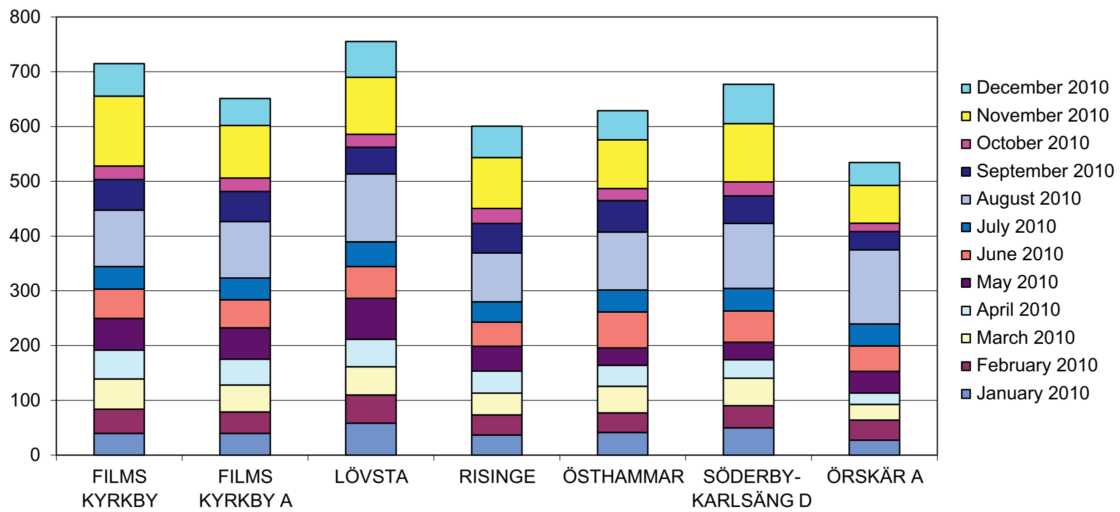

***Figure 5-1.** Monthly precipitation in mm at SMHI's stations. The values are not corrected for wind, wetting and evaporation losses.*

Table 5-2. Corrections in percent of SMHI's stations according to /Alexandersson 2003/.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Örskär A	19	22	23	15	15	13	13	15	14	15	17	20	16
Östhammar	9	13	10	9	9	12	8	9	8	7	8	10	9
Lövsta	10	9	12	10	11	12	8	8	8	8	9	9	9
Risinge	11	12	10	11	13	12	8	8	8	9	8	9	9
Film's Kyrkby A	13	16	19	15	13	14	11	13	13	13	14	16	14
Film's Kyrkby D	9	9	12	9	13	13	8	8	8	9	8	10	10
Söderby-Karlsäng D	10	11	10	10	12	12	9	9	8	8	8	9	10

The precipitation at Högmasten is presented in Table 5-3. "001" in the table means originally measured value, "COR" means corrected and approved value by SMHI, "ALX" is an estimation of the true precipitation, and "MES" means analysed values from MESAN.

The method for estimating the true precipitation (ALX) is the same method as used for the SMHI stations. Table 5-4 gives the corrections (in percent) for each month. More information about the estimation of true precipitation can be found in /Alexandersson 2005/ (Appendix 2).

The registered 30-minutes precipitation values have to be filtered before storage. That is because the instrument is very sensitive and registers incorrectly small values of precipitation.

Table 5-5 compares the accumulated uncorrected precipitation from January 1, 2010, to December 31, 2010, from the SMHI stations. These values can be compared with the COR-values from Forsmark in the same table. The values at the stations from SMHI are higher, except for Örskär and Risinge.

Table 5-3. Monthly precipitation in mm at SKB's station Högmasten. "001" in the table means originally measured value, "COR" means corrected and approved value by SMHI, "ALX" is the estimation of the true precipitation, and "MES" is analysed values from MESAN.

Precipitation	1	2	3	4	5	6	7	8	9	10	11	12	2010
COR	25.5	50.7	37.3	28.5	41.7	44.0	38.0	118.1	40.2	18.5	98.0	61.6	602.1
ALX	28.6	57.5	42.1	31.5	45.9	48.4	41.8	129.9	44.2	20.4	108.3	68.6	667.1
001	25.5	50.7	52.0	28.4	41.7	44.0	38.0	118.0	40.3	18.5	100.1	61.6	618.8
MESAN	39.9	33.7	44.5	35.5	70.2	44.9	38.9	113.8	61.1	30.0	65.2	45.7	623.4

Table 5-4. Corrections in percent of SKB's station according to /Alexandersson 2005/ (Appendix 2).

	J	F	M	A	M	J	J	A	S	O	N	D	Year
Högmasten	13	14	13	11	10	10	10	10	10	10	11	12	11

Table 5-5. Precipitation in mm from January 1, 2010, to December 31, 2010. The uncorrected values given for the SMHI stations correspond to the COR-values at SKB´s stations).

Precipitation (mm)	2010
Forsmark (Högmasten) COR	602.1
Forsmark (Högmasten) ALX	667.1

Precipitation (mm)	2010
Film's Kyrkby D	714.9
Film's Kyrkby A	651.2
Lövsta	755.1
Risinge	600.6
Östhammar	629.0
Söderby-Karlsäng	676.9
Örskär	534.3

Precipitation ALX (mm)	2010
Film's Kyrkby D	782.7
Film's Kyrkby A	743.1
Lövsta	826.5
Risinge	658.1
Östhammar	687.7
Söderby-Karlsäng	740.8
Örskär	621.8

As an example of high-resolution precipitation data, Figure A-7 in Appendix 1 shows the 30-minutes precipitation values for January 2010 for Forsmark.

5.1.2 Air temperature

Figure A-1 in Appendix 1 presents a graph of daily temperature, using values from Forsmark (Högmasten) and MESAN. Figure A-8 shows the 30-minutes values for January 2010. The values correspond very well with each other.

5.1.3 Barometric pressure

Figure A-2 in Appendix 1 shows a graph of the daily barometric pressure, presenting values from Forsmark (Högmasten) and MESAN. Figure A-9 shows the 30-minutes values for January 2010. The two curves are nearly identical.

5.1.4 Wind speed and wind direction

Figure A-3 in Appendix 1 illustrates a graph of the wind speed (daily mean),presenting values from Högmasten (Forsmark) and MESAN-values. Figure A-10 shows the 30-min values for January 2010. The wind speeds are higher from MESAN compared to Högmasten. This can be explained by the fact that MESAN-values represent wind at 10 m above ground level for a grid area with mixed vegetation while the Högmasten site represents wind at 10 m above ground level in forest vegetation.

In Figure A-11 in Appendix 1, the wind directions for the same stations are compared for January 2010. The data correspond well to each other.

5.1.5 Relative humidity

Figure A-4 in Appendix 1 presents a graph of relative humidity, displaying values from Forsmark (Högmasten) and MESAN-values. Figure A-12 shows the 30-minutes values for January 2010. The two curves follow each other very well.

5.1.6 Global radiation

Figure A-5 in Appendix 1 presents a graph of the daily sum of global radiation. Figure A-13 in Appendix 1 shows the 30-minutes values for January 2010, presenting values from Forsmark (Högmasten) and Strång-values. Strång is the analysed global radiation from the SMHI radiation model, which uses data from MESAN. Values from Strång (MESAN) correspond well to measured global radiation at Forsmark (Högmasten).

During days with a clear sky, for example June 4–June 7 2010, it is obvious that something blocks the view of the sensor (Figure 5-2). Every day at about 08:00 there is a notch in the graph. This is due to the high mast of the nuclear plant that shadows the global radiation instrument.

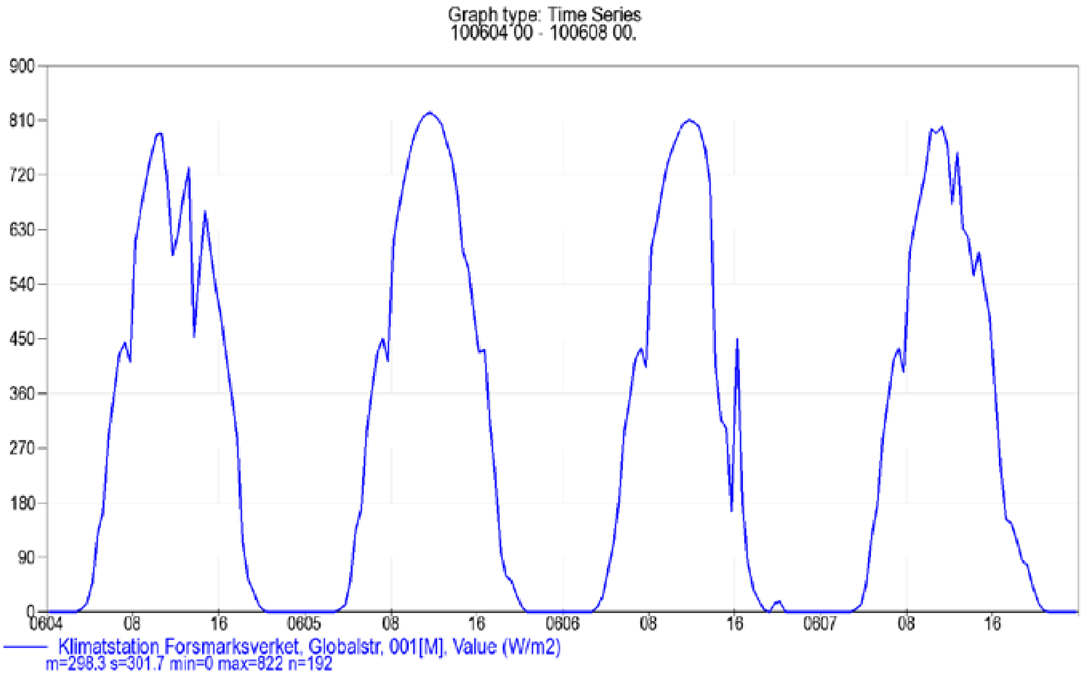

Figure 5-2. Global radiation 4–7 June 2010.

5.1.7 Calculated potential evapotranspiration

The potential evapotranspiration E_p is calculated from the Penman equation:

$$E_P = \left(\frac{\Delta \cdot (R_n - G)}{(\Delta + \gamma) \cdot L} + \frac{\gamma \cdot f(u) \cdot (e_s - e)}{(\Delta + \gamma)}\right) \cdot tstep$$

where

Δ	proportionality constant
R_n	net radiation flux density
G	heat flux density into ground
γ	psychrometric constant
$f(u)$	function of wind speed
e_s	saturated water vapor pressure
e	water vapor pressure
L	latent heat of vaporisation
$tstep$	time step

The method is described in detail in /Eriksson 1981/.

Measured data every 30 minutes of temperature, relative humidity, wind speed and global radiation are required as input data to the equation to calculate the potential evapotranspiration. The potential evapotranspiration is much higher at Örskär compared to at Forsmark and Film's Kyrkby.

During the period January–December 2010 the calculated potential evapotranspiration at Högmasten was 445 mm and at Film's Kyrkby 475 mm, while at Örskär it was 623 mm. The reason for this difference is mainly that the wind speed is much higher at Örskär (sea station).

Figure A-6 in Appendix 1 presents a graph of the potential evapotranspiration for Forsmark (Högmasten). Figure A-14 shows the 30-minutes values for June 2010.

References

SKB's (Svensk Kärnbränslehantering AB) publications can be found at www.skb.se/publications.

Alexandersson H, 2003. Korrektion av nederbörd enligt enkel klimatologisk metodik. SMHI Meteorologi 111, Sveriges meteorologiska och hydrologiska institut. (In Swedish.)

Alexandersson H, 2005. Enkel bedömning av nederbördsförluster på fyra automatstationer. (In Swedish.)

Andersson C, Jones J, 2009. Forsmark site investigation. Meteorological monitoring at Forsmark, January 2008 until December 2008. SKB P-09-04, Svensk Kärnbränslehantering AB.

Andersson C, Jones J, 2010. Forsmark site investigation. Meteorological monitoring at Forsmark, January–December, 2009. SKB P-10-05, Svensk Kärnbränslehantering AB.

Eriksson B, 1981. Den "potentiella" evapotranspirationen i Sverige. SMHI RMK 28, Sveriges meteorologiska och hydrologiska institut. (In Swedish.)

Førland E J, Allerup P, Dahlström B, Elomaa E, Jónsson T, Madsen H, Perälä J, Rissanen P, Vedin H, Vejen F, 1996. Manual for operational correction of Nordic precipitation data. DNMI Klima 24/96, Det norske meteorologiske institutt.

SKB, 2007. Forsmark site investigation. Programme for long-term observations of geosphere and biosphere after completed site investigations. SKB R-07-34, Svensk Kärnbränslehantering AB.

Wern L, Jones J, 2006. Forsmark site investigation. Meteorological monitoring at Forsmark, June 2003 until July 2005. SKB P-05-221, Svensk Kärnbränslehantering AB.

Wern L, Jones J, 2007a. Forsmark site investigation. Meteorological monitoring at Forsmark, August 2005 until September 2006. SKB P-06-322, Svensk Kärnbränslehantering AB.

Wern L, Jones J, 2007b. Forsmark site investigation. Meteorological monitoring at Forsmark, October 2006 until June 2007. SKB P-07-175, Svensk Kärnbränslehantering AB.

Wern L, Jones J, 2008. Forsmark site investigation. Meteorological monitoring at Forsmark, July 2007–December 2007. SKB P-08-100, Svensk Kärnbränslehantering AB.

Meteorological monitoring

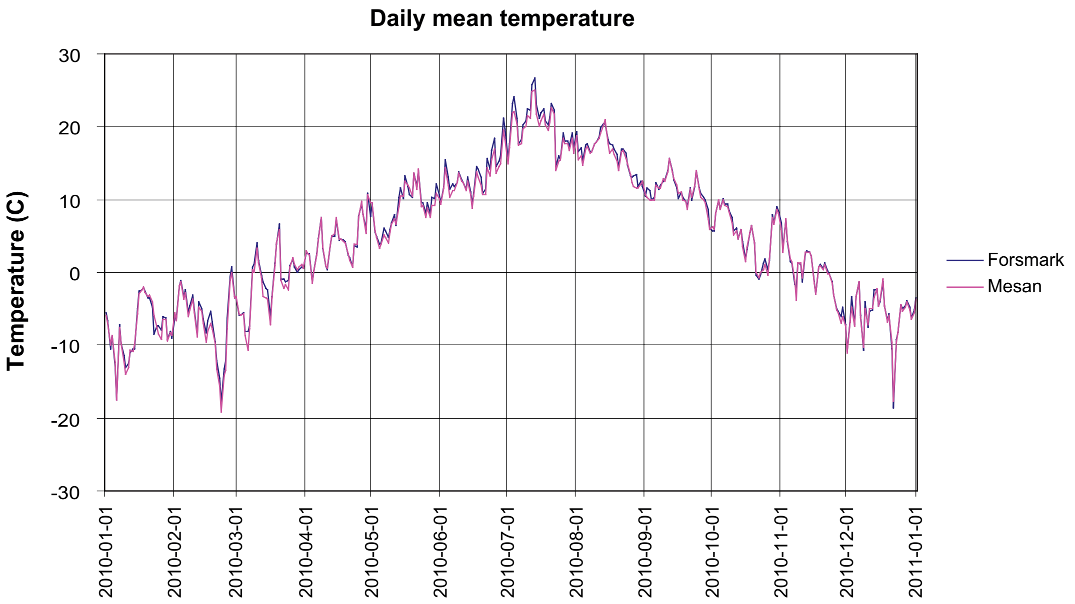

Figure A-1. *Temperature in °C, daily values, January 2010–December 2010.*

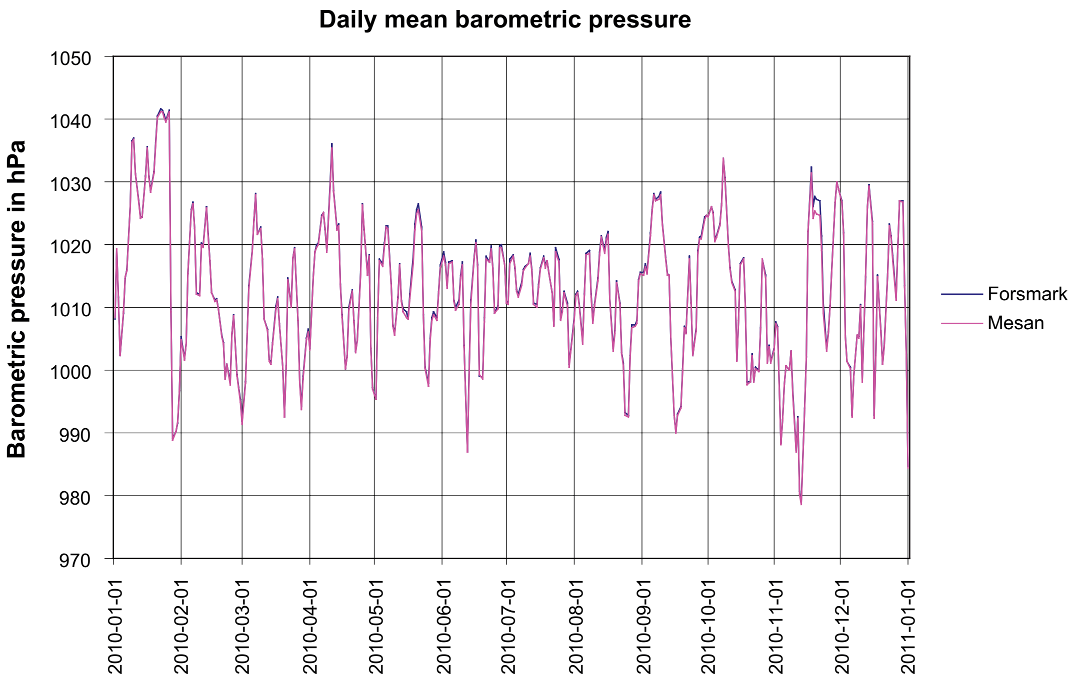

Figure A-2. *Barometric pressure in hPa, daily values, January 2010–December 2010.*

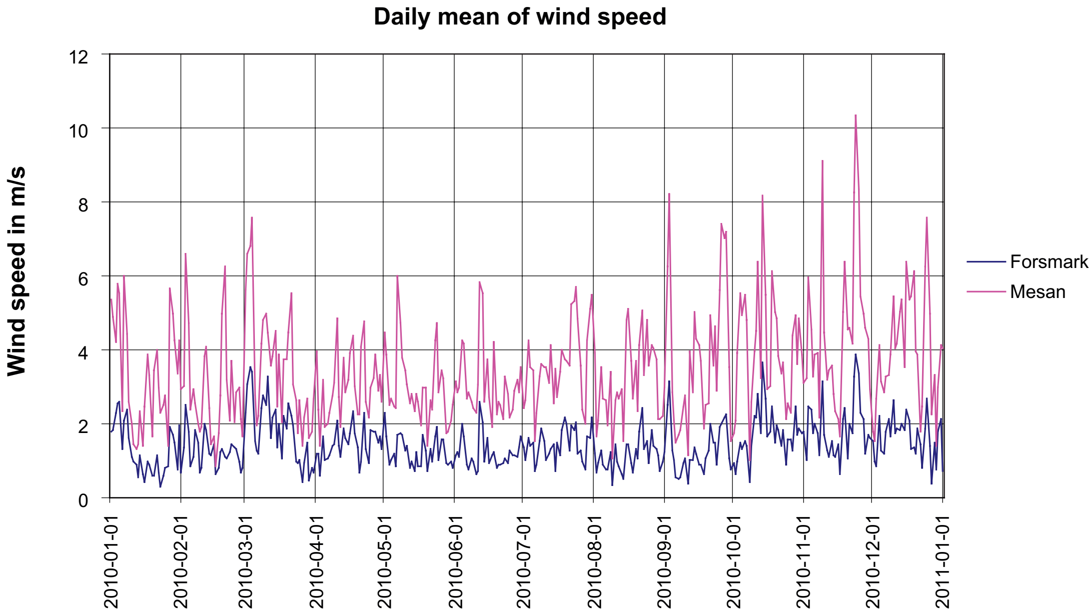

Figure A-3. *Wind speed in m/s, daily values, January 2010–December 2010.*

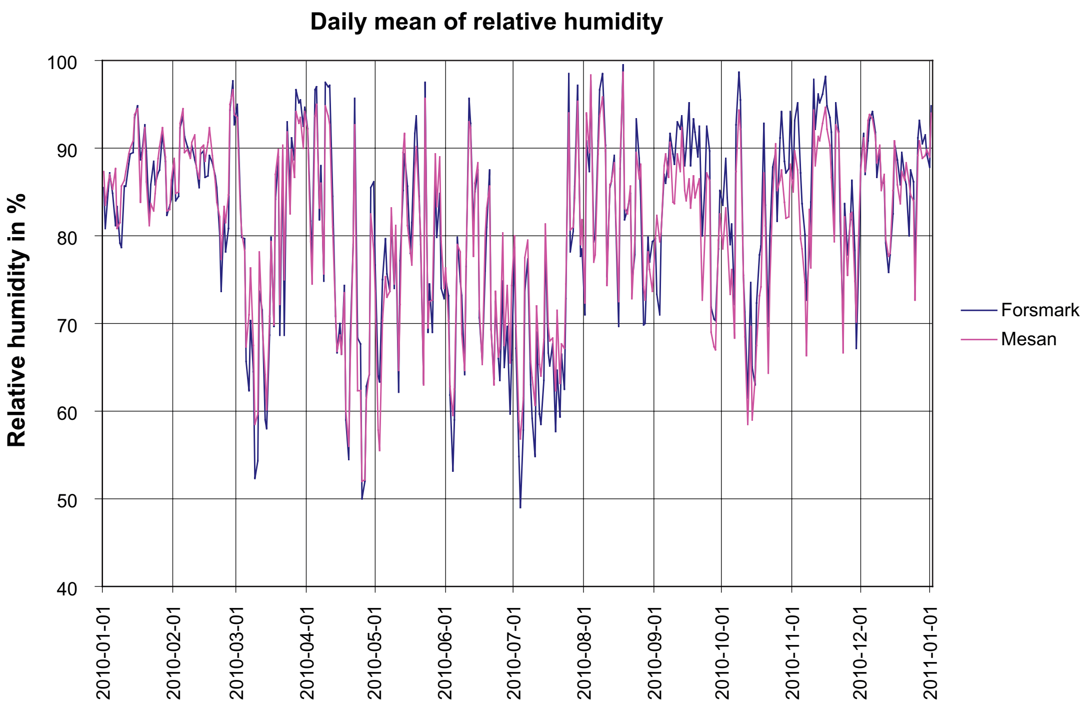

Figure A-4. *Relative humidity in %, daily values, January 2010–December 2010.*

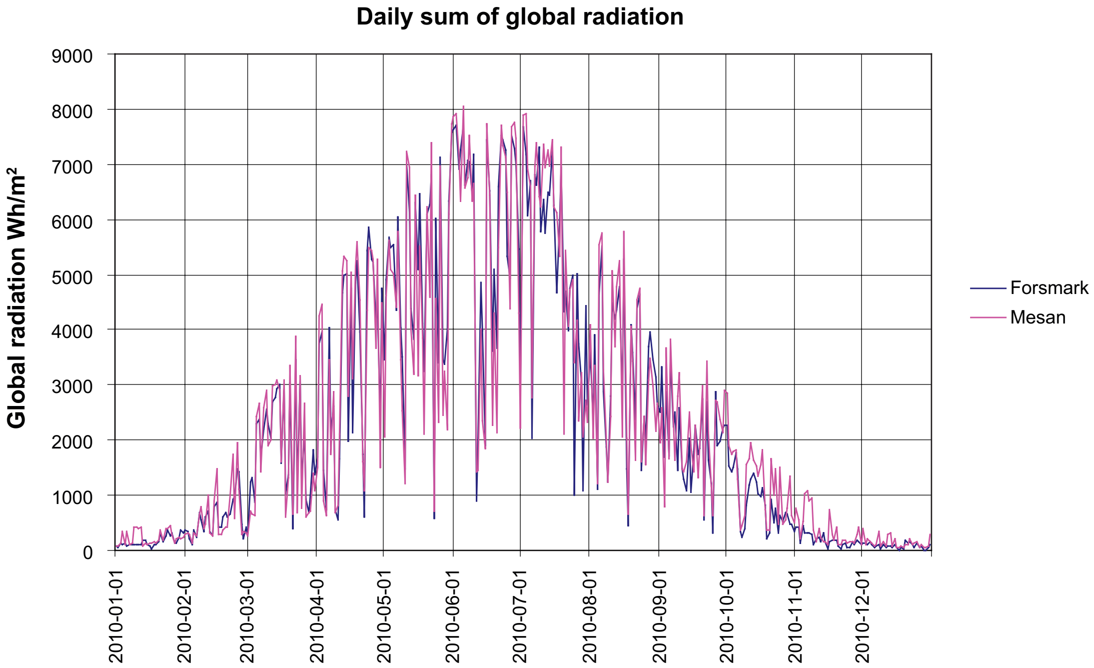

Figure A-5. *Global radiation in Wh/m², daily sum, January 2010–December 2010.*

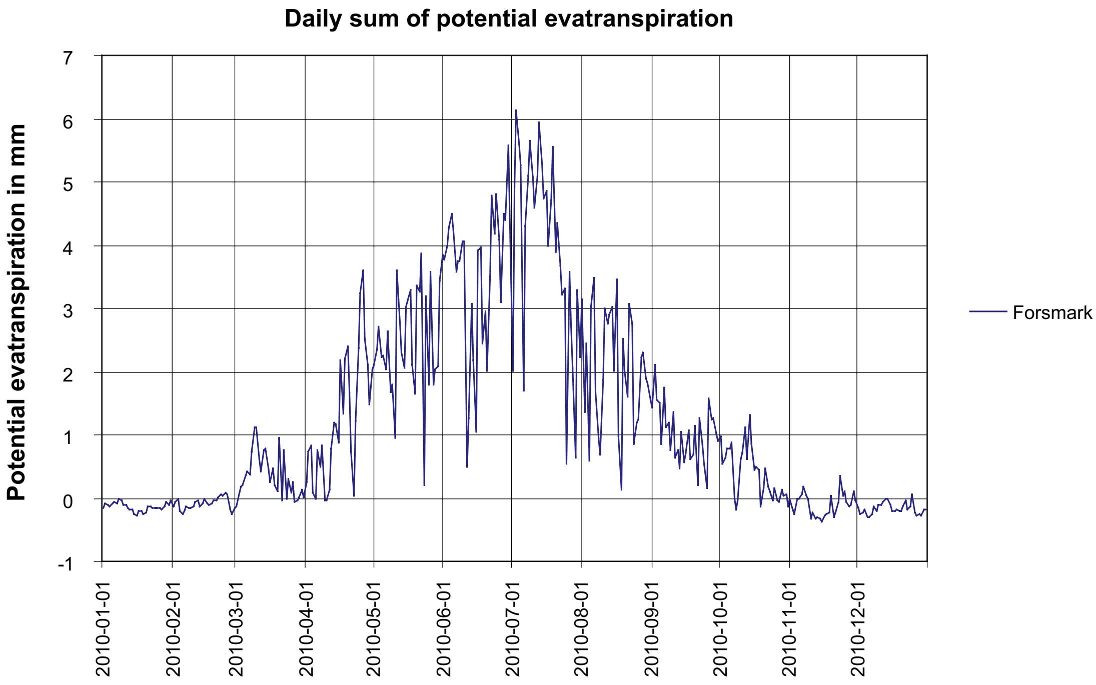

Figure A-6. *Potential evapotranspiration in mm, daily sum, January 2010–December 2010.*

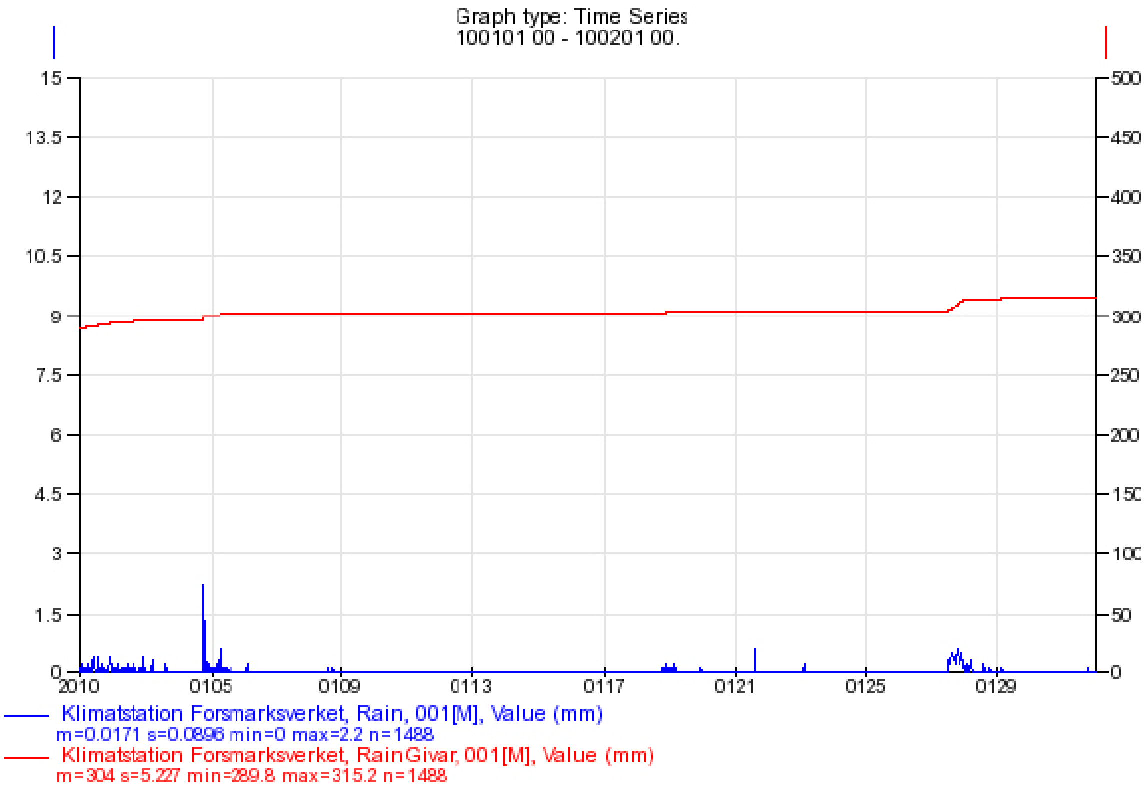

Figure A-7. *Precipitation in mm, 30-min values, January 2010. (Red line: accumulated value, blue line: single 30-min values.)*

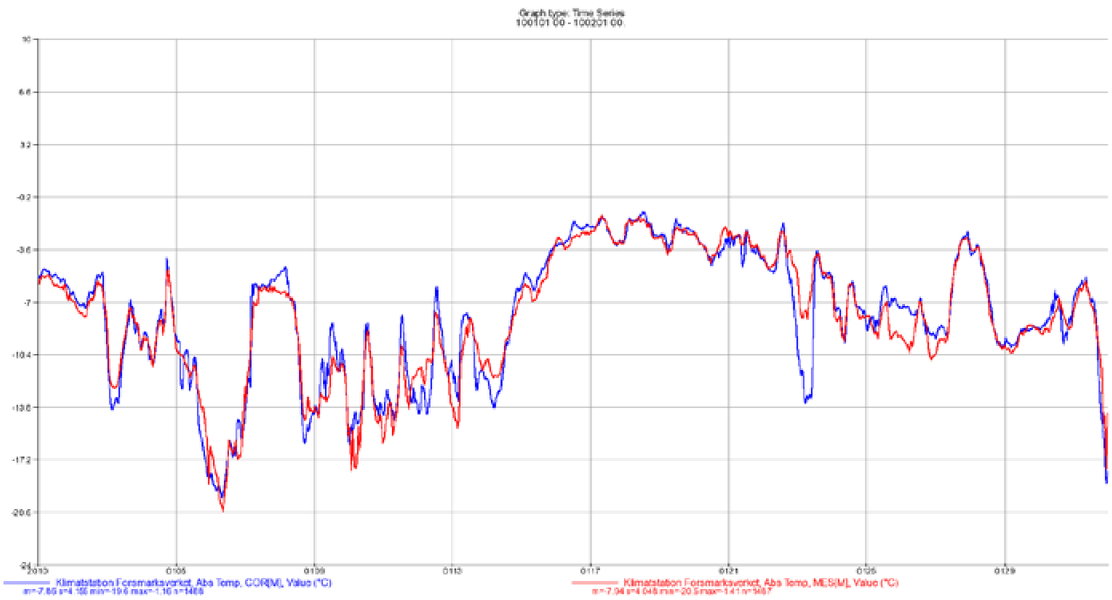

Figure A-8. *Temperature in °C, 30-min values, January 2010. (Blue line: measurements, red line: interpolated values from MESAN.)*

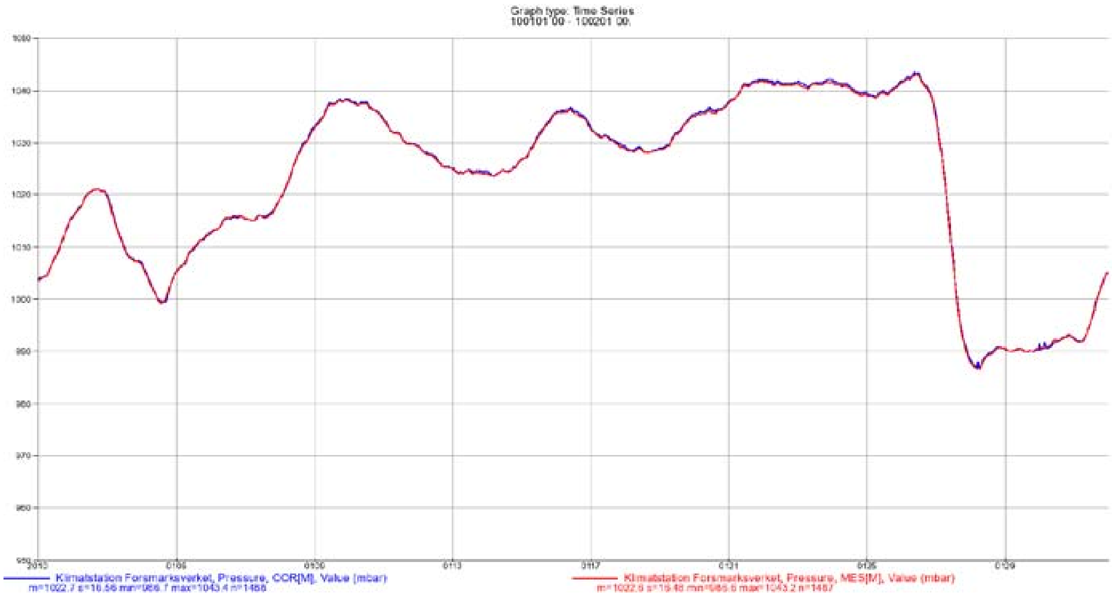

Figure A-9. *Barometric pressure in hPa, 30-min values, January 2010. (Blue line: measurements, red line: interpolated values from MESAN.)*

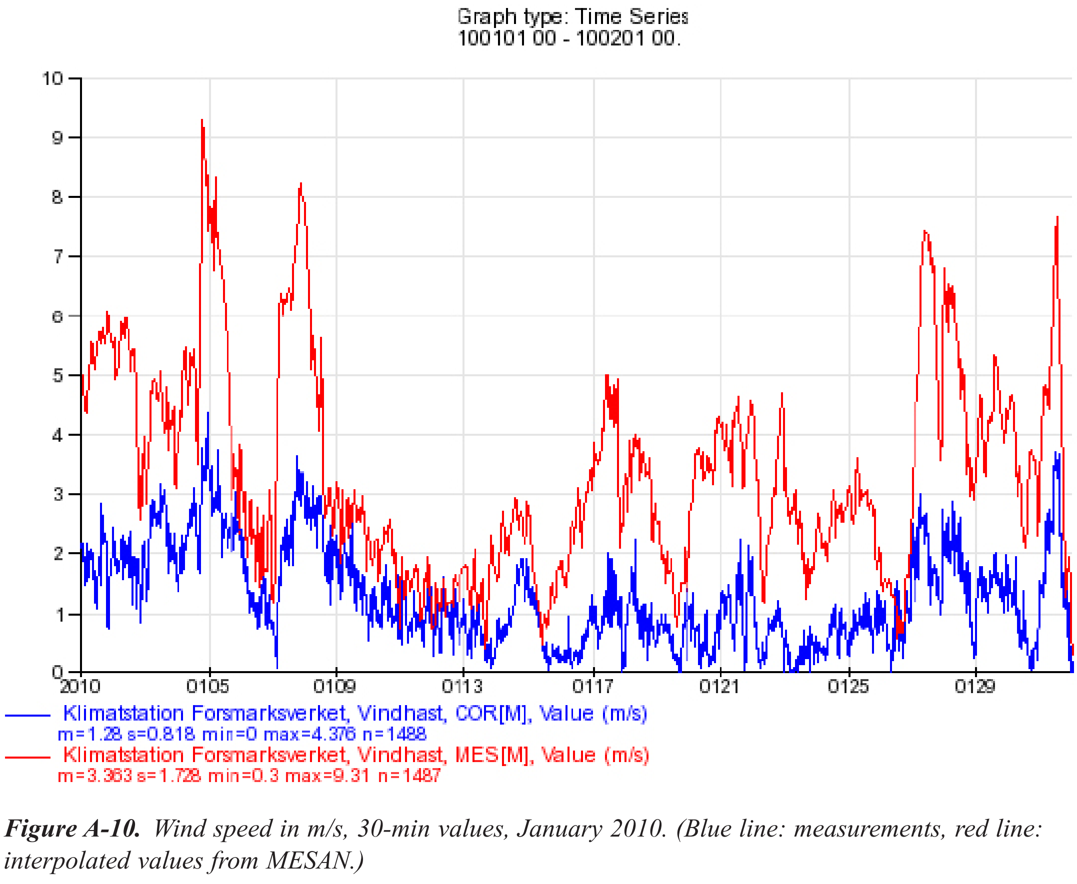

Figure A-10. *Wind speed in m/s, 30-min values, January 2010. (Blue line: measurements, red line: interpolated values from MESAN.)*

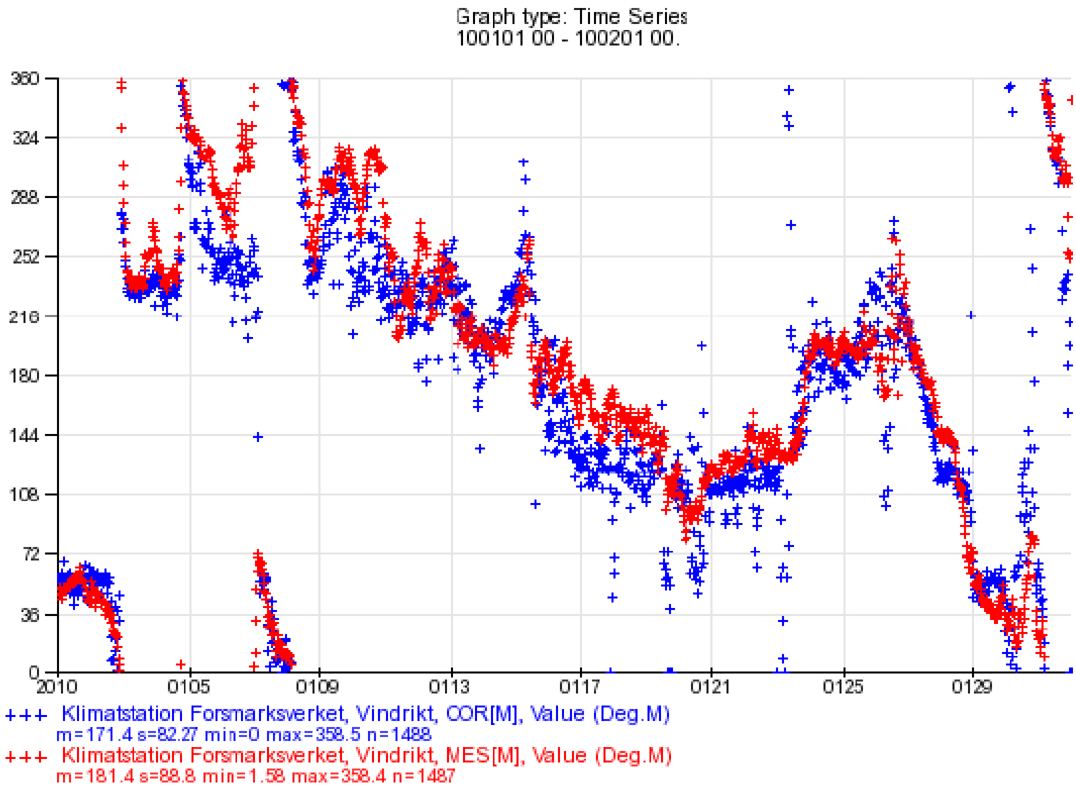

Figure A-11. *Wind direction in °, 30-min values, January 2010. (Blue line: measurements, red line: interpolated values from MESAN.)*

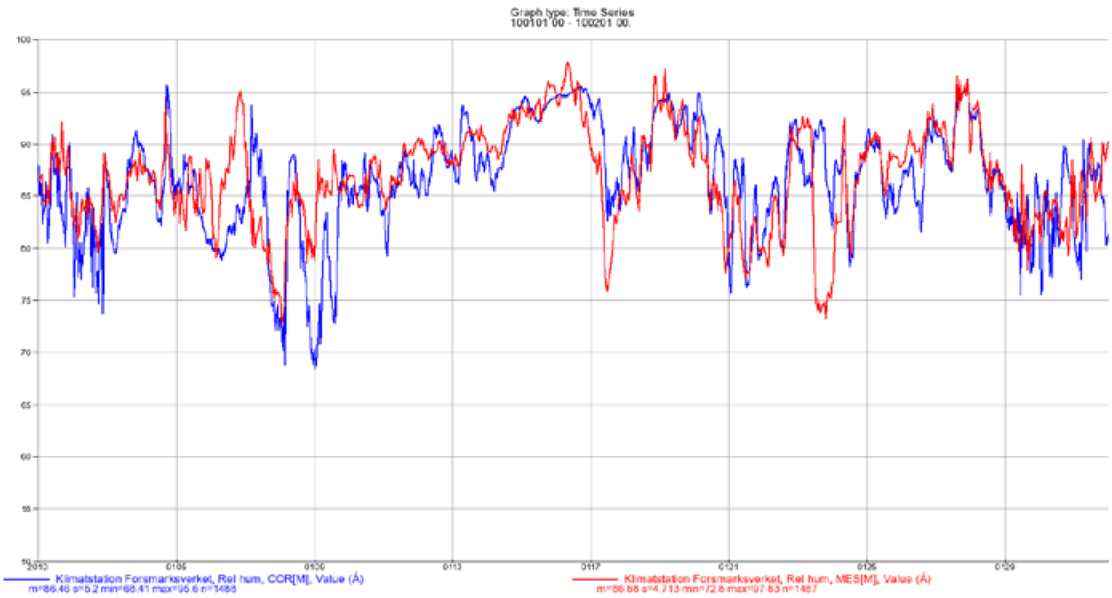

Figure A-12. *Relative humidity in %, 30-min values, January 2010. (Blue line: measurements, red line: interpolated values from MESAN.)*

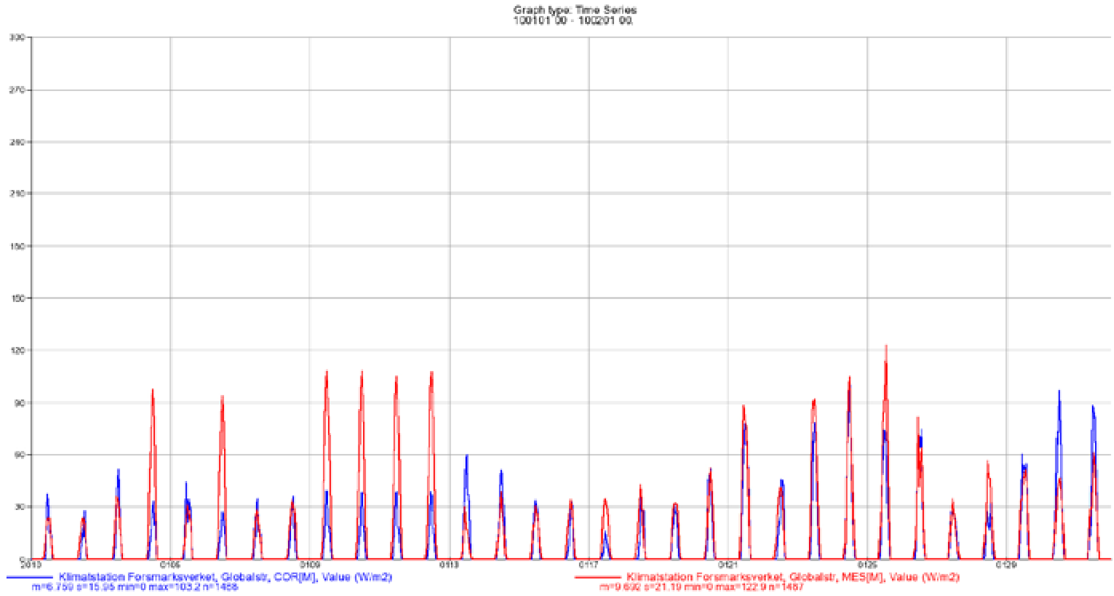

Figure A-13. *Global radiation in W/m², 30-min values, January 2010. (Blue line: measurements, red line: interpolated values from MESAN.)*

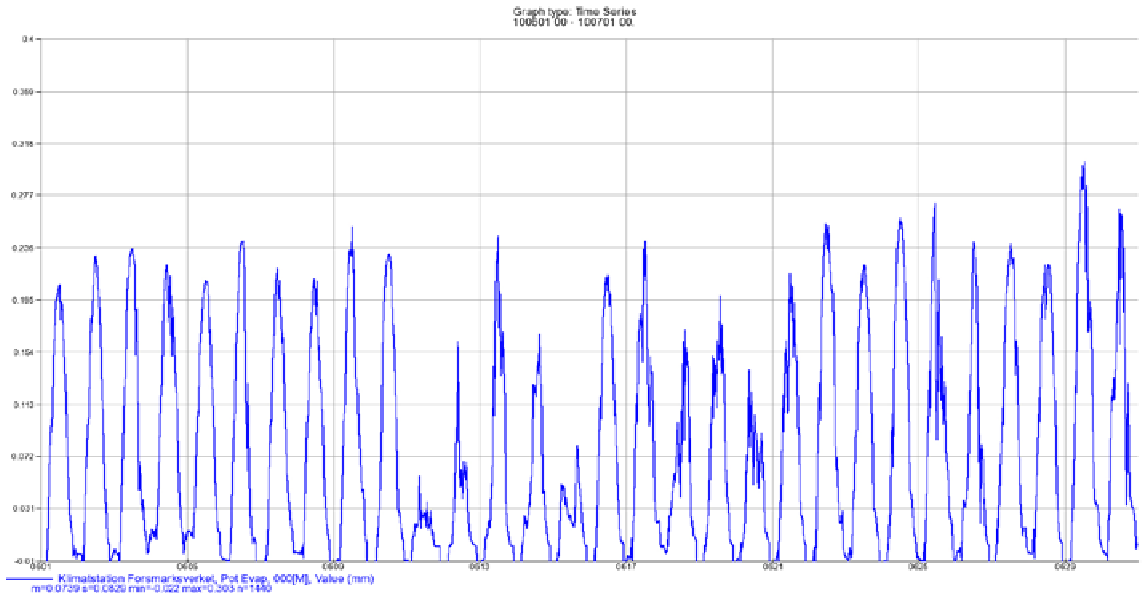

Figure A-14. *Potential evapotranspiration in mm, 30-min values, June 2010.*

Appendix 2

Enkel bedömning av nederbördsmätförluster på fyra automatstationer

Av Hans Alexandersson

För fyra stationer med GEONOR-nederbördsmätare, två nära Forsmark och två nära Simpevarp, har en bedömning av mätförluster gjorts enligt samma kriterier som i /Alexandersson 2003/. För bedömningen användes främst ett antal foton samt kartor med det exakta läget. Efter att stationerna klassats med avseende på vindutsatthet las denna information in i samma program som tidigare körts för SMHI:s stationsnät.

Vindförlusterna är under i övrigt lika betingelser större för GEONOR-mätaren än för den traditionella manuella mätaren (SMHI-kannan) som används i Sverige. Därför läggs det på lite extra korrektion för GEONOR-mätaren inom respektive vindklass. För GEONOR-mätaren kombineras adhesions- och avdunstningförluster.

Följande vindklasser (1 perfekt, 7 ytterst olämplig) och temperaturstationer användes

Högmasten	2	Forsmark
Storskäret	2	Forsmark
Äspö	4	Oskarshamn
Plittorp	2	Oskarshamn

Alla stationer utom i viss mån Äspö sitter alltså väldigt bra placerade. Klass 2 är en så gott som ideal placering, 4 är däremot en placering som ger lite större förluster. I stort sett sitter tre av mätarna så bra det är möjligt i en kustzon med ofta relativt höga vindhastigheter i samband med nederbörd. Mätaren på Äspö sitter dock på en något välvd kulle med berg i dagen, men egentligen med tämligen bra skydd av träd för att vara en ö. Trädridåer finns på 20–30 meters håll i alla riktningar utom i någon smal glipa ungefär mot ostnordost. Tillhörande temperaturstationer användes för att ge ett mått på den genomsnittliga andelen snönederbörd.

Programmet som körts ger primärt uppmätta och korrigerade normalvärden. För dessa stationer har (fiktiva) uppmätta normalvärden tagits från nämnda grannstationer. Sedan har korrektioner i % beräknats för varje månad utifrån dessa uppmätta respektive korrigerade värden. Det är mest praktiskt att använda faktorer och det ger inget nämnvärt fel (mot att t ex ge adhesionsfelet som ett absolutbelopp vid ett visst ”nederbördstillfälle”) sett över lite längre perioder.

Följande tabell med korrektioner i % erhölls:

Plats	Jan	Feb	Mar	Apr	Maj	Jun	Jul	Aug	Sep	Okt	Nov	Dec
Högmasten	13	14	13	11	10	10	10	10	10	10	11	12
Storskäret	13	14	13	11	10	10	10	10	10	10	11	12
Äspö	21	21	19	16	14	14	14	14	14	16	17	20
Plittorp	12	13	12	10	10	9	9	10	10	10	10	12

För Högmasten och Storskäret, som fått identiska korrektioner i denna bedömning, ska sålunda nederbörden i januari multipliceras med 1.13. Korrektionen kan, då det bara är en faktor, tillämpas på timvärden men man får behålla några decimaler så att summor över längre tid – beräknade som summor av timvärden – blir korrigerade enligt samma faktor som vid en direkt korrektion av t ex en dygnssumma.

Vid en efterkontroll jämfördes korrigerade värden med motsvarande korrigerade manuella mätningar i närheten. Dessa jämförelser baserades dock bara på cirka två års mätningar. Manuella jämförelsestationer var främst Östhammar för Forsmarksmätarna och Kråkemåla för Simpevarpsmätarna. Även de yttäckande analyserna i Väder och Vatten utnyttjades. De först antagna vindförlustklasserna behövde därvid **ej** omprövas då de korrigerade mängderna föll in tillräckligt väl i mönstret. Vid jämförelsen var den mest slående olikheten att Östhammar hade närmare dubbel nederbörd jämfört med Högmasten och Storskäret under höstmånaderna 2004. Vid en kontroll av hur analyserna såg ut för dessa månader var det dock slående hur stark gradienten var i detta område. Nederbörden avtog nämligen snabbt åt norr och nordväst längs denna del av Upplandskusten. För övrigt var det nästan motsatta förhållanden hösten 2003, medan det som helhet var mycket likartade och mycket starkt korrelerade månadsvärden.

Förslag på individuella korrektioner för varje mättillfälle och som funktion av vindhastighet vid mätarens öppning samt rådande temperatur finns publicerade /Førland et al. 1996/. Dessa samband är dock ganska komplicerade att tillämpa, bl a då vind ej mäts vid själva nederbördsmätarens öppning. En sådan metod kan heller inte ta hänsyn till närmiljöns inflytande på vindfältet inklusive vertikalvindarna, ett inflytande som kan vara stort i komplicerade miljöer. Här har vi i stället valt att satsa på en enklare korrektion vars huvudsyfte är att ge någotsånär sann nederbörd sett över en lite längre tid.

Slutligen kan sägas att röjning av buskar och kanske vid något tillfälle träd bör ske så ofta att inga buskar eller träd når mer än cirka 45° över horisonten sett från mätarens öppning. Röjning bör då troligen behöva utföras med några års mellanrum i de fall det inte är mest berg i dagen nära mätaren.