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Forsmark site investigation

Meteorological monitoring at Forsmark, August 2005 until September 2006

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SMHI

January 2007

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Keywords: Meteorological stations, Precipitation, Air temperature, Barometric pressure, Wind speed, Wind direction, Air humidity, Global radiation, Calculated potential evapotranspiration, AP PF 400-05-132.

Abstract

In the Forsmark area meteorological monitoring has been going on since 2003. Meteorological measurements are performed at two locations, Högmasten and Storskäret. Measured and calculated parameters 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 of the two stations used for meteorological monitoring.

In general, the quality of the meteorological measurements during the period, starting August 1, 2005, and ending September 30, 2006, has shown to be good. Except problems with the precipitation gauges August 1–22, 2005, only minor interruptions in the measurements according to malfunctioning equipment have occurred.

Sammanfattning

I Forsmarksområdet har meteorologiska mätningar pågått sedan 2003. Dessa sker på två ställen, vid Högmasten och Storskäret. Här har master med registrerande instrument monterats. 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 ansvariga för utformandet av de två meteorologiska mätstationerna.

Kvaliteten hos de meteorologiska mätningarna utförda under perioden 2005-08-01 t.o.m. 2006-09-30 har generellt varit god. Bortsett från problem med nederbördsmätarna 1–22 augusti, 2005, har det endast förekommit några kortare avbrott i mätningarna orsakade av fel på mätutrustningen.

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1 Introduction

This document reports the results of meteorological measurements made in the area of Forsmark during the period August 2005–September 2006. The activities are performed within the site investigation at Forsmark and carried out in accordance to activity plan SKB AP PF 400-05-132, and the method desciption SKB MD 364.007 (SKB internal controlling documents). The controlling documents used in the activity are listed in Table 1-1.

To characterise the investigation area regarding meteorological conditions, SMHI has placed two stations with meteorological measuring equipment on the site; Högmasten (Forsmark) and Storskäret. The results of the meteorological monitoring will be used for general site characterisation, water balance calculations and as input data for hydro(geo)logical modelling. The geographical locations of the meteorological monitoring stations are shown 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 locations of the two SKB stations and the coordinates of the two stations are given in Table 1-2.

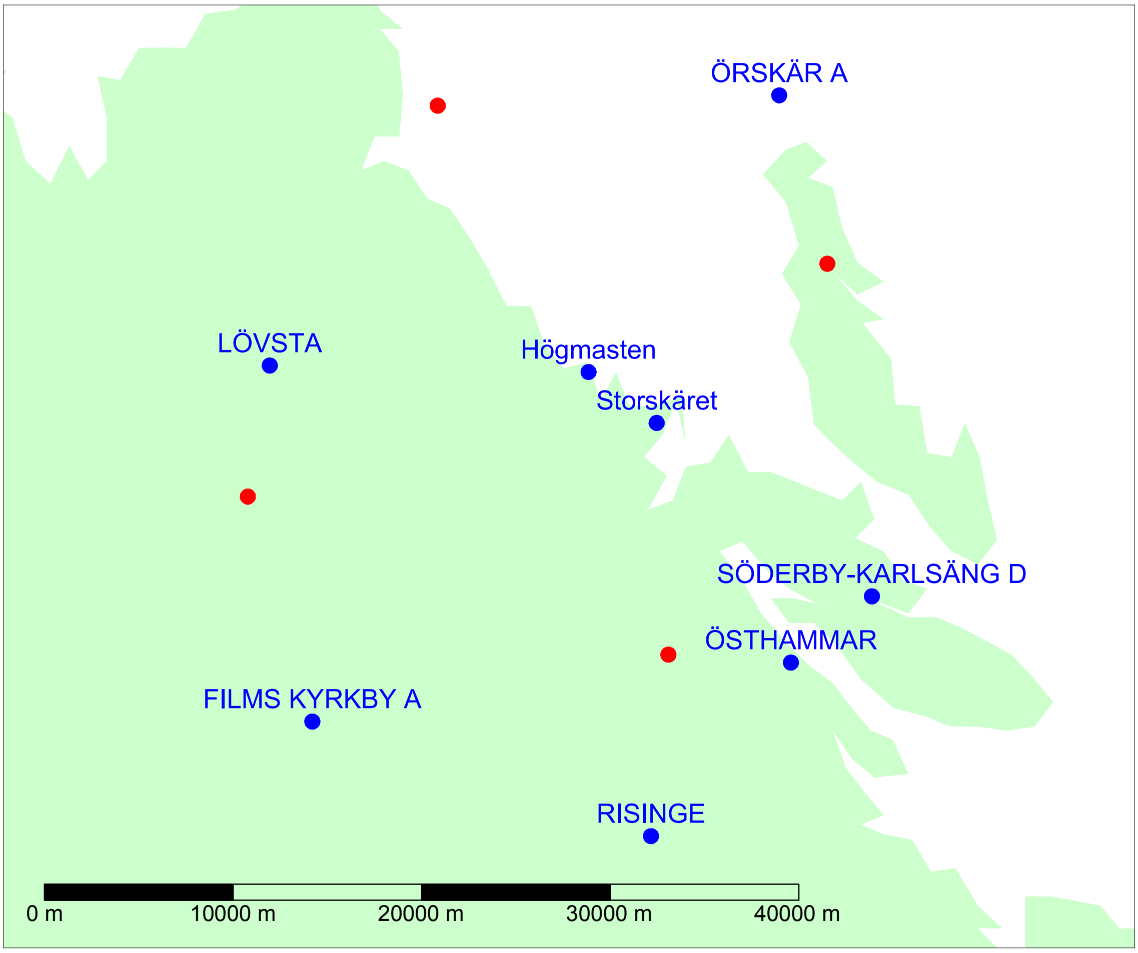


Figure 1-1. *Map showing the location of SMHI's monitoring stations (capital letters), SKB's stations (lower-case letters), and the MESAN-points (red points).*

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

Activity plan	Number	Version
Lokala meteorologiska mätningar till stöd för modellversion 2.2	SKB AP PF 400-05-132	1.0
Method description	**Number**	**Version**
Metodbeskrivning för meteorologiska mätningar	SKB MD 364.007	1.0

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

Original data from the reported activity are stored in the primary database Sicada, where they are traceable by the Activity Plan number (AP PF 400-05-132). Only data in SKB's 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 data revisions entail a revision of the P-report. Minor data revisions are normally presented as supplements, available at www.skb.se.

Figure 1-2. A detailed map showing the locations of SKB's meterological stations at Högmasten and Storskäret.

2 Objective and scope

SKB carries out site investigations at the Forsmark area. SMHI has, commissioned by SKB, installed two stations with meteorological measuring equipment at the site to characterise the meteorological conditions. The results will also be used for water balance calculations and as input data for hydro(geo)logical modelling.

The objective of this report is to present quality checked results from the meteorological monitoring during the period from August 1, 2005, until September 30, 2006.

3 Equipment

3.1 Meteorological measuring stations

Table 3-1 gives technical information about the equipment. Polycarbonate cupboards house data loggers (type Campbell CR10X), modems (Siemens TC35 and COM200E), and are earthed for lightning protection.

The wind is measured at 10 m above ground level and the other parameters at 2 m.

3.1.1 Calibration of equipment used at meteorological measuring stations

Calibration of the instruments, using data submitted by the manufactures, was done by FDS Mätteknik along with the installation of the instruments. No further need of calibration has been identified.

Table 3-1. Measuring equipment for collection of meteorological data at the stations.

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

4 Execution

4.1 General

This execution chapter is intended to describe the complete course of events, from measuring at Högmasten and Storskäret, via quality check and data handling to the storage in SKB's database Sicada.

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. Data in Sicada are traceable by the activity plan number. It is from data in Sicada that the modelling and analyses are performed.

4.2 Meteorological measurements

Data are collected 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 any data finally will be stored in Sicada they are checked and approved by SMHI. Every week a primary check for missing and incorrect values is performed by SMHI 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 Sicada.

4.2.2 Data handling/post processing

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

The data loggers at the stations have internal memories 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.

SMHI has, commissioned by SKB, constructed a homepage where the results of the measurements can be 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 values are interpolated from the nearest grid points in MESAN. The resolution of MESAN is 22×22 km and an analysis is made every hour. Corrected data have been stored in a special database. In Table 4-1, the coordinates of the nearest MESAN grid point are presented and in Figure 1-1 they are shown on a map.

4.4 Nonconformities

There are no nonconformities that affect the results or nonconformities with respect to the activity plan or the method description. However, some system malfunctions occurred and some data were lost. The precipitation gauges were not emptied after the winter 2005, entailing that the gauges were full in the end of June. The problem was discovered in August and the precipitation measurements re-started August 23. Furthermore, for two minor periods, October 8–12, 2005, and May 28–29, 2006, precipitation data were lost at Storskäret.

Table 4-1. Mesan grid points.

Latitude	Longitude
60.348	17.855
60.531	18.050
60.449	18.420
60.266	18.253

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 value of precipitation showed too high numbers. This occurred because of the high sensitivity of the instrument and that the precipitation was measured so often. The software in the data logger was 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 are shown for all parameters except for precipitation and wind direction. As an example of the high-resolution variations during a month, data from January 2006 are presented for all parameters, including precipitation and wind direction.

5.1.1 Precipitation

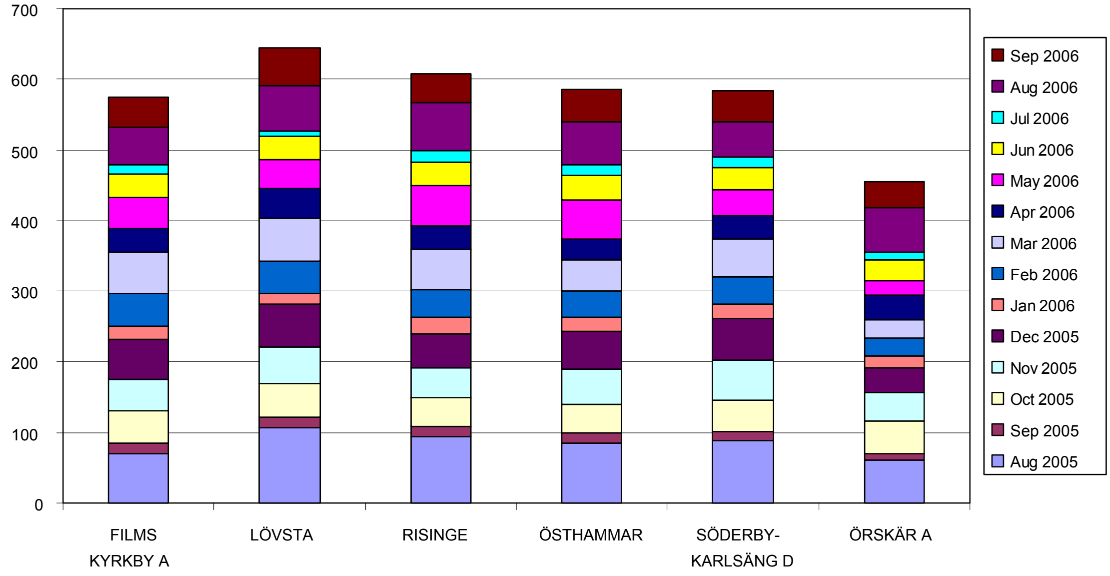
The monthly precipitation for the SMHI stations is presented in Table 5-1 and Figure 5-1 below. "Films Kyrkby A" and "Örskär A" are automatic stations whereas the others are manual stations. The precipitation differed substantially between stations and between months. The presented precipitation values were all checked and approved by SMHI. However, the values were 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. These values are not corrected for wind, wetting and evaporation losses.

	2005-08	2005-09	2005-10	2005-11	2005-12	2006-01	2006-02	2006-03	2006-04	2006-05	2006-06	2006-07	2006-08	2006-09
Film Kyrkby A	70.7	14.3	45.7	44.7	56.4	18.5	46.0	58.7	32.9	45.8	32.3	13.7	52.4	43.0
Lövsta	107.0	14.7	48.0	51.1	60.3	15.7	45.1	62.4	41.8	39.8	33.1	8.0	63.5	54.7
Risinge	93.1	15.4	40.6	41.7	48.2	23.8	39.8	56.3	33.1	58.3	32.9	16.9	66.9	40.4
Östhammar	85.5	14.5	40.8	48.4	54.5	19.6	36.3	45.1	28.5	56.7	33.4	16.5	59.6	46.0
Söderby-Karlsäng D	87.7	13.3	45.3	56.5	59.7	19.7	38.5	52.9	33.7	37.3	30.1	15.4	50.0	43.3
Örskär A	61.6	8.9	46.2	40.0	34.7	17.3	24.8	26.3	34.5	19.9	30.8	11.2	61.2	38.1

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 Kyrkby A	13	16	19	15	13	14	11	13	13	13	14	16	14
Söderby-Karlsäng D	M I S S I N G												



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

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

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

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

	2005-8	2005-9	2005-10	2005-11	2005-12
Forsmark 001	25.5	28.6	47.8	48.7	57.4
Forsmark COR	13.5	9.9	47.8	48.8	57.9
Forsmark ALX	14.9	10.8	52.6	54.3	64.9
Storskäret 001	42.8	27	86.2	51.3	93.9
Storskäret COR	16.4	11.7	43.9	51.4	56.7
Storskäret ALX	18.0	12.9	48.3	57.1	63.5

	2006-1	2006-2	2006-3	2006-4	2006-5	2006-6	2006-7	2006-8	2006-9
Forsmark 001	14.8	42.1	44.8	31.4	26.0	28.9	6.7	58.4	45.4
Forsmark COR	14.7	42.2	44.8	30.8	26.0	28.9	6.8	58.4	45.4
Forsmark ALX	16.6	48.1	50.6	34.2	28.6	31.8	7.5	64.2	49.9
Storskäret 001	16.2	38.4	47.7	28.9	29.0	26.7	11.8	49.5	47.2
Storskäret COR	16.1	38.4	47.8	28.6	4.8	26.9	11.9	49.6	47.1
Storskäret ALX	18.2	43.8	54.0	31.5	5.3	29.6	13.1	54.6	51.8

Table 5-4. Corrections in percent of SKB's stations 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
Storskäret	13	14	13	11	10	10	10	10	10	10	11	12	11

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.

If the accumulated uncorrected precipitation from September 1, 2005, to September 30, 2006, from the different stations is compared, it can be seen that the SMHI-station at Örskär only got 394 mm, whereas the other SMHI stations got between 481 and 538 mm (Table 5-5) (the time period September 1, 2005, to September 30, 2006, is presented due to the missing data at SKB´s station most of August 2005). These values can be compared with the COR-values from Forsmark and Storskäret in the same table. The values correspond well with each other.

As an example of high-resolution precipitation data, Figure A1-7 in Appendix 1 shows the 30-minutes precipitation values for Jan 2006 for Forsmark and Storskäret.

5.1.2 Air temperature

A graph of daily mean temperature is presented in Figure A1-1 in Appendix 1. Values from Forsmark (Högmasten), Storskäret and MESAN-values are exposed. Figure A1-8 shows the 30-minutes values for January 2006. The three curves follow each other very well.

5.1.3 Barometric pressure

A graph of the daily barometric pressure is shown in Figure A1-2 in Appendix 1. Values from Forsmark (Högmasten) and MESAN-values are presented. Figure A1-9 shows the 30-minutes values for January 2006. The two curves are nearly identical.

Table 5-5. Precipitation in mm from Sep. 1, 2005, to Sep. 30, 2006. The uncorrected values given for the SMHI stations correspond to the COR-values at SKB's stations.

Forsmark COR	462
Forsmark ALX	514
Storskäret COR	434
Storskäret ALX	483
ÖRSKÄR	394
ÖRSKÄR ALX	459
ÖSTHAMMAR	500
ÖSTHAMMAR ALX	546
LÖVSTA	538
LÖVSTA ALX	589
RISINGE	514
RISINGE ALX	565
FILMS KYRKBY A	481
FILMS KYRKBY A ALX	550
SÖDERBY KARLSÄNG D	496
SÖDERBY KARLSÄNG D ALX	–

5.1.4 Wind speed and wind direction

A graph of the wind speed (daily mean) is illustrated in Figure A1-3 in Appendix 1. Values from Forsmark (Högmasten), Storskäret and MESAN-values are presented. Figure A1-10 shows the 30-minutes values for January 2006. The wind speeds from MESAN are higher than at Högmasten and Storskäret.

From Figure 1-1, it can be seen that two of the MESAN-points are situated at sea and therefore provide very high wind speeds. The other mesan-points give values closer to Forsmark, especially when the wind is from west. When interpolating the wind speed to the location of Forsmark, MESAN overestimates the wind speed. The wind speed curves from Högmasten and Storskäret follow each other quite well.

In Figure A1-11 in Appendix 1, the wind directions for the same stations are compared for January 2006. The data correspond well to each other.

5.1.5 Relative humidity

A graph of relative humidity is presented in Figure A1-4 in Appendix 1. Values from Forsmark (Högmasten) and Storskäret are displayed. Figure A1-12 shows the 30-minutes values for January 2006. The three curves follow each other very well.

5.1.6 Global radiation

A graph of the daily sum of global radiation is presented in Figure A1-5 in Appendix 1. Figure A1-13 in Appendix 1 shows the 30-minutes values for January 2006. Global radiation is measured only at Forsmark (Högmasten). Values from Forsmark (Högmasten) and Strång-values are presented. 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 29–July 1, 2006, it can be seen that something blocks the view of the sensor (Figure 5-2). Every day at about 08:00 there is a notch in the graph. It is the high mast of the nuclear plant that is blocking the sensor.

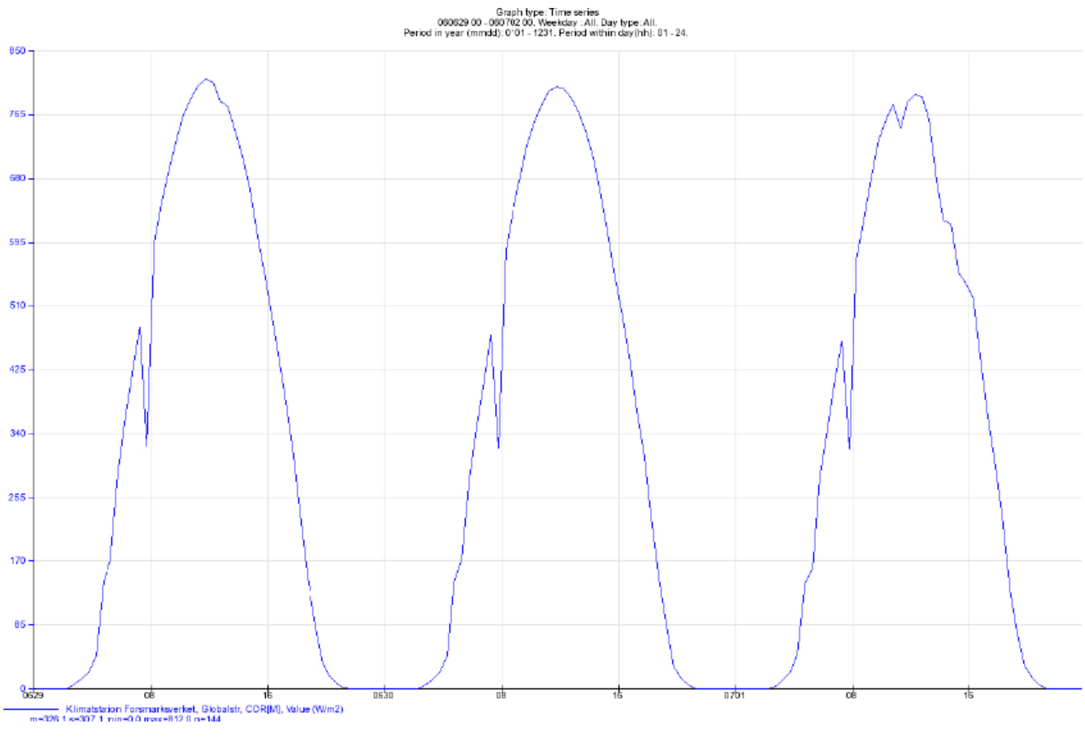


Figure 5-2. Global radiation 29 June–1 July, 2006 at Högmasten.

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 vaporization,

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 were required as input data to the equation to calculate the potential evapotranspiration. The wind speed was measured at 10 m above the ground but for the estimation of potential evapotranspiration the wind speed was re-calculated to a value representing 2 m above the ground by multiplying by a factor 0.8. The net radiation was calculated from the measured global radiation and the albedo was set to 0.12 when the ground was not covered with snow and to 0.5 when there was a snow cover. The applied method included heat storage in the ground.

The potential evapotranspiration is much higher at Örskär compared to Forsmark and Films Kyrkby. During August 2005–September 2006 the calculated potential evapotranspiration at Högmasten was 652 mm and at Films Kyrkby 726 mm, while it was 900 mm at Örskär. The reason for this difference is mainly that the wind speed is much higher at Örskär (sea station).

A graph of the potential evapotranspiration for Högmasten is presented in Figure A1-6 in Appendix 1. Figure A1-14 shows the 30-minutes values for January 2006.

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Meteorological monitoring

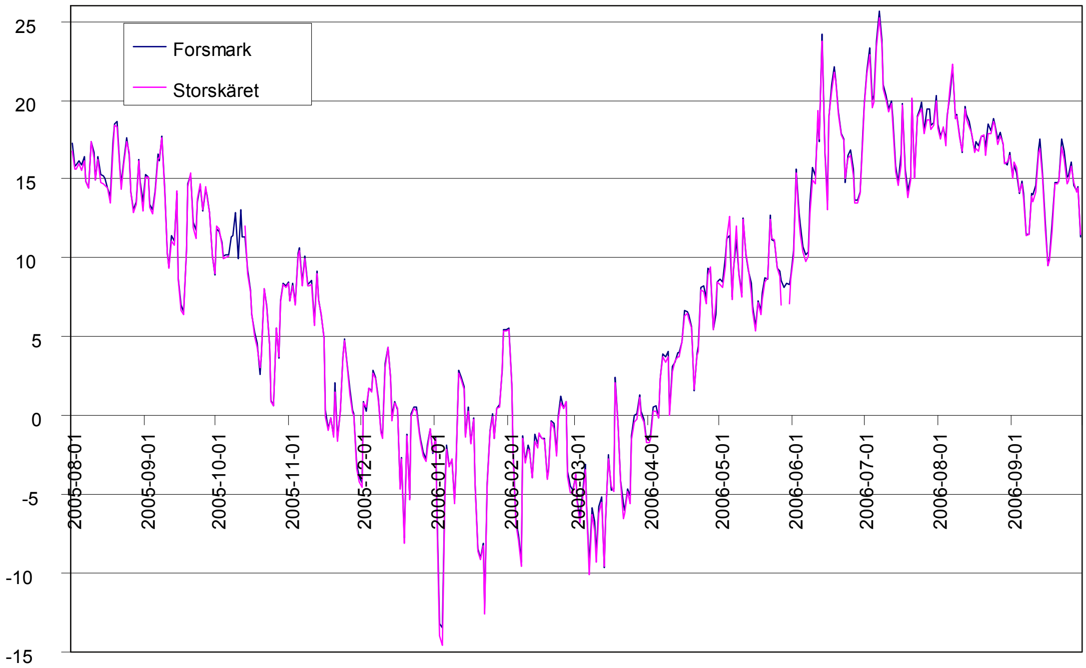

Figure A1-1. *Temperature in °C, daily values, August 2005–September 2006.*

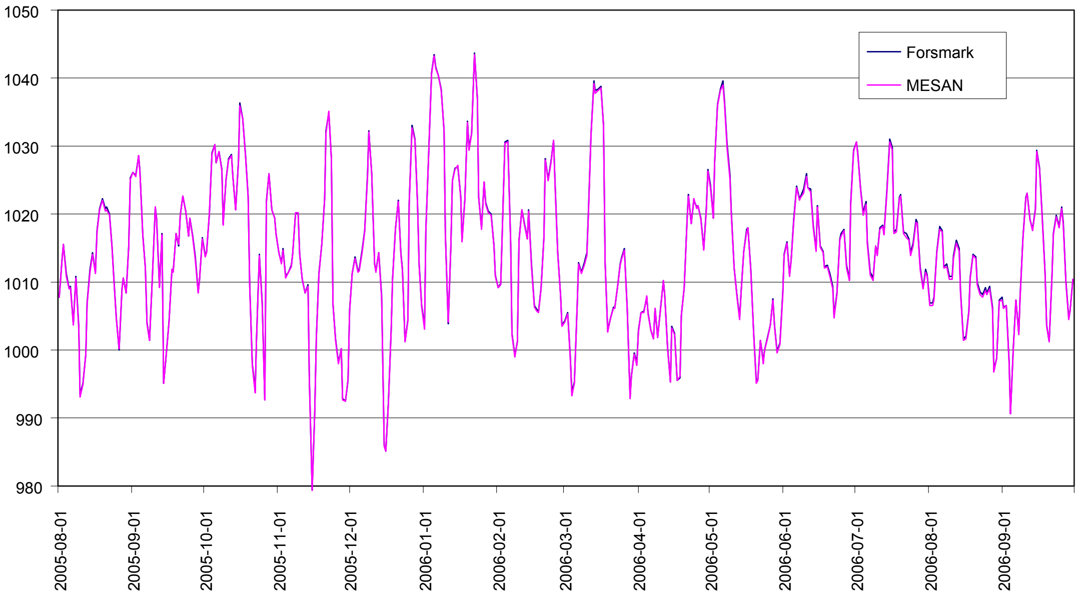

Figure A1-2. *Barometric pressure in hPa, daily values, August 2005–September 2006.*

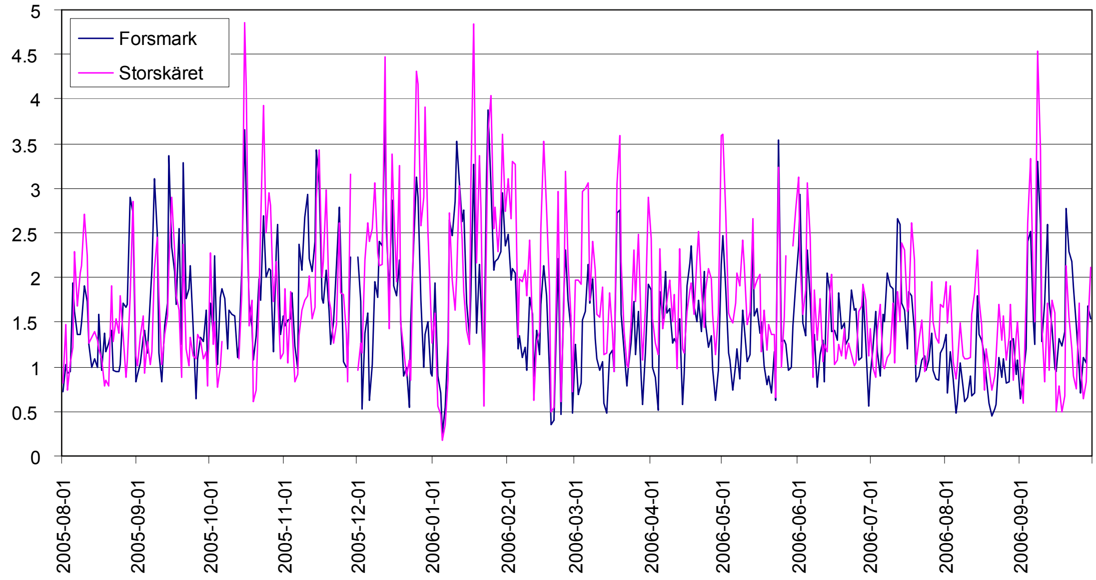

Figure A1-3. *Wind speed in m/s, daily values, August 2005–September 2006.*

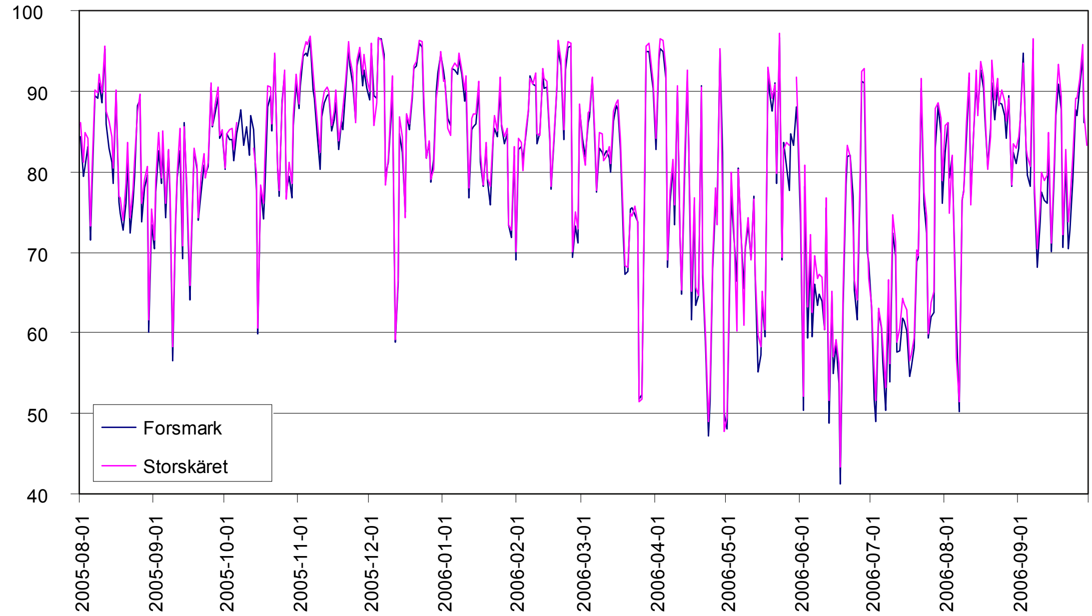

Figure A1-4. *Relative humidity in %, daily values, August 2005–September 2006.*

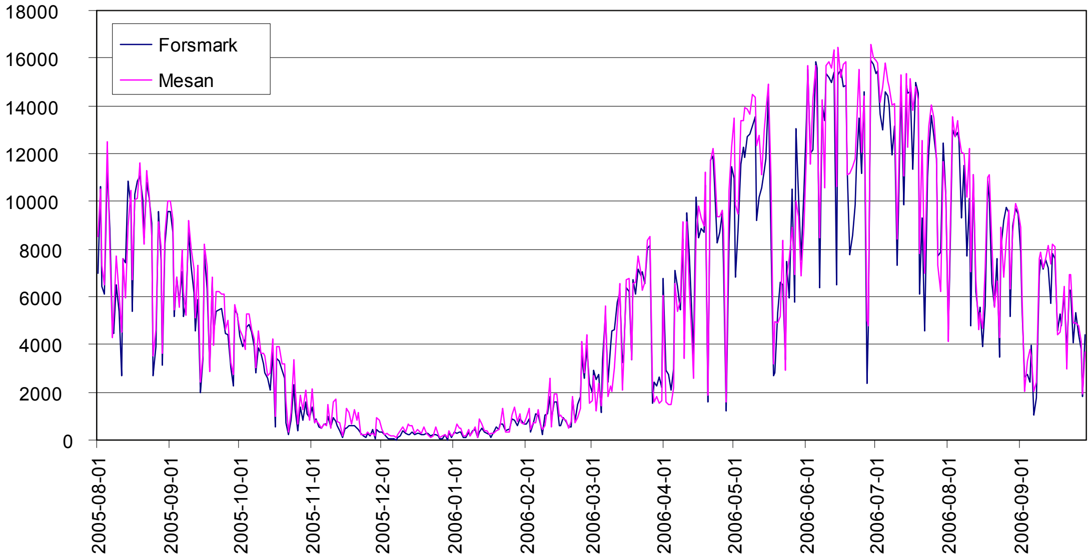

Figure A1-5. *Global radiation in Wh/m², daily sum, August 2005–September 2006.*

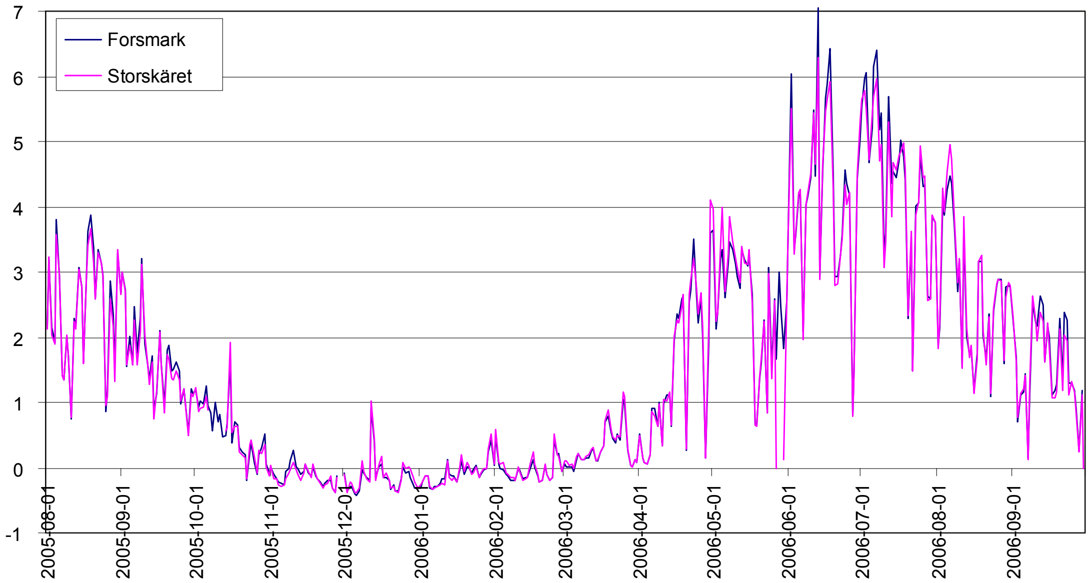

Figure A1-6. *Potential evapotranspiration in mm, daily sum at Forsmark, August 2005–September 2006.*

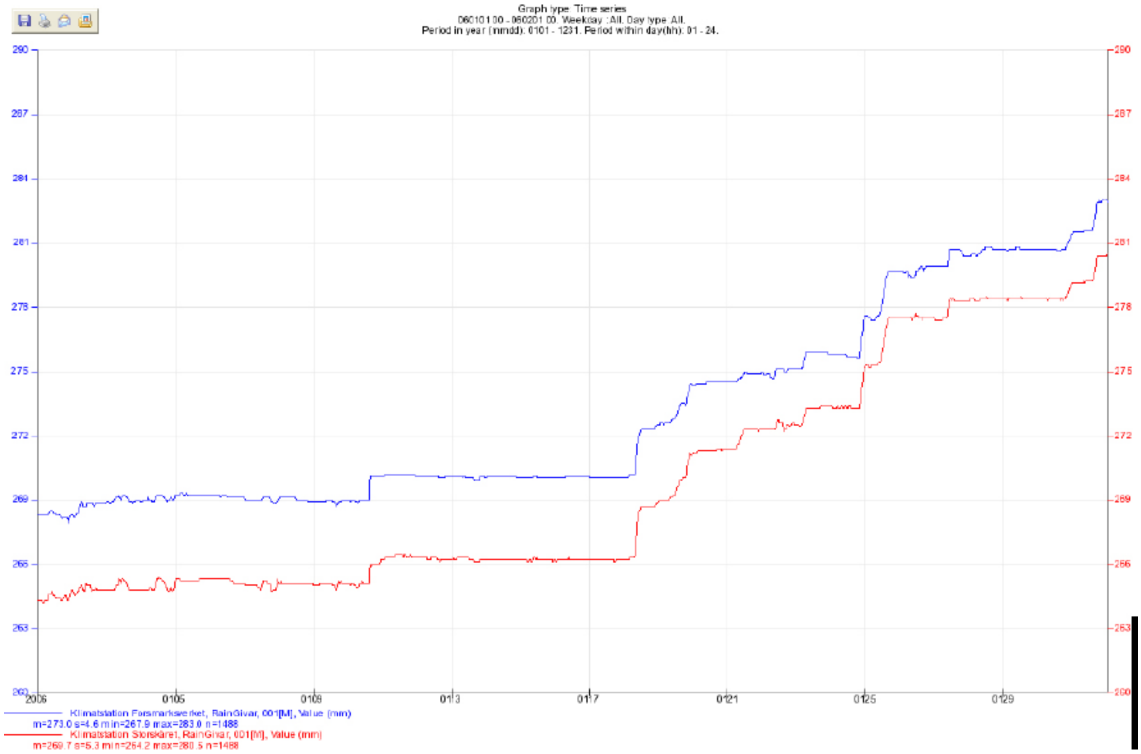

Figure A1-7. *Precipitation in mm, 30 min.-values, January 2006.*

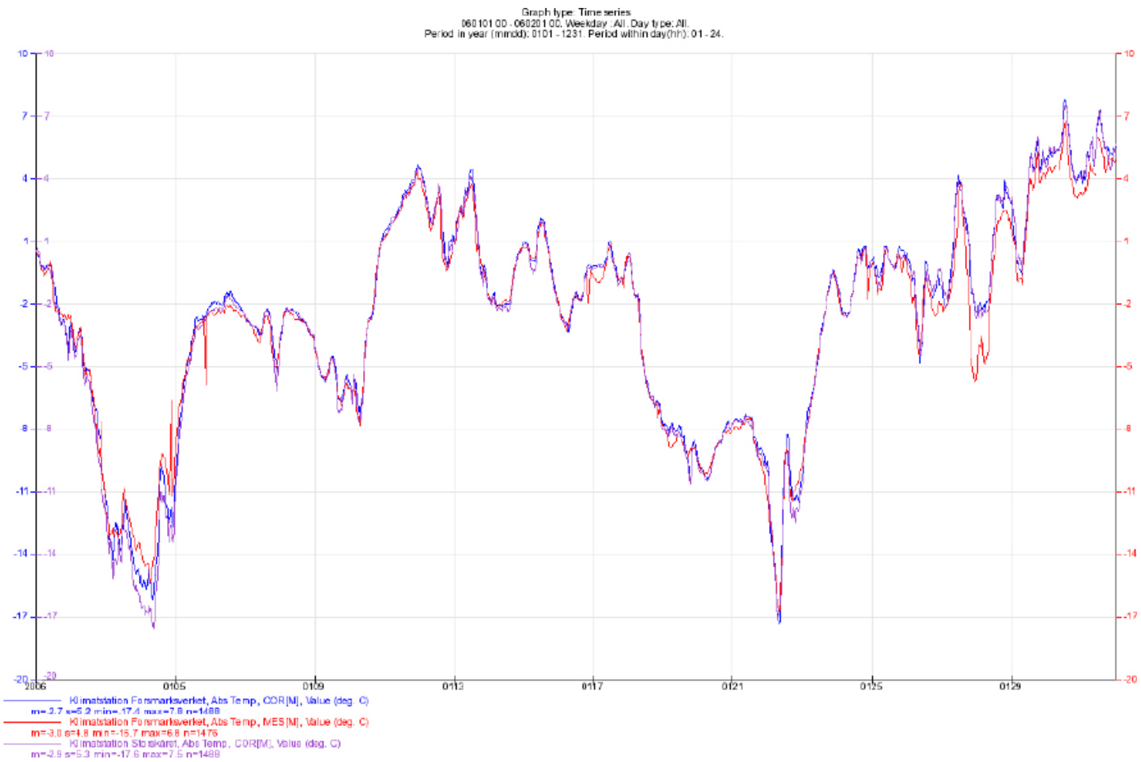

Figure A1-8. *Temperature in °C, 30 min.-values, January 2006.*

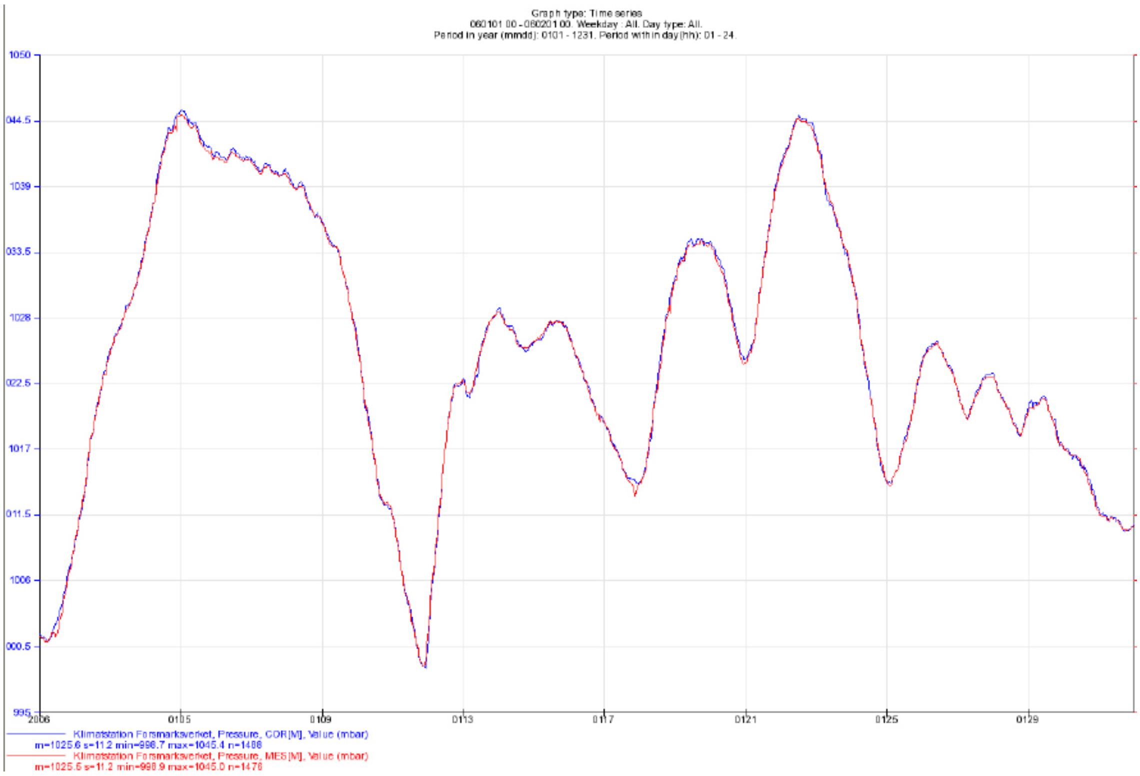

Figure A1-9. *Barometric pressure in hPa, 30 min.-values, January 2006.*

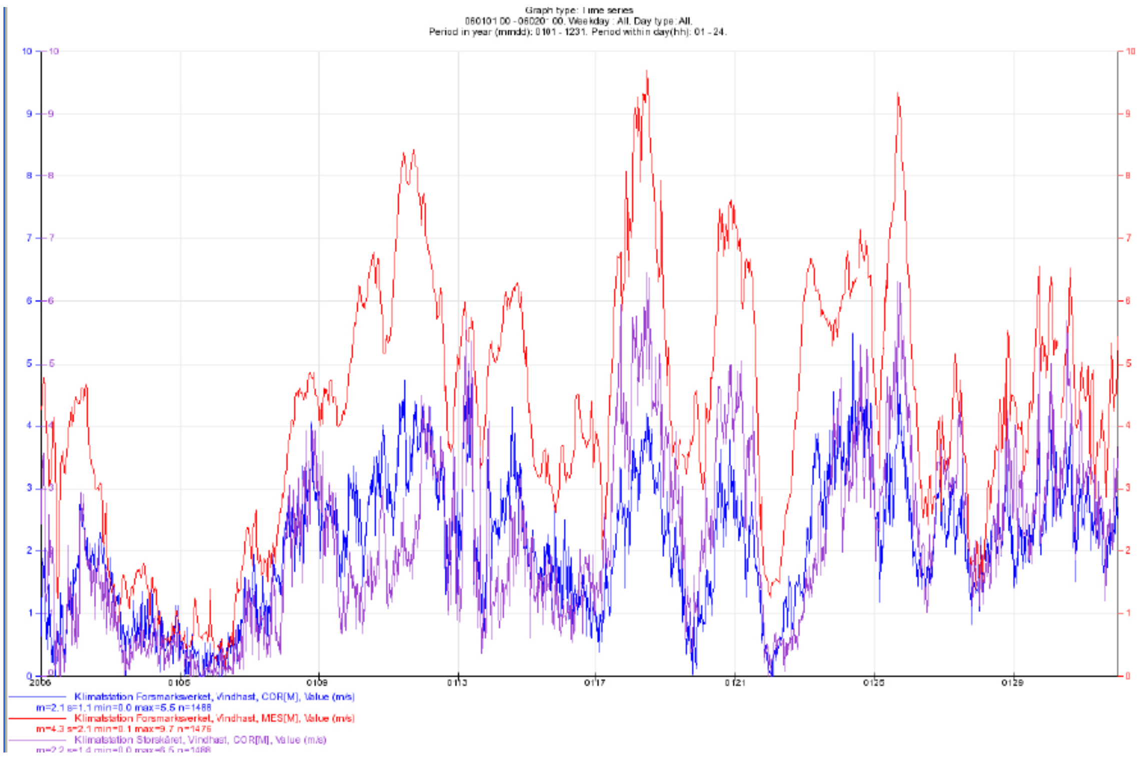

Figure A1-10. *Wind speed in m/s, 30 min.-values, January 2006.*

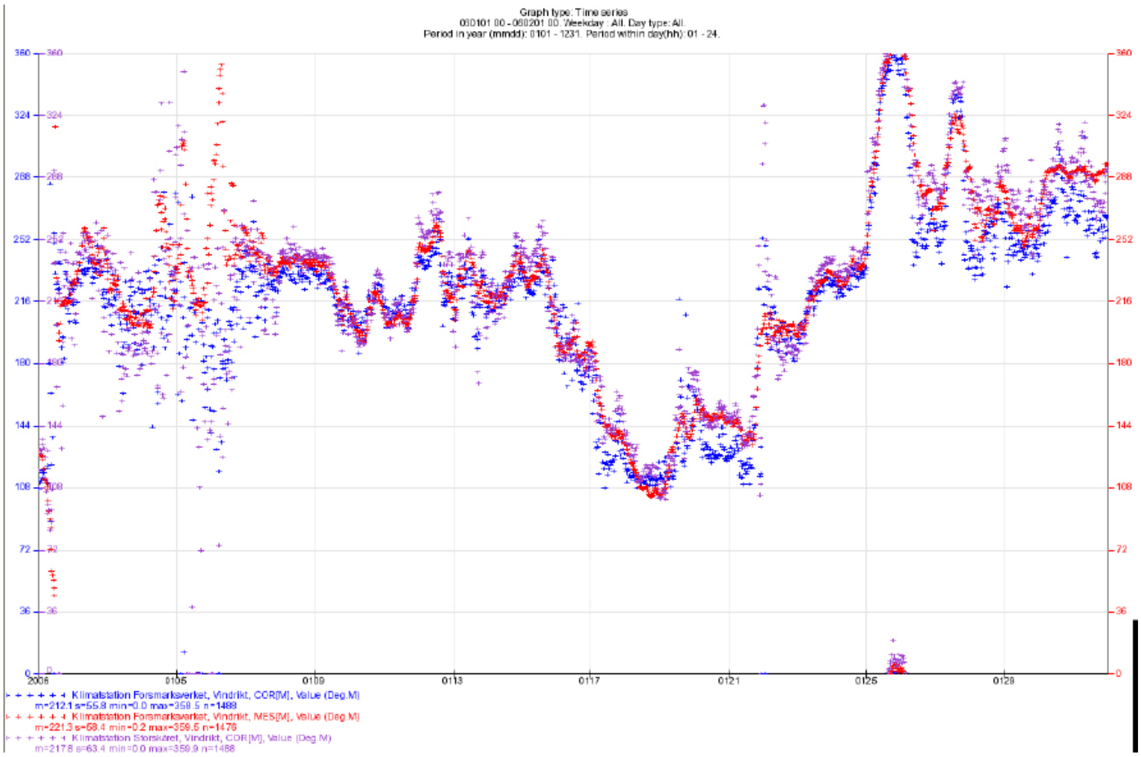

Figure A1-11. *Wind direction in °, 30-min.-values, January 2006.*

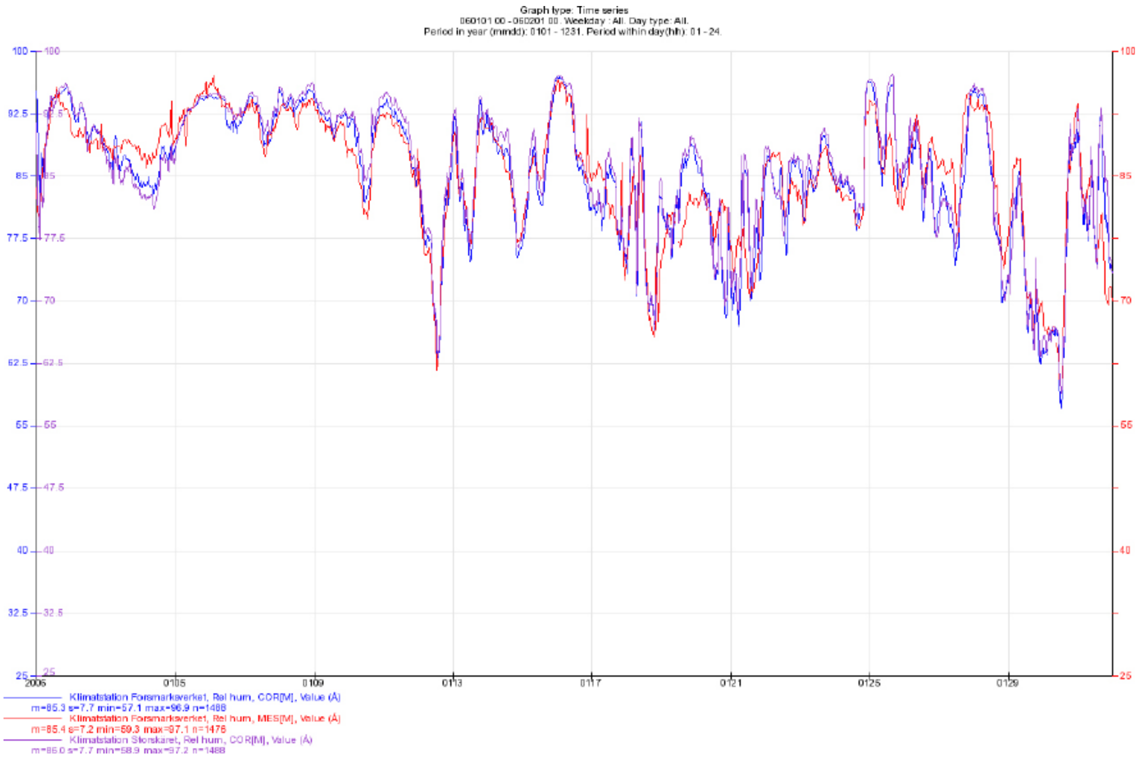

Figure A1-12. *Relative humidity in %, 30 min.-values, January 2006.*

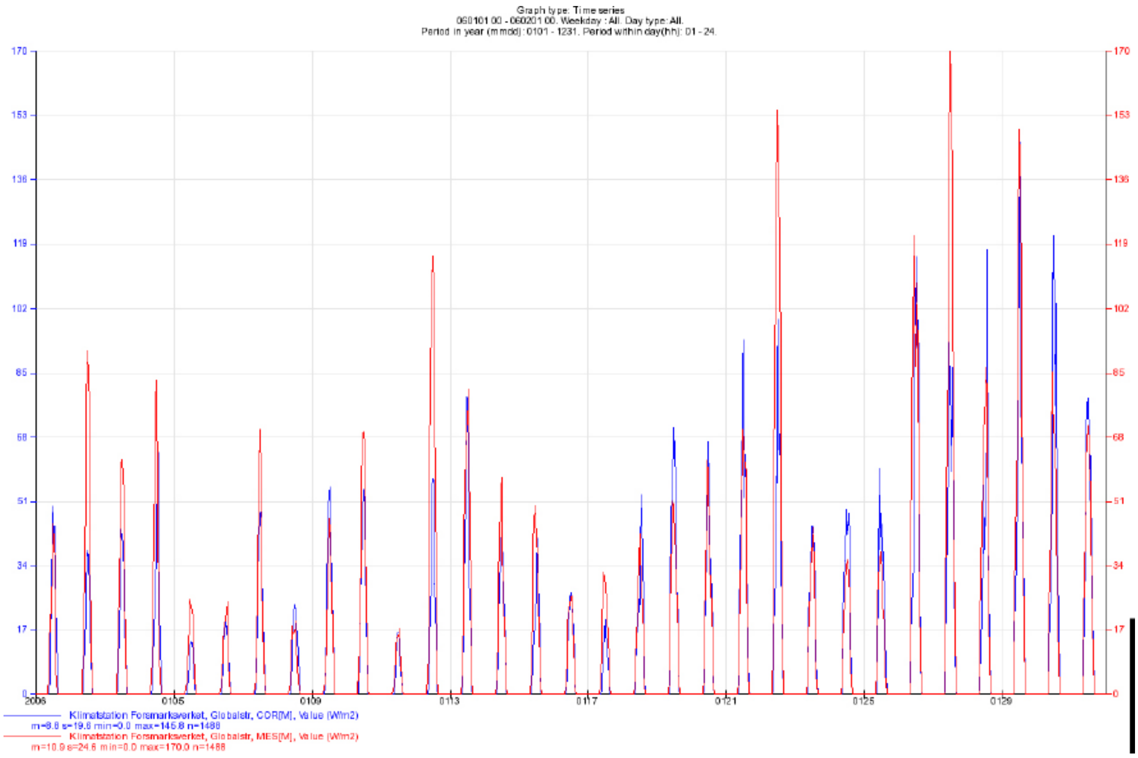

Figure A1-13. *Global radiation in W/m², 30 min.-values, January 2006.*

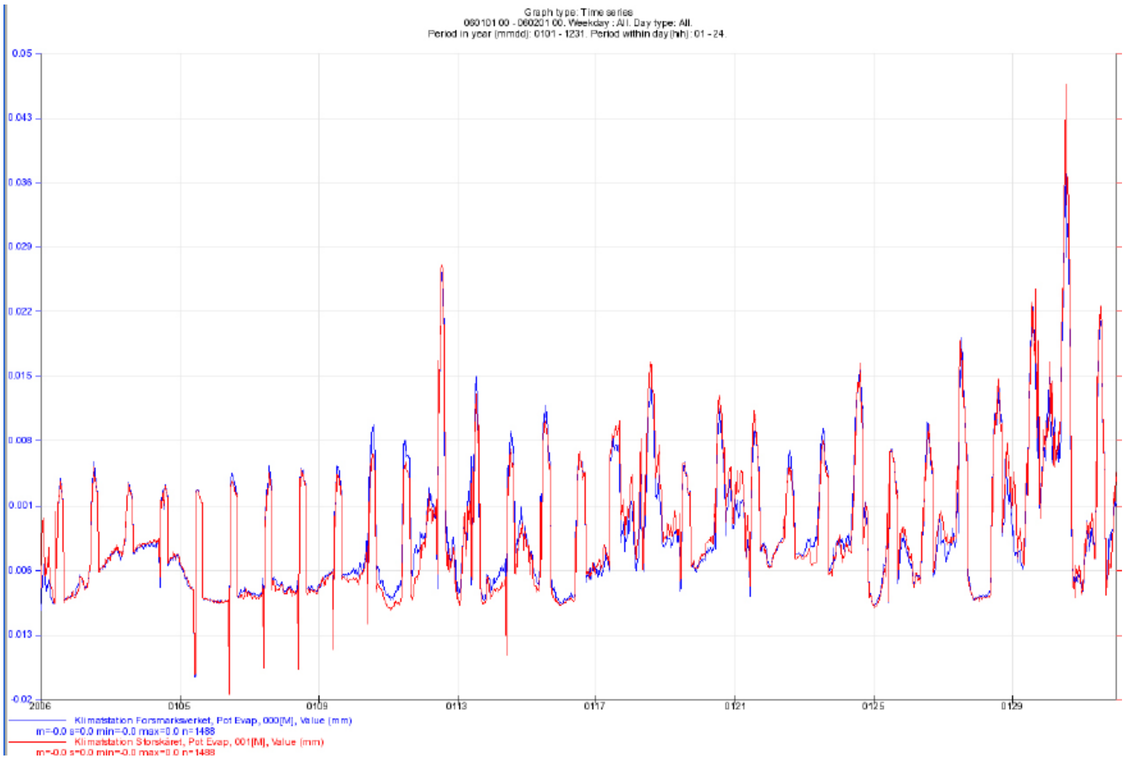

Figure A1-14. *Potential evapotranspiration in mm, 30 min.-values, January 2006.*

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	Singö
Storskäret	2	Singö
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 45º 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.