P-08-100

Forsmark site investigation

Meteorological monitoring at Forsmark July 2007–December 2007

Lennart Wern, Jörgen Jones
SMHI

December 2008

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Keywords: AP PF 400-07-046, Meteorological stations, Precipitation, Air temperature, Barometric pressure, Wind speed, Wind direction, Air humidity, Global radiation, Calculated potential evapotranspiration.

Abstract

In the Forsmark area, meteorological monitoring has been going on since 2003. The Swedish Meteorological and Hydrological Institute, SMHI, was responsible for planning and design of the meteorological stations. Originally measurements were performed at two stations; Högmasten and Storskäret. However, since July 1 2007, measurements are only performed at Högmasten. Measured and calculated parameters are precipitation and corrected precipitation, air temperature, barometric pressure, wind speed and direction, air humidity, global radiation and potential evapotranspiration.

In general, the quality of the meteorological measurements during the period concerned, starting July 1 2007, and ending Dec 31 2007, has shown to be good. Only minor interruptions in the measurements due to malfunctioning equipment have occurred.

Sammanfattning

I Forsmarksområdet har meteorologiska mätningar pågått sedan 2003. Sveriges Meteorologiska och Hydrologiska Institut, SMHI, var ansvariga för utformandet av de meteorologiska mätstationerna. Mätningar gjordes ursprungligen på två platser; Högmasten och Storskäret. Sedan 2007-08-01 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.

Kvaliteten hos de meteorologiska mätningarna utförda under perioden 2007-07-01 t o m 2007-12-31 har generellt varit god. Endast några kortare avbrott i mätningarna har förekommit, orsakade av fel på mätutrustningen.

Contents

1 Introduction

This document reports the results of meteorological measurements made at Forsmark during the period July–December, 2007. 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 400-07-046 and the method description SKB MD 364.007 (SKB 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 measurements at Storskäret were completed in June 30, 2007. The results of the meteorological monitoring will be used for general site characterisation, water balance calculations and as input data for hydrological and hydrogeological modelling.

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

Activity plan	Number	Version
Lokala meteorologiska mätningar i Forsmark, 1 juli–31 dec 2007	SKB AP PF 400-07-046	1.0
Method description	**Number**	**Version**
Metodbeskrivning för meteorologiska mätningar	SKB MD 364.007	1.0

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.

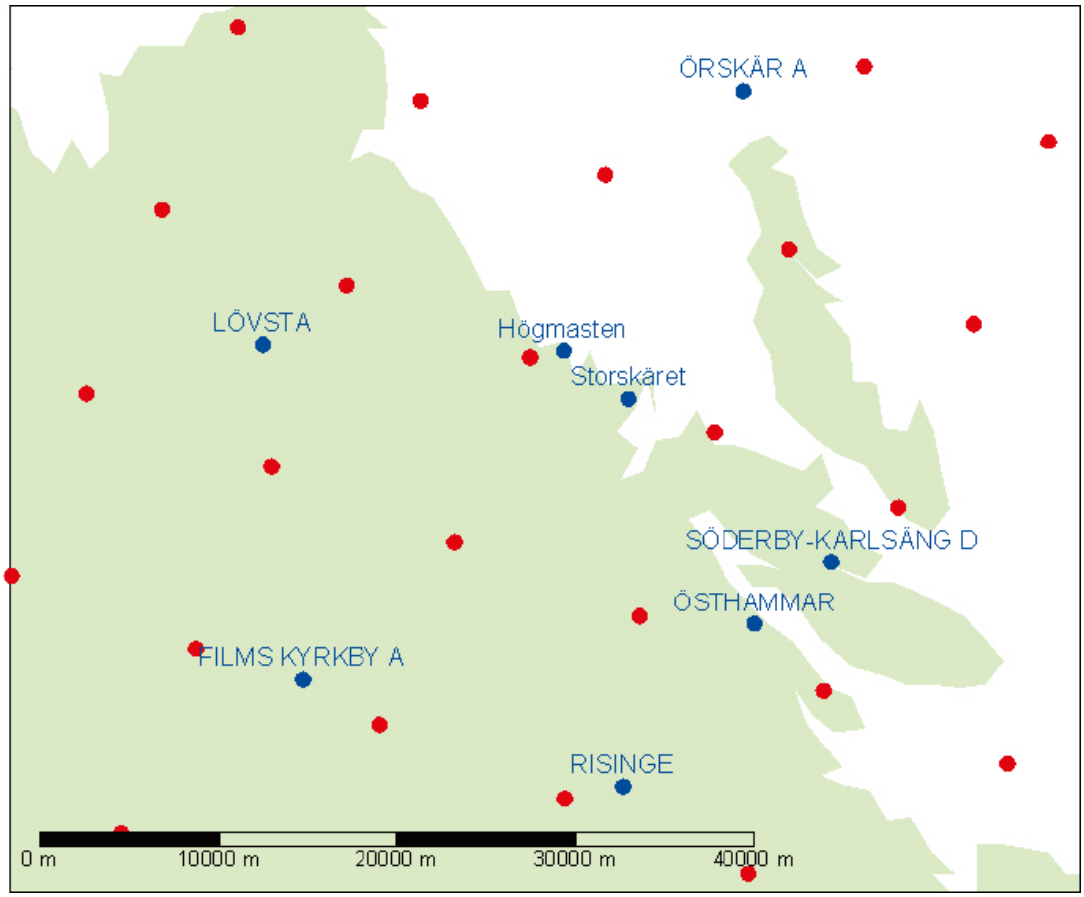


Figure 1-1. *Map showing the location of SMHI's monitoring stations (capital letters), SKB's stations (lower-case letters), and the MESAN-points (red points).*

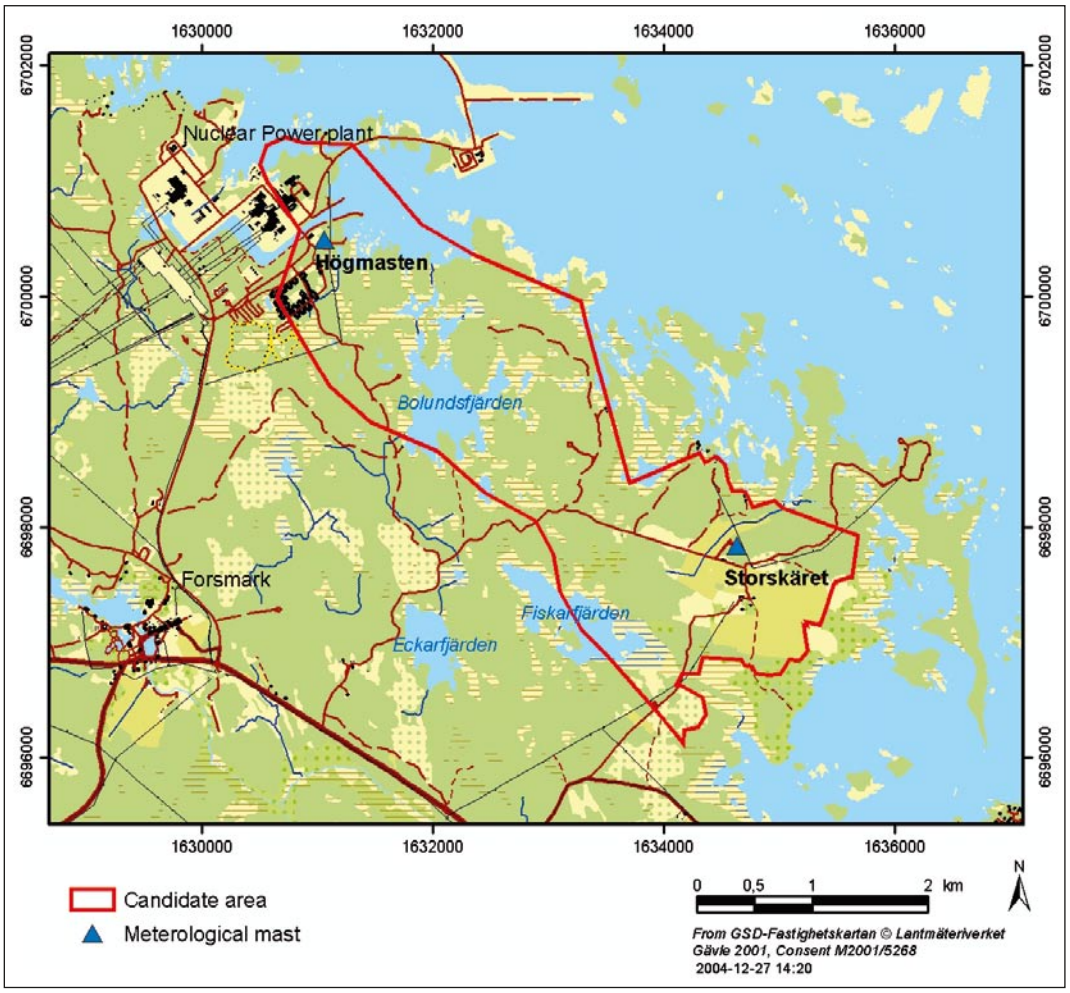


Figure 1-2. *A detailed map showing the location of Högmasten and Storskäret.*

Table 1-2. SKB:s monitoring stations. Coordinates in RT 90 2.5 gon V 0:–15.

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

2 Objective and scope

In 2003 SMHI installed two stations with meteorological measuring equipment for SKB's site investigations at Forsmark to characterise the meteorological conditions.
The meteorological measurements now continue within the long-term monitoring programme after completed site investigations. However, only the station at Högmasten is active from July 1 2007. Besides for general meteorological charcaterisation, the results are also 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 during the period from 1 July 2007 until 31 December 2007.

3 Equipment

3.1 Högmasten meteorological monitoring station

Table 3-1 gives technical information about the equipment at the Högmasten meteorological monitoring station. A polycarbonate cupboard houses data logger (type Campbell CR10X), modem (Siemens TC35 and COM200E), and is earthed for lightning protection.

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

3.1.1 Calibration of equipment used at meteorological measuring stations

FDS Mätteknik performed service and calibration of the instruments at Högmasten and at Storskäret on May 28 2007 using data submitted by the manufacturers in connection with the instrument installations, see Appendices 3 and 4. The service reports showed that the instruments are in good condition.

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

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

4 Execution

4.1 General

This execution chapter is intended to describe the complete course of events, from measuring at Högmasten, via quality check and data handling to the storage in 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. 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 400-07-046). 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 any data finally will be stored in SKB's database 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 SKB's database, Sicada.

4.2.2 Data handling/post processing

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

The data loggers at the station 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's database.

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 11 x 11 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.

Table 4-1. Mesan grid points.

Latitude	Longitude
60.40	18.15
60.36	18.34
60.45	18.42
60.49	18.24

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 were too high. This is due to the high sensitivity of the instrument and 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.

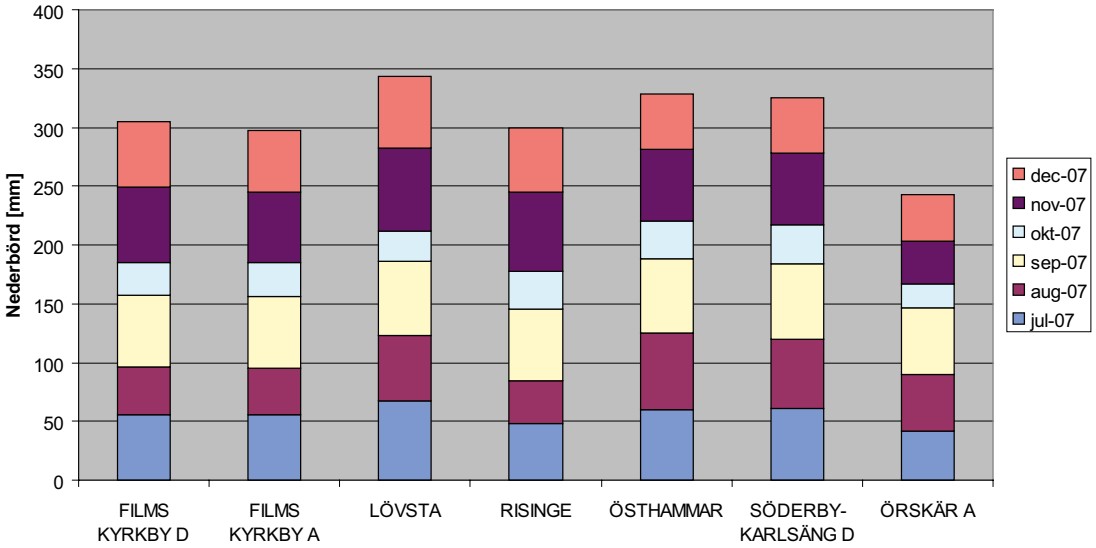
The locations of all monitoring stations from which results are presented below are shown in Figures 1-1 and 1-2. In Appendix 1, daily values are shown for all parameters except for precipitation and wind direction. As an example of the high-resolution variations during a month, data from July 2007 are 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 differs substantially between stations and between months. The presented precipitation values are all checked and approved by SMHI. 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.

	2007-07	2007-08	2007-09	2007-10	2007-11	2007-12	Sum
Films Kyrkby D	56.0	40.6	60.7	27.5	64.7	54.9	304.4
Films Kyrkby A	55.8	39.3	61.0	28.4	60.2	53.0	297.7
Lövsta	67.0	55.9	63.0	25.8	71.1	60.0	342.8
Risinge	47.7	36.9	61.3	32.1	67.3	53.7	299.0
Östhammar	59.8	65.2	63.1	32.5	60.4	47.7	328.7
Söderby-Karlsäng D	61.0	58.4	64.5	32.7	61.5	46.8	324.9
Örskär A	41.8	48.4	56.8	19.8	36.7	38.8	242.3



Figur 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 for wind, wetting and evaporation losses in percent at SMHI's precipitation 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
Film 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, and "ALX" is an estimation of the true precipitation.

The method for estimating the true precipitation (ALX) is the same 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.

The accumulated uncorrected precipitation from 1 July 2007 to 31 December 2007 from the different stations is compared in Table 5-5. The values at the stations from SMHI are higher.

As an example of high-resolution precipitation data, Figure A-7 in Appendix 1 shows the 30-min precipitation values for July 2007 for Forsmark.

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.

	2007-07	2007-08	2007-09	2007-10	2007-11	2007-12	Summa
Högmasten 001	10.3	51.7	53.5	24.1	52.8	48.8	241.2
Högmasten COR	10.2	51.9	53.5	24.0	34.3	32.5	206.4
Högmasten ALX	11.2	57.1	58.8	26.4	38.1	36.4	228.0

Table 5-4. Corrections for wind, wetting and evaporation losses in percent at Högmasten 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 1 July 2007 to 31 December 2007. The uncorrected values given for the SMHI stations correspond to the COR-values at SKB´s stations.

Forsmark (Högmasten) COR	206
Forsmark (Högmasten) ALX	228
Örskär	242
Örskär Alx	280
Östhammar	329
Östhammar Alx	356
Lövsta	343
Lövsta Alx	372
Risinge	299
Risinge Alx	324
Films Kyrkby A	298
Films Kyrkby A Alx	337
Films Kyrkby D	304
Films Kyrkby D Alx	330
Söderby Karlsäng D	325
Söderby Karlsäng D Alx	353

5.1.2 Air temperature

A graph of daily temperature is presented in Figure A-1 in Appendix 1. Values from Forsmark (Högmasten) and MESAN are exposed. Figure A-8 shows the 30-min. values for July 2007. The two curves follow each other very well.

5.1.3 Barometric pressure

A graph of the daily barometric pressure is shown in Figure A-2 in Appendix 1. Values from Forsmark (Högmasten) and MESAN-values are presented. Figure A-9 shows the 30-min. values for July 2007. The two curves are nearly identical.

5.1.4 Wind speed and wind direction

A graph of the wind speed (daily mean) is illustraded in Figure A-3 in Appendix 1. Values from Forsmark (Högmasten) and MESAN-values are presented. Figure A-10 shows the 30-min. values for July 2007. The wind speeds are higher from MESAN compared with Högmasten.

In Figure A-11 in Appendix 1, the wind directions for the same stations are compared for July 2007. The data correspond well to each other.

5.1.5 Relative humidity

A graph of relative humidity is presented in Figure A-4 in Appendix 1. Values from Forsmark (Högmasten) and MESAN-values are displayed. Figure A-12 shows the 30-min. values for July 2007. The two curves follow each other very well.

5.1.6 Global radiation

A graph of the daily sum of global radiation is presented in Figure A-5 in Appendix 1. Figure A-13 in Appendix 1 shows the 30-min. values for July 2007. 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 5 June–7 June 2007, it can be seen that something blocks the view of the sensor (Figure 5-3). Every day at about 08:00 there is a notch in the graph. The high mast of the nuclear plant shadows the global radiation instrument.

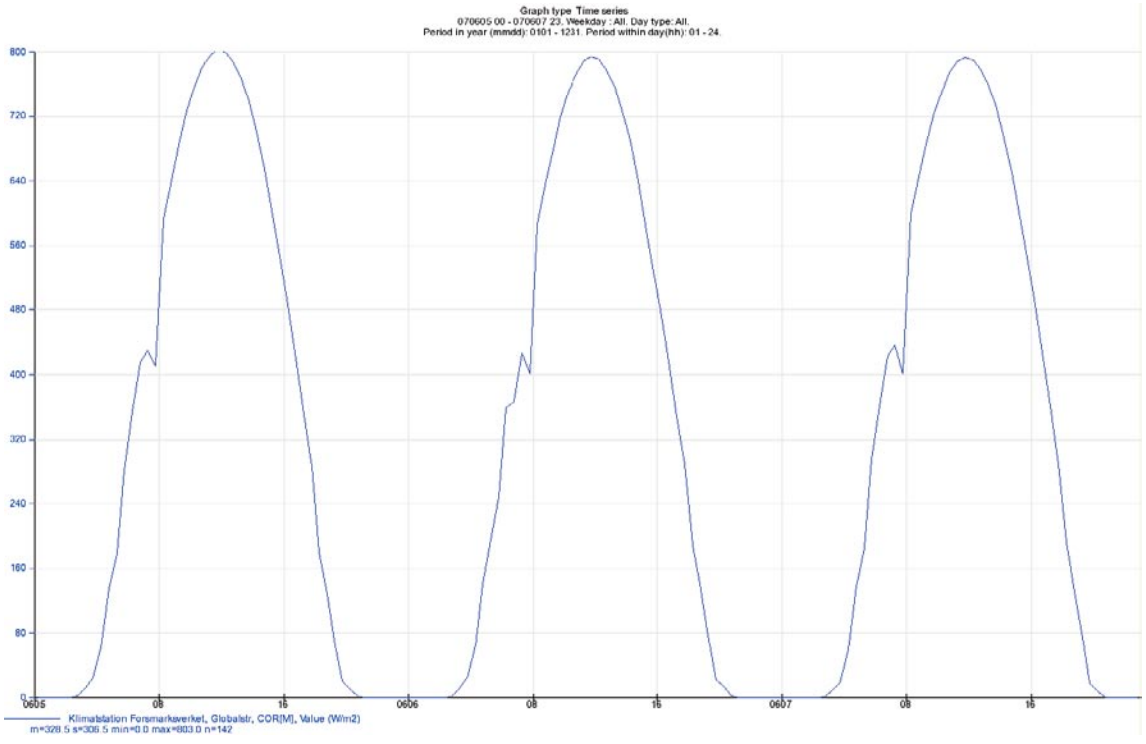


Figure 5-3. *Global radiation 5 June–7 June, 2007.*

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-min 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 Forsmark and Films Kyrkby.

During the period July–December 2007 the calculated potential evapotranspiration at Högmasten was 223 mm and at Films Kyrkby 247 mm, while at Örskär it was 355 mm. 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 Forsmark (Högmasten) is presented in Figure A-6 in Appendix 1. Figure A-14 shows the 30-min. values for July 2007.

References

Alexandersson H, 2003. Korrektion av nederbörd enligt enkel klimatologisk metodik. SMHI, Meteorologi, Nr 111. (In Swedish.)

Alexandersson H, 2005. Enkel bedömning av nederbördsförluster på fyra automatstationer (see Appendix 2). (In Swedish.)

Eriksson B, 1981. Den ”potentiella” evapotranspirationen i Sverige. SMHI, RMK 28. (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.

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.

Appendix 1

Meteorological monitoring

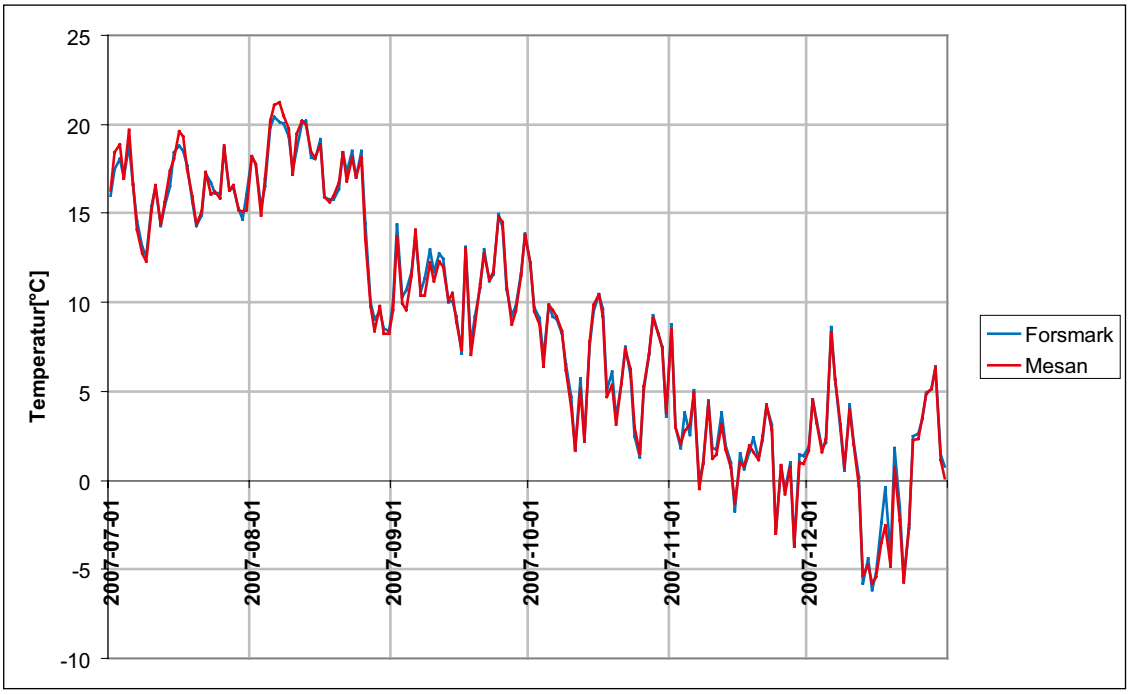


Figure A-1. *Temperature in °C at Högmasten and MESAN-values, daily values, July 2007–December 2007.*

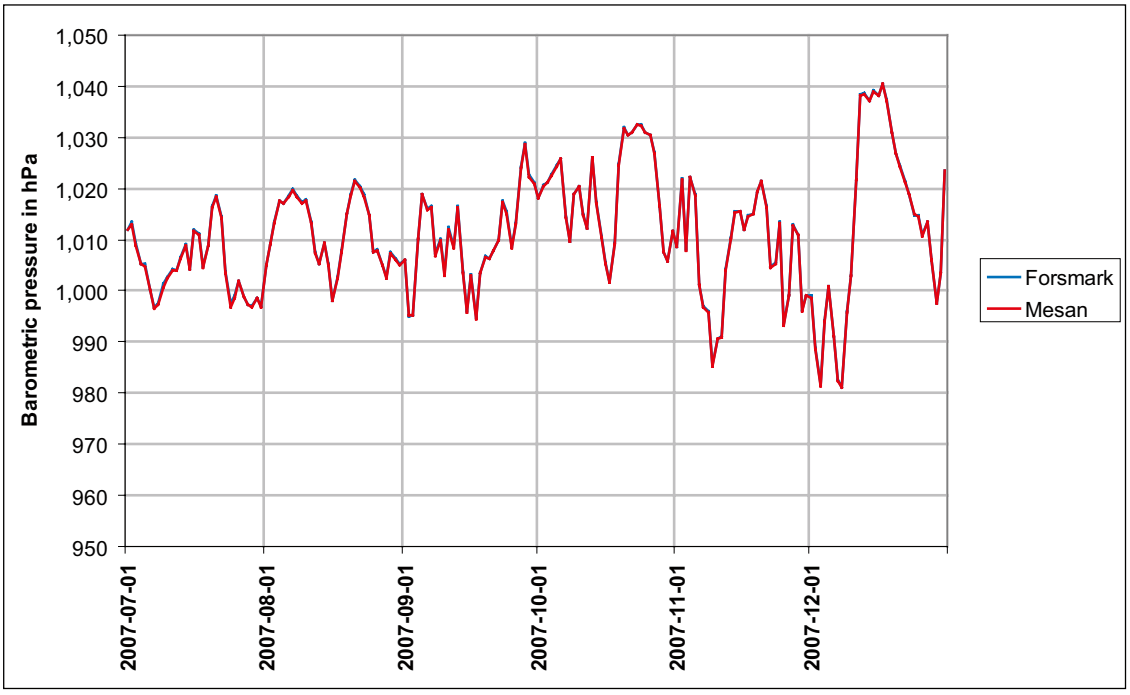


Figure A-2. *Barometric pressure in hPa at Högmasten and MESAN-values, daily values, July 2007–December 2007.*

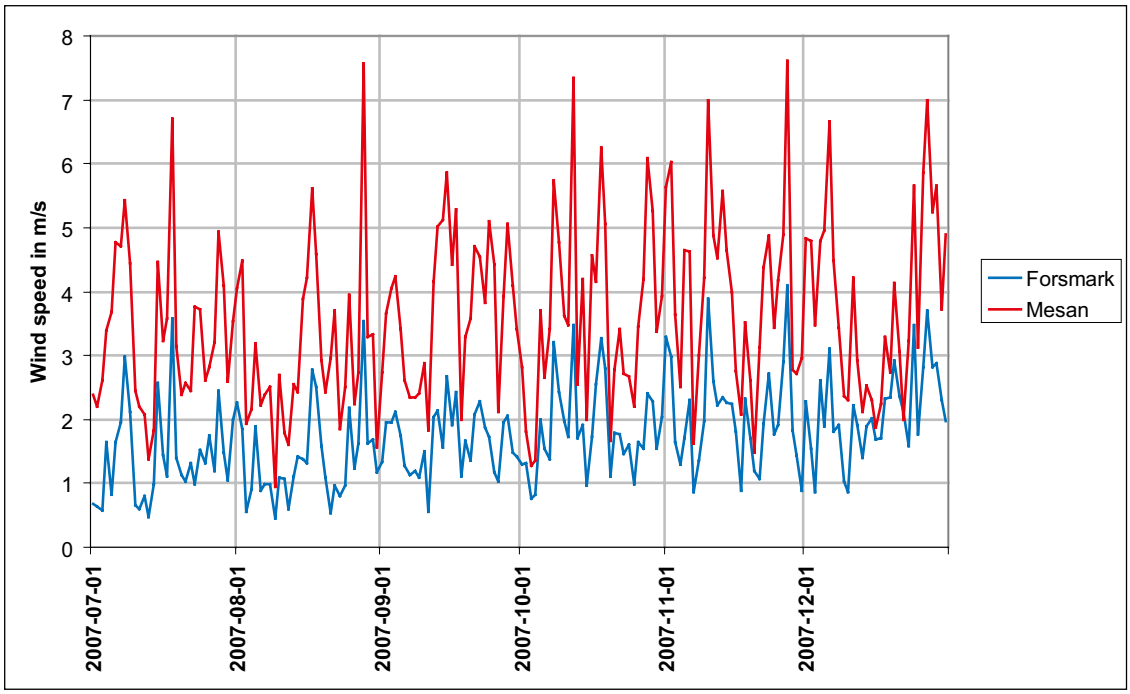


Figure A-3. *Wind speed in m/s at Högmasten and MESAN-values, daily values, July 2007–December 2007.*

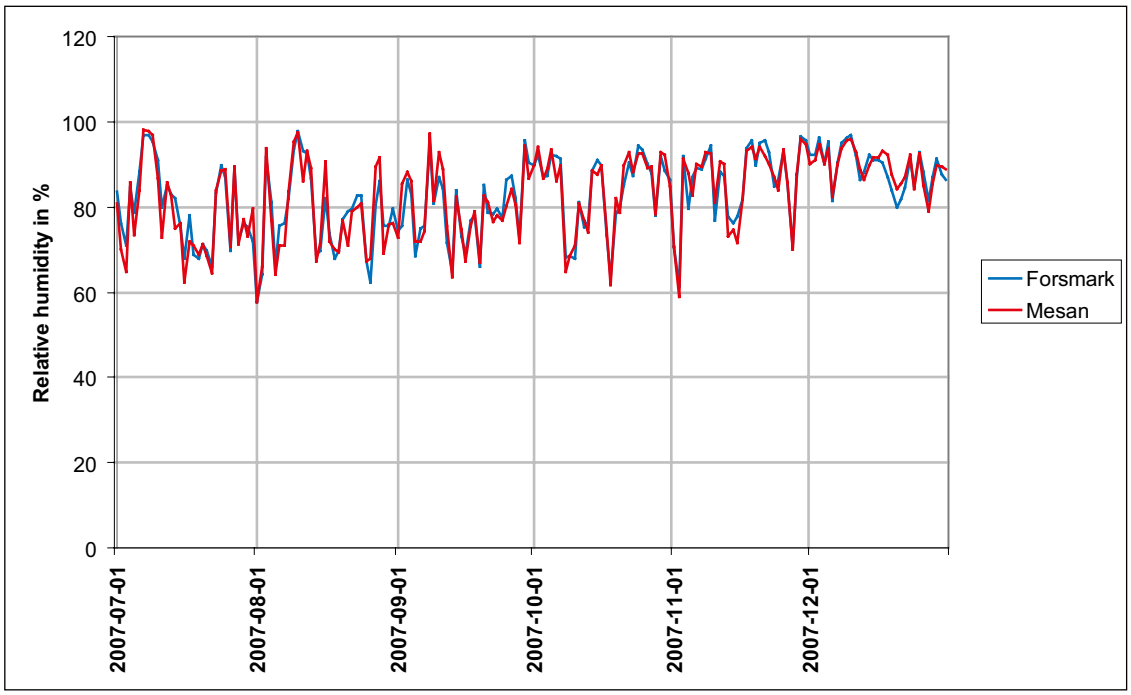


Figure A-4. *Relative humidity in % at Högmasten and MESAN-values, daily values, July 2007–December 2007.*

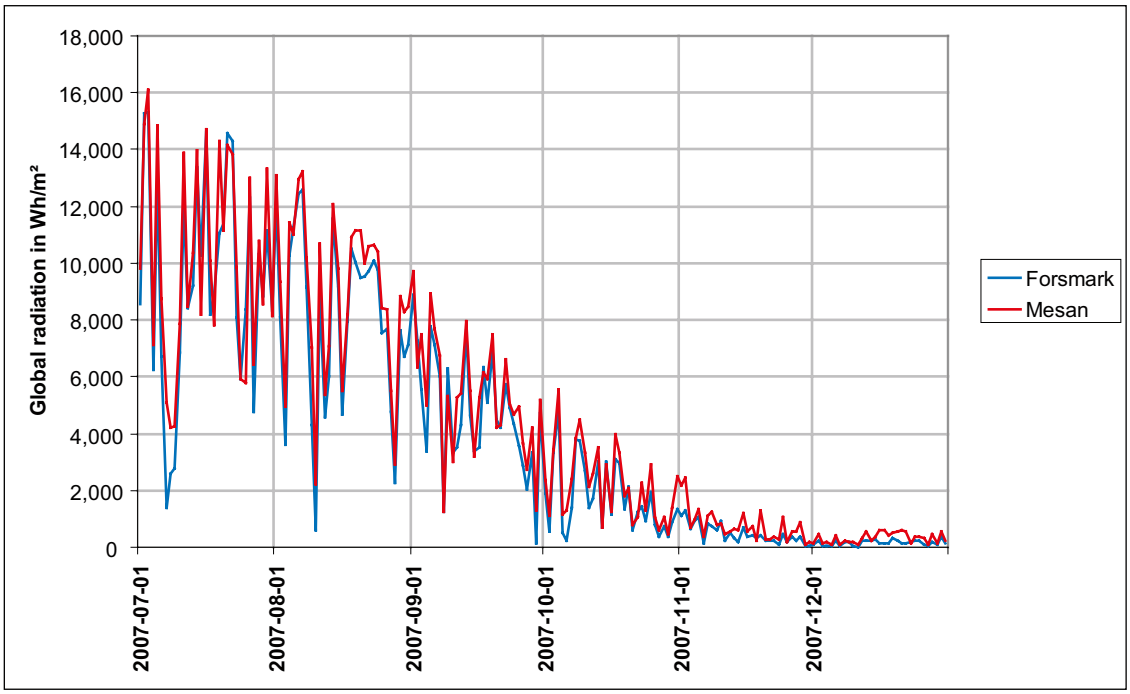


Figure A-5. *Global radiation in Wh/m² at Högmasten and MESAN-values, daily sum, July 2007–December 2007.*

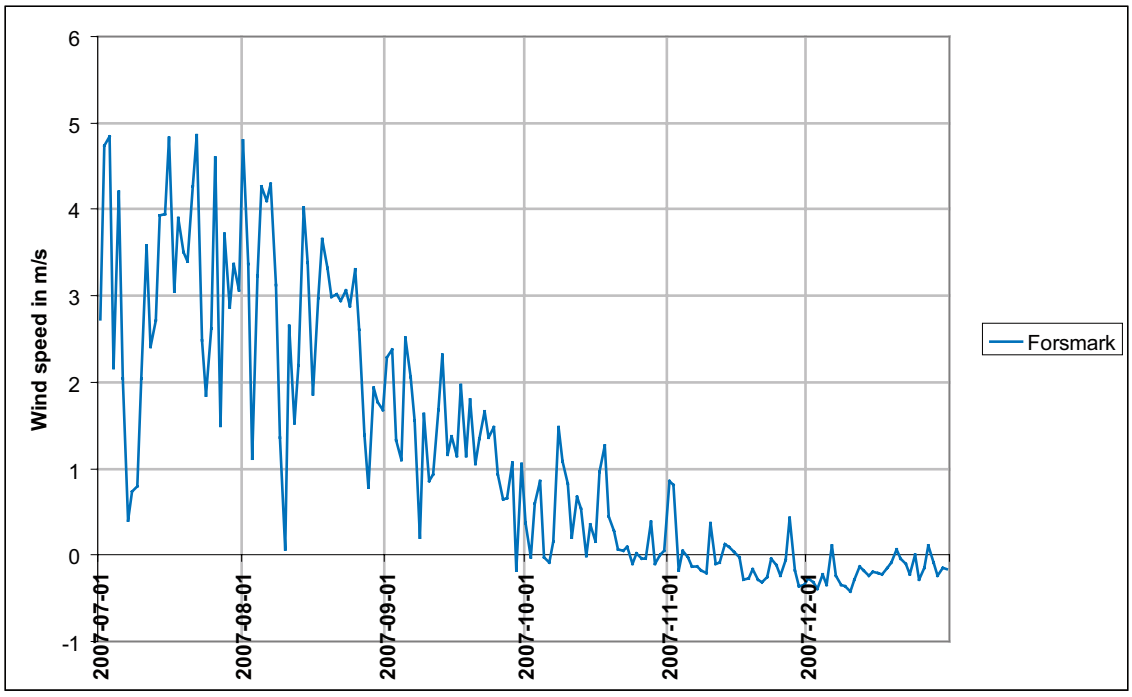


Figure A-6. *Potential evapotranspiration in mm at Högmasten, daily sum, July 2007–December 2007.*

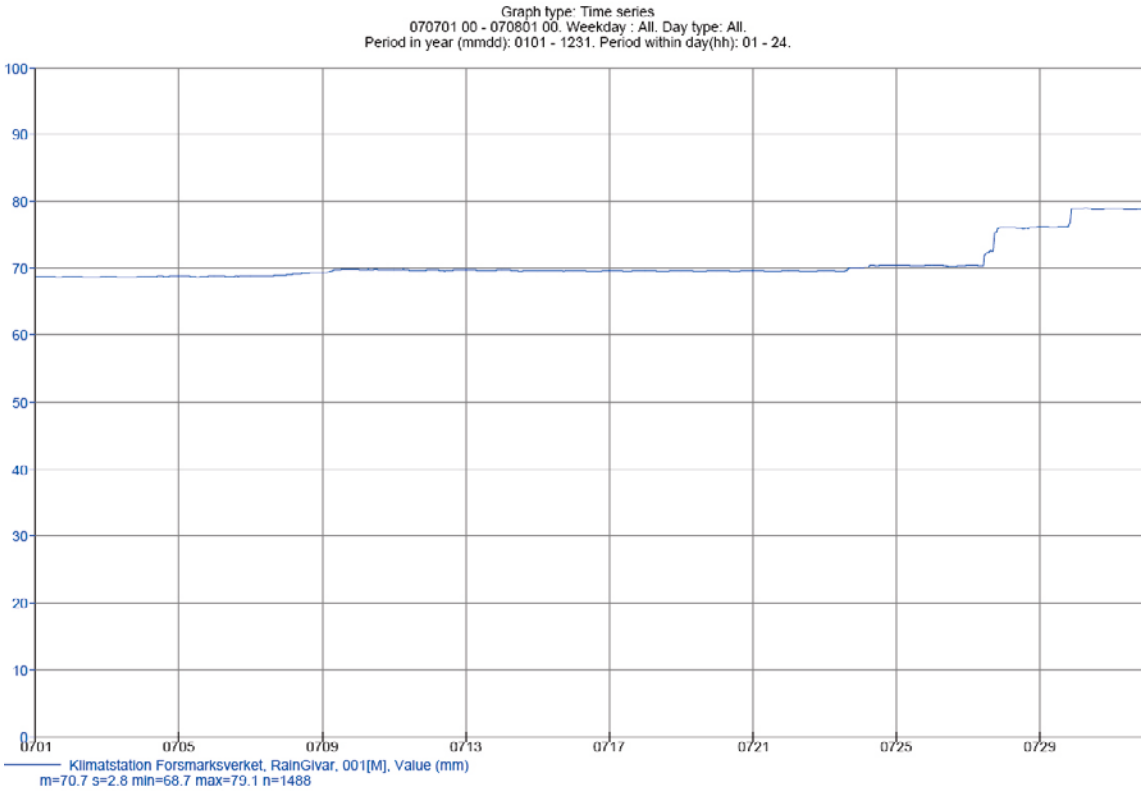


Figure A-7. *Precipitation in mm at Högmasten, 30-min. values, July 2007.*

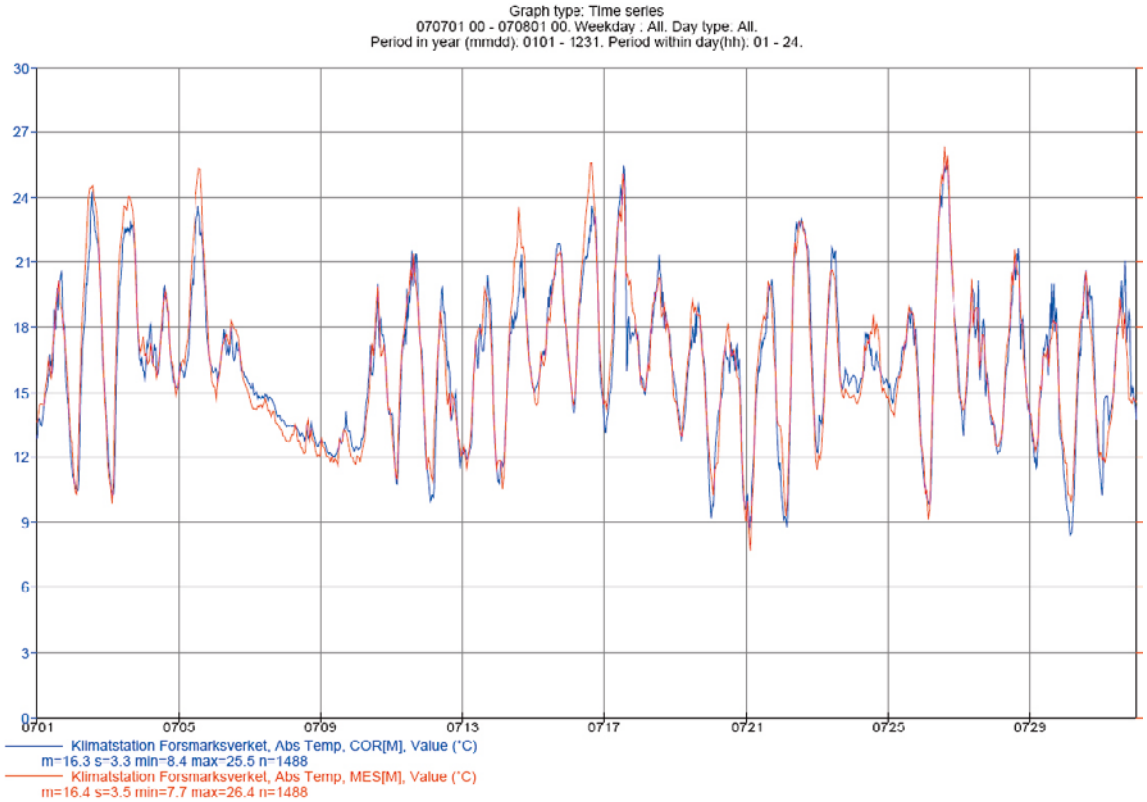


Figure A-8. *Temperature in °C at Högmasten and MESAN-values, 30-min. value, July 2007.*

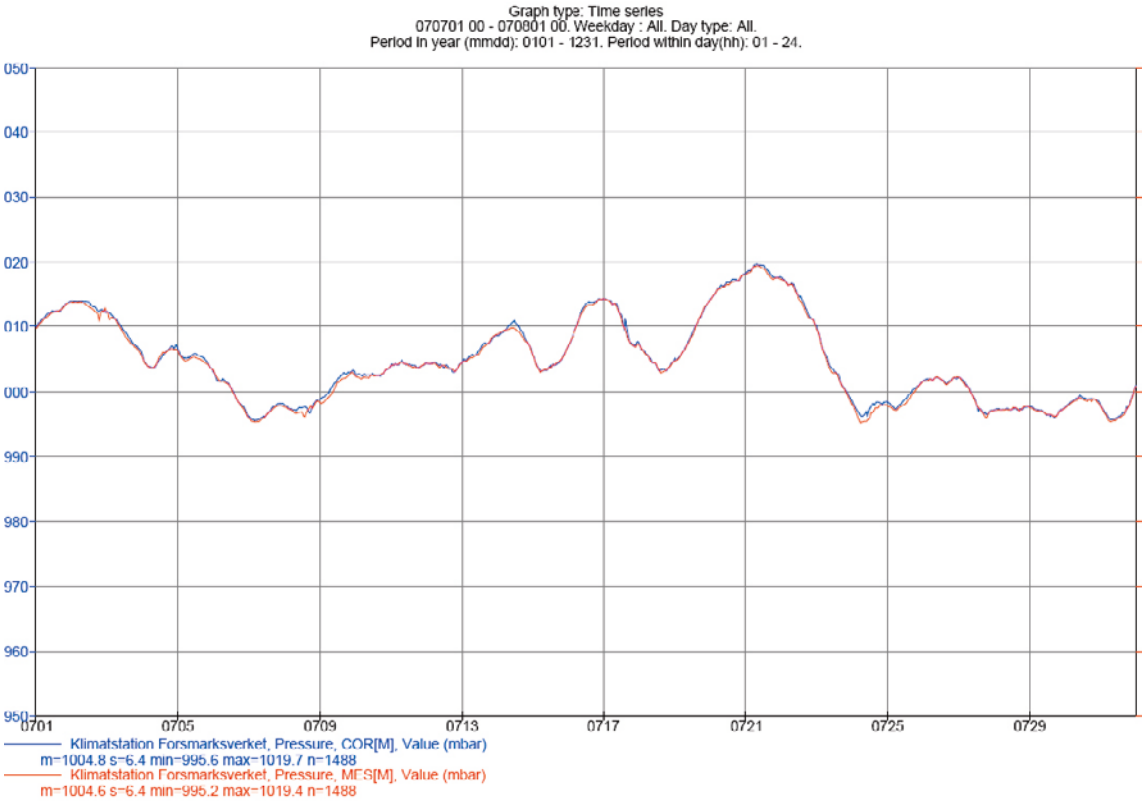


Figure A-9. *Barometric pressure in hPa at Högmasten and MESAN-values, 30-min. values, July 2007.*

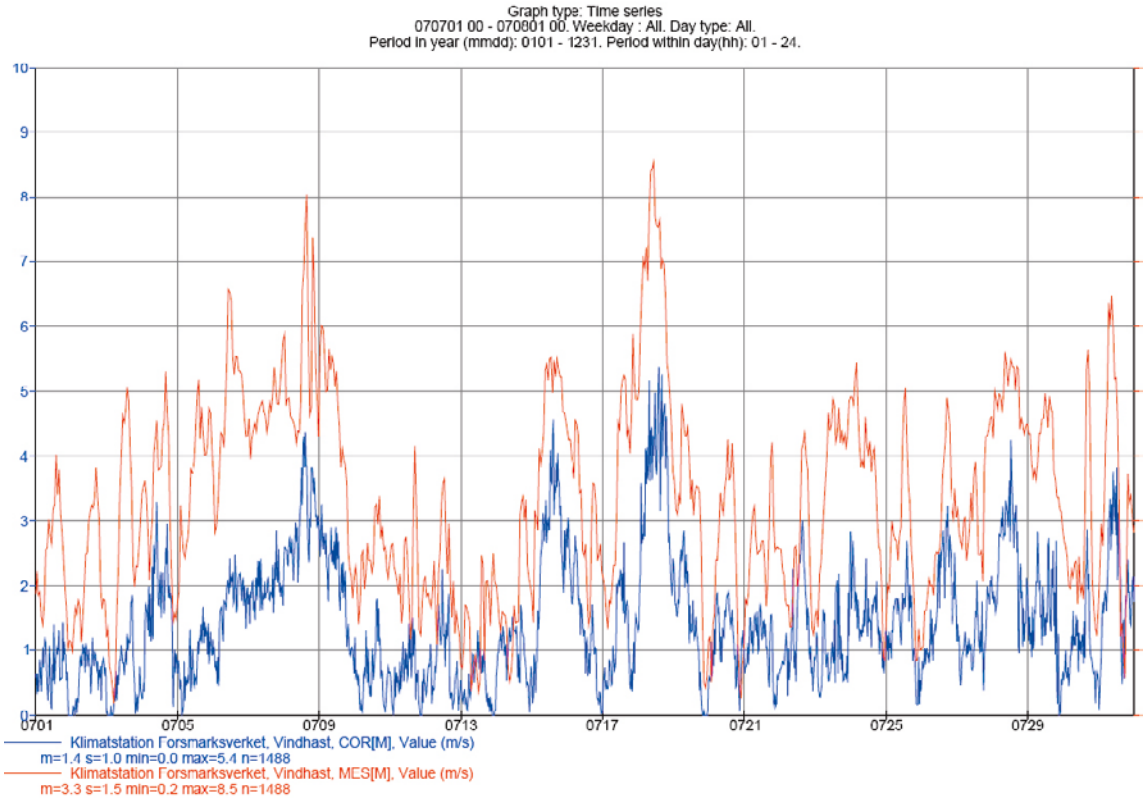


Figure A-10. *Wind speed in m/s at Högmasten and MESAN-values, 30-min. values, July 2007.*

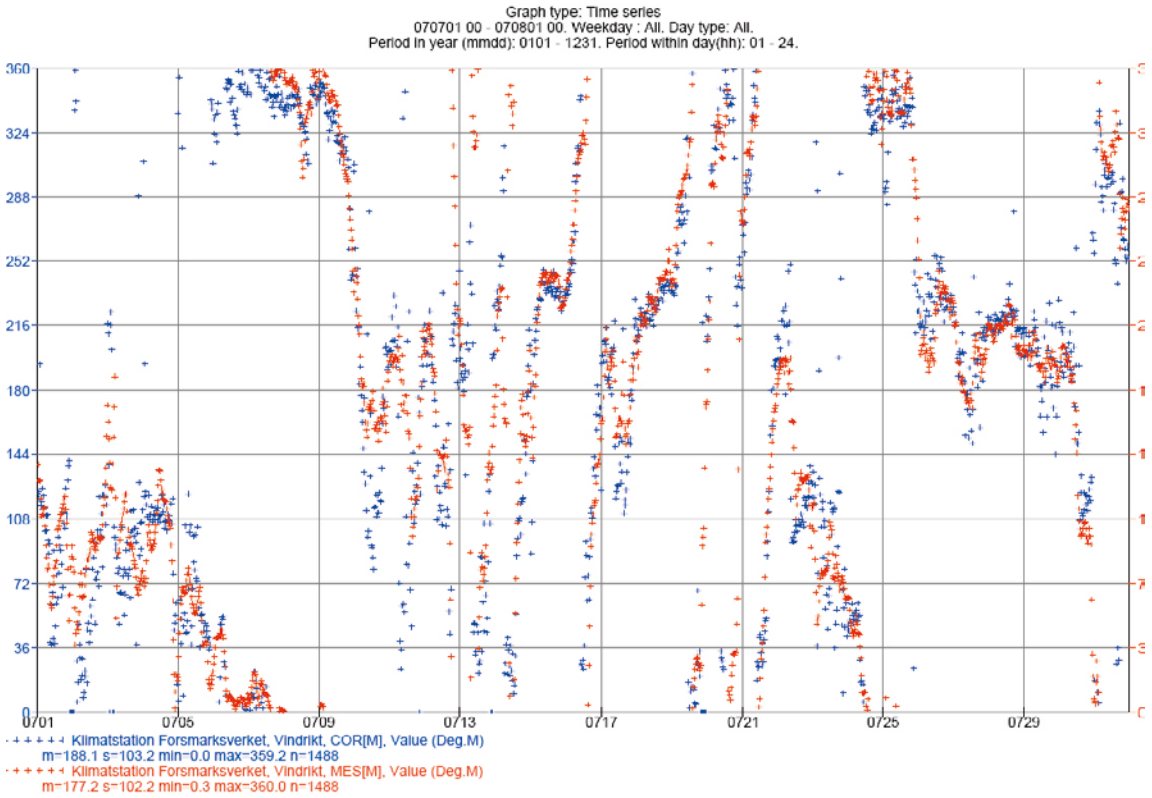


Figure A-11. *Wind direction in ° at Högmasten and MESAN-values, 30-min. values, July 2007.*

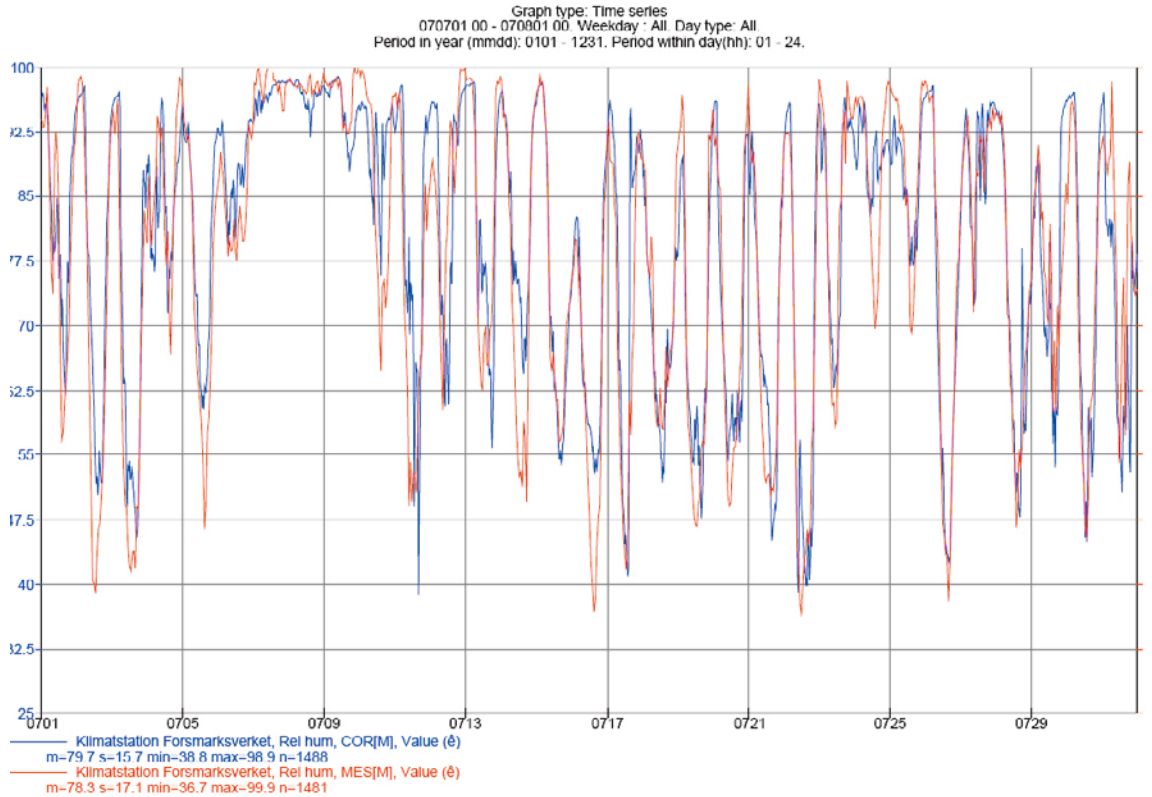


Figure A-12. *Relative humidity in % at Högmasten and MESAN-values, 30-min. values, July 2007.*

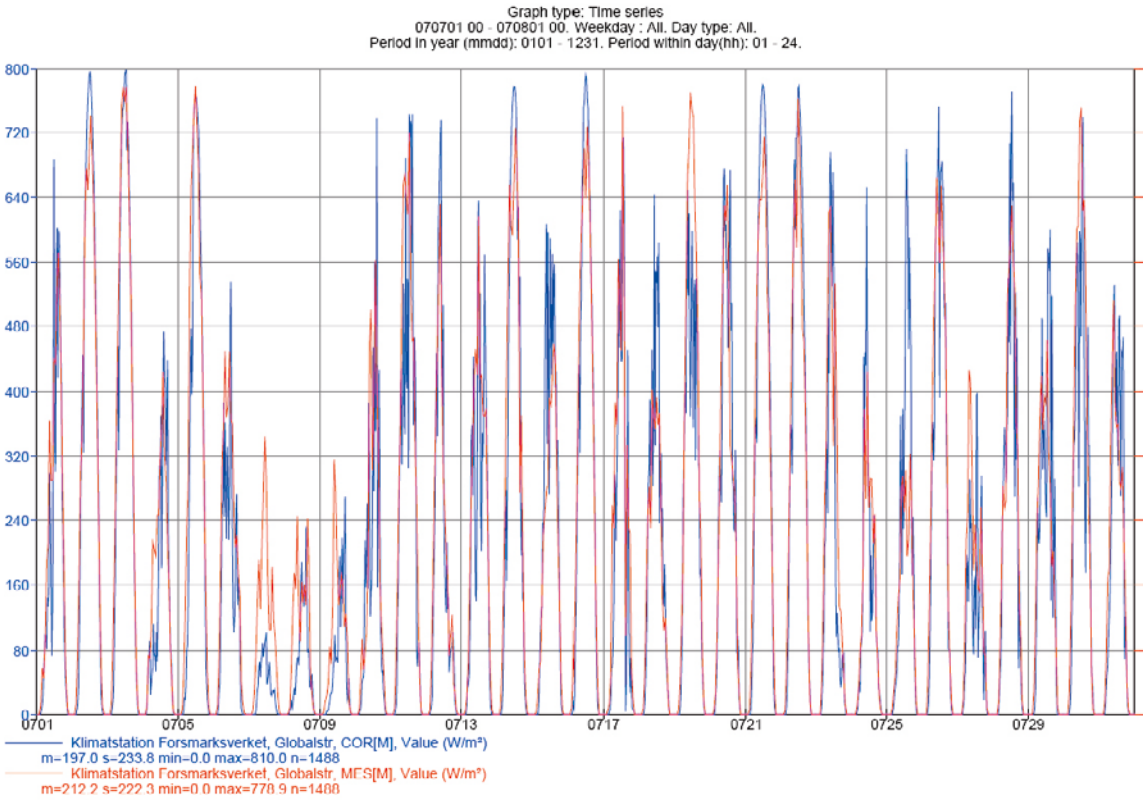


Figure A-13. *Global radiation in W/m² at Högmasten and MESAN-values, 30-min. values, July 2007.*

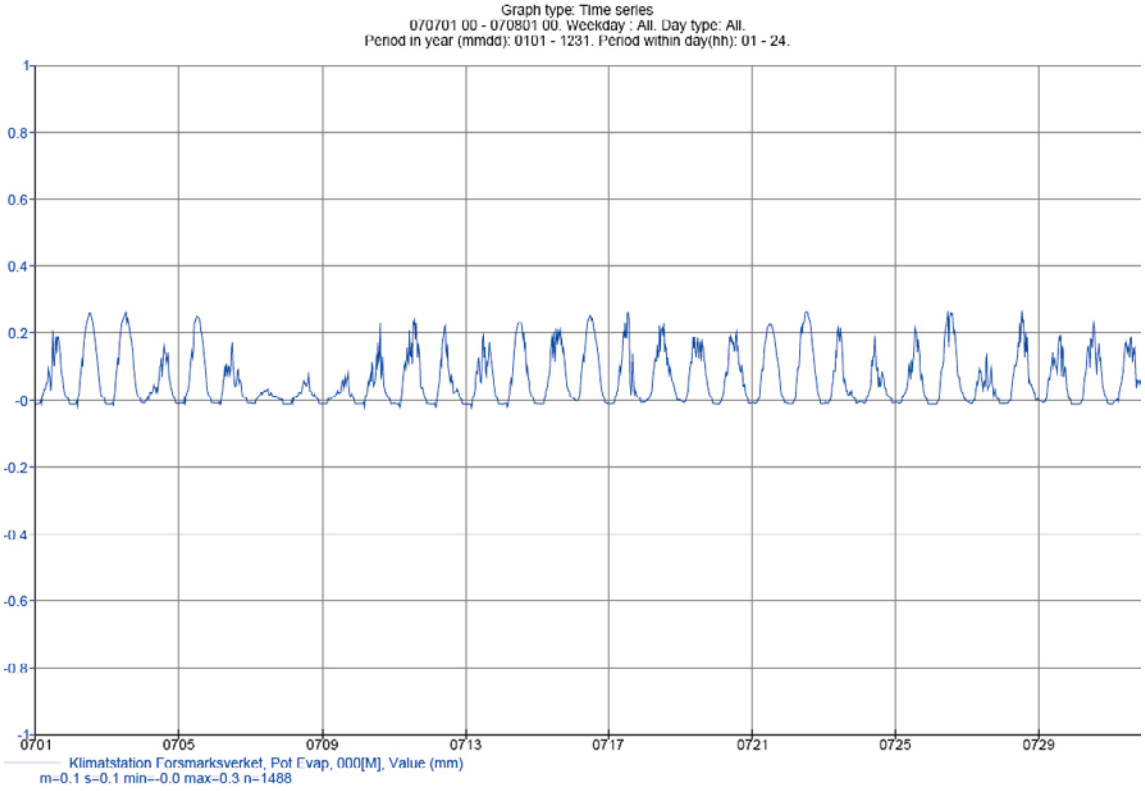


Figure A-14. *Potential evapotranspiration in mm at Högmasten, 30-min. values, July 2007.*

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	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 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.

Appendix 3

Servicerapport Högmasten

FDS Mätteknik AB

SERVICERAPPORT

Station: Forsmark Högmast

Datum: 2007-05-28

Logger typ: CR10X

Loggerprogram med datum: FORSCM21 2004-09-30

Typ av mast, stag eller fristående: 100 m stagad

Höjd: installationer 10 meter

Temperaturgivare abs.

Typ:_PT100

Visar värde: 18,10°C Ref: 18,03°C

Multiplikator föregående: 99,97

------ " ------ ny: --

Temperaturgivare i Rh probe

Uppmätt värde: 19,62°C Ref: 19,46°C

Luftfuktighet Vaisala 50Y

Uppmätt värde: 53,5% Ref: 52,4%

(Referens: Ny Rotronic MP101H S3 serie nr: 44256238)

Pyranometer

Typ: Kipp&Zonen CM21

Kontroll av fäste och planvinkel: OK

Kontrolleras mot referensgivare: CM21 Ref: (SKS1110)

378W 381W

(medelvärden 5 avläsningar)

Referens: SKYE SKS 1110 Serie Nr: 32631 (Kal dat: 20060803)

Regnmätare:

Typ: Geonor T-200 Vibrerande tråd

Kalibreringsvolym ml: 200 ml 2007-06-28 10:05

Antal mm registrerat: 9,8

Rengöring: OK

Noteringar: 1% av volymen registrerades ej, ej signifikant.

Horisontalvind

Mätarens resp. monteringsbommens riktning anges i grader eller mot siktat större objekt i terrängen.

Typ: RM Young Wind Monitor 05103-5

Bommens rikt: 233°

Mätarens rikt: 180°

Offset: 53°

GPS visar på 53° (2° magnetisk missvisning)

Kullager propeller:_____

Bytt 2007 05 28 (årligen)

Barometer:

Typ: Vaisala PTB101C

Visar: Kl 11:05 991,4hPa

Kontroll: Meteorologen

Kontroll mätskåp

Logger typ: CR10X

Modem typ: COM200E

Åskskydd: Ja

Värmelement: Ja

Kondensfukt: Nej

Efterdragning av samtliga plintar: OK

Batteri byte utfört: Nytt 2004, Nästa byte 2008

Jordtagskontroll: Ej kontrollerat (Ej relevant)

Övriga noteringar:
Servicen utförd av: Anders Ekman
Skara 2007-07-05
FDS Mätteknik AB
Anders Ekman

Appendix 4

Servicerapport Storskäret

FDS Mätteknik AB

SERVICERAPPORT

Station: Forsmark Storskäret

OBS: Storskäret Endast begränsad givarkontroll, Pga mätningarna avslutas.

Datum: 2007-05-28

Logger typ: CR10X

Loggerprogram med datum: FORGSM 2004-09-30

Typ av mast, stag eller fristående: 24 m fristående

Höjd: installationer 10 meter

Temperaturgivare abs.

Typ:_PT100

Visat värde: 20,23°C Ref: 19,95°C

Multiplikator föregående: 99,97

------ " ------ ny: --

Temperaturgivare i Rh probe

Visat värde: 20,6°C Ref: 20,4°C

Luftfuktighet Vaisala 50Y

Visat värde: 47,9% Ref: 46,0%

(Referens: Ny Rotronic MP101H S3 serie nr: 44256238)

Pyranometer

N/A

Regnmätare:

Typ: Geonor T-200 Vibrerande tråd

Kalibreringsvolym ml: 200 ml 2007-06-28 12:05

Antal mm registrerat: 9,6

Rengöring: OK

Noteringar : 2% av volymen registrerades ej, ej signifikant.

Horisontalvind

Mätarens resp. monteringsbommens riktning anges i grader eller mot siktat större objekt i terrängen.

Typ: RM Young Wind Monitor 05103-5

Bommens rikt: 248°

Mätarens rikt: 180°

Offset: 68°

Kullager propeller:_____

Ej Bytt

Barometer:

N/A

_____

Kontroll mätskåp

Logger typ: CR10X

Modem typ: GSM Siemens TC35

Åskskydd: ---

Värmelement: ---

Kondensfukt: ---

Efterdragning av samtliga plintar: ---

Batteri byte utfört: Nytt 2004, Nästa byte 2008

Jordtagskontroll: Ej kontrollerat (Ej relevant).

Övriga noteringar:
Servicen utförd av: Anders Ekman
Skara 2007-07-05
FDS Mätteknik AB
Anders Ekman