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High Arctic IRMA automatic weather station field data 1991-92

Part 1 – Documentation
Part 2 – Plots

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HIGH ARCTIC IRMA AUTOMATIC WEATHER STATION FIELD DATA

1991-92

PART I: DOCUMENTATION

by

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August 1993

1992-93 report of Green Plan Program:

INSTRUMENTAL MONITORING OF CLIMATE CHANGE IN THE HIGH ARCTIC

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ABSTRACT

This is the second annual report of the High Arctic IRMA Green Plan Program of Instrumental Monitoring of Climate Change. This second year continues the work initiated in 1991 which consisted of creating procedures, software and documentation for the data management and archiving of the data from High Arctic automatic weather stations. Upgrading the instrumentation at the two existing IRMA sites during the 1991 field season provided expanded data sets for 1991-92. These new data sets allow the first real test of the proposed procedures and processes. The main focus of this report has been to resolve the problems created by the incorporation of the new data and to continue the first version of a user friendly processes to create a large variety of standardized graphs.

The data obtained from the loggers were split, organized, quality controlled and then imported into spreadsheets. Visual examination of quick plots identified periods of problem data which were removed and documented. These cleaned data were plotted in standardized formats developed during the study. A selection of these plots are presented. Extensive appendices provide necessary information for the ongoing data processing efforts. User feedback is encouraged.

The documentation and appendices are presented in Part I and the plots in Part II.

ACKNOWLEDGMENTS

The authors wish to thank all those who contributed to the field programs at the two field stations and to existence and preparation of the report. On Agassiz Ice Cap, David Fisher, Mike Waszkiewicz , Lief Lundgaard and Jocelyne Bourgeois all contributed to setting up, digging out or maintaining the instrumentation. On the Devon Ice Cap, Mike Waszkiewicz performed the field data transfer and site verification. At Hot Weather Creek, Hock Woo, Cathy Young and Steve Robinson participated in the meteorology program. Barrie Maxwell of Arctic Division (CCAD AES) continued support for the program. Campbell Scientific (Canada) Corp. contributed most of the equipment for the main Agassiz site and the service personnel for the Ice Cap station(s). Polar Continental Shelf Project provided the flying hours for the field programs. Paul Egginton laboured to retain funding for the data processing. Doug Hodgson provided valuable suggestions regarding the text and diagrams. Sharon Parnam of GSC and Nicole Wallace of CSCC prepared the final text.

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PART I

DOCUMENTATION 1991-1992 SEASON

INTRODUCTION

New Developments

During the field season of 1991 both the Agassiz and Hot Weather Creek Autostations were upgraded to bring them closer to the standards published in the AES Autostation Guidelines (AES, 1992) and to better serve the needs of the multidisciplinary research underway at the two stations. This was accomplished, in spite of major funding cuts, by close cooperation between GSC, AES and CSCC. The planned station for Hot Weather Divide delayed from 1991 was not possible in 1992 either due to funding restraints. However, a basic temperature recording station was established on Devon Ice Cap which has a 20 year Mass Balance record and from which the first Canadian deep ice cores were obtained. This will allow the determination of transfer functions for the ice core melt percent time series.

The history of field camp instrumental recording and the High Arctic IRMA are discussed in the first report of this series (Open File 2562 , Alt et al., 1992).

Purpose of Report

The present report is the second in a series of reports resulting from a Green Plan project designed to maintain, standardize and process the data from High Arctic IRMA, regional, automatic weather stations. The aim of these reports is to make the most recent season's data available to users:

- rapidly enough to be used for analysis of the current seasons field data (as in the case of a masters degree thesis or Current Research papers)
- in a standard format year after year
- with out of range and questionable data removed
- in a graphic format (ie., plots) for initial comparative studies
- as data or spreadsheet files for use in climate and transfer function calculations and for creating publishable diagrams
- with all necessary documentation

Producing this second data report provided the first real test of the Procedures developed the previous year. The 1991-92 data contained additional parameters and changes in the configuration of existing sensors. The main focus of this years work report has been to resolve the new problems created by the incorporation of this new data into existing formats. The first generation of reasonably user friendly graph templets (Tables 1.4 and 2.4 and Appendix 3) and spreadsheet setup macros (Appendix 5) were completed and tested on the new data sets. The protocols for data handling and graphing were refined based on this years experience (Appendix 3) and standardized labelling and abbreviation criteria established (Appendix 6).

Contact is being maintained with other agencies, such as Agriculture Canada and AES Regional Offices, undertaking similar work to avoid duplication and to allow the incorporation of useful techniques and software into our Procedures.

This report includes data from the regionally representative sites established for long term monitoring in the GSC High Arctic IRMA. They are designed to provide this climate information for the use of all investigators working in the area. Subsidiary weather data collecting sites are the responsibility of the individual researcher.

It must be emphasized that these are still field camp data and must be used with caution even in the cleaned format presented in the present series of reports. Some of the problems are discussed in the following but others are yet to be investigated.

Organization of Report

Part I of this report contains all the documentation necessary to use the data. This includes the information needed to use the computer files generated as well as documentation of each step in the data preparation process and of the logger and sensor configuration, programming and environmental conditions. This will allow users the reliability of any piece of data before further processing is undertaken. It must be stressed that this is the users responsibility.

The Appendices contain information to be used in the preparation of subsequent reports in this series. These Appendices are refined once a year with the aim of producing a manual for processing field camp autostation data by the end of the project. In addition a bibliography of work being carried out in association with GSC High Arctic IRMA activities has been included and will be updated each year.

The stations are discussed in alphabetical order. Their location within the High Arctic IRMA is shown in Figure 1. Further station information such as photos etc., will be included in subsequent reports. The station abbreviations are in the form STN (STE) where STN is the field area (ie., AGA Agassiz Ice Cap) and STE is the instrument site (ie., A77 the 1977 borehole). See the list of abbreviations (Appendix 6) for details.

DATA PROCESSING AND PRESENTATION

Based on processing the data from the previous field season (1990-91) a protocol or set of procedures was developed. These start with the data files dumped from the logger and finish with the final cleaned data files which are included with this report. (The term 'dump' has been used to signify the copying of data from a data logger or module and the time of dump refers to the last record transferred at that time). The ultimate aim of the six year project is to produce a data processing system that can be used successfully in the field camp on a portable, solar powered, field computer by computer-literate, but not necessarily extensively trained, personnel. The intermediate steps of this procedure would satisfy the need for on site validation of sensor continuity at the time of servicing. The final step would allow immediate use of the current season's data and comparisons to previous seasons. This would include presentation of these cleaned data as standardized plots for on-the-spot analysis by non-meteorological field personnel. (It might be noted that comparable AES manned permanent meteorological station data for daily maximum and minimum temperature and for radiation are not available until several years after their collection.) Considerable effort has been expended to make the procedures as universal as possible and the preparation of the plots for each new data set as simple as possible. The procedure protocol is presented in Appendix 3.

Quatro Pro spreadsheet software was used as it seemed to be the simplest and most universal such software to meet the aims of the processing and presentation procedures. It makes use of extended memory, allows an unlimited number of data points in the graphs, is compatible with Lotus and Excel and can be imported into Word Perfect 5.1 and is currently used in climate spreadsheet operations by the agencies co-operating in this program. Developments in autostation data processing underway at other agencies suggest that it will be advantageous in the future to convert the spreadsheets into a larger data base format such as D-Base or Fox-Pro. The final cleaned spreadsheets formats will take this into account. Presently none of the other agencies have had to deal with data with as many nonstandard aspects, season to season changes and potential sensor problems as is present in the High Arctic station data. Nor have they addressed the production of standardized plots of the data.

The Data

The High Arctic loggers discussed here sample most sensors every 60 seconds. The data can be stored and used to produce hourly (or in the case of Agassiz six hourly) and daily values. These values can be a variety of calculated data: mean, total, maximum, minimum, standard deviation or frequency distribution for the period in question. The actual sampled value can also be output. Power hungry sensors such as the CSMAL01 snow depth sensors are usually sampled only once a day. In the case of wind speed and direction the mean values are usually vector means. For applications such as turbulence or pollution transport studies such vector means are invaluable. Vector values can be misleading, however for comparison with data from manned stations or for study of synoptic conditions. A low vector wind speed and direction that may never have occurred can be recorded for an hour during which a strong wind shifted, for example from north to south-southeast.

Hourly and three hourly observations at manned meteorological stations are the equivalent of sampled or spot observations or are observer averaged values as in the case of 5 minute wind speed and direction observations. The standards being developed by AES for co-operative climate autostations will ask for both sampled (one minute average) and one hour mean values of some parameters. Due to storage and power limitations and to additional demands on the system such as ground temperature strings or testing of multiple snow depth sensors, field autostations must modify these requirements.

The climatological day is defined for Canada as the 24-hour period ending at 0600 UCT. For the CST zone which runs through the middle of the High Arctic Islands this is 0000 (or 2400) local time. Thus for autostations, the climatological day begins with the 0100 CST hourly (or the first observation following 0100 CST, eg. 0600 CST six hourly) observation and encompasses the 24-hour period ending at 0000 CST (0600 UCT). AES maintained loggers are run on UCT as this is the WMO (World Meteorological Organization) standard. Non-AES AWS climate loggers in the High Arctic are set to CST which simplifies data reduction as the logger day then corresponds to the above described climatological day.

The final cleaned data are presented as:

- six monthly files for the **daily (D)** values produced by the logger programming
- six month files for the **calculated (C)** daily values which were obtained by calculating the mean, max and min etc.,values of hourly (or six hourly) values
- one month files for the **hourly (H)** (or six hourly) values

The six month files are for the periods April to September **(summer)** and October to March **(winter)**. These periods were chosen to facilitate production of the plots and to ensure files of a manageable size. These standard files of course do not correspond to the period between data dumps which differ from year to year and from station to station.

The Plots

The plots produced for this report are designed to:

- allow field personnel from other disciplines, who do not have access to computers or time to produce their own plots to analyze the meteorological data in conjunction with their own observations as soon as possible after the data is dumped
- to allow detailed examination of sensor functioning ideally before leaving the field (ie., during the servicing of the station) to identify environmental problems such as drifting and riming etc.,

- to allow comparison of daily and hourly data on the same time scale

- to allow comparison of each new season's data with past seasons without having to re-plot the past data

- to allow preparation of figures for posters and papers with as few changes as possible

Producing accurate, standardized, presentable plots from unprocessed data is a very time consuming process which discourages many individual researchers from undertaking it. Often they will have to be satisfied with plots for irregular periods which are good for just the immediate application or which have inconsistencies not particularly critical for that application. Other potential users of the data just do not have the time or experience to produce such plots and so do not utilize the data fully.

The procedures followed in producing the final cleaned spreadsheets were discussed in the first report and are outlined in Appendix 6. Spreadsheet templets have been created for each of the three data set types, **Daily(D), Calculated(C)** and **Hourly(H) [Six-hourly(6)]** for the existing stations. These have incorporated in them as many as 30 graphs. The graph titles and legends change in response to changing the year and sensor information in the spreadsheet. The final cleaned data spreadsheets include two tables which can be imported into Wordperfect for use in the data report. Table 1.3 and 2.3 of Part I detailing the parameter formats and the lists of plots (Tables 1.1 - 2.4) in Part II are generated in this manner.

DISCUSSION AND FUTURE DIRECTIONS

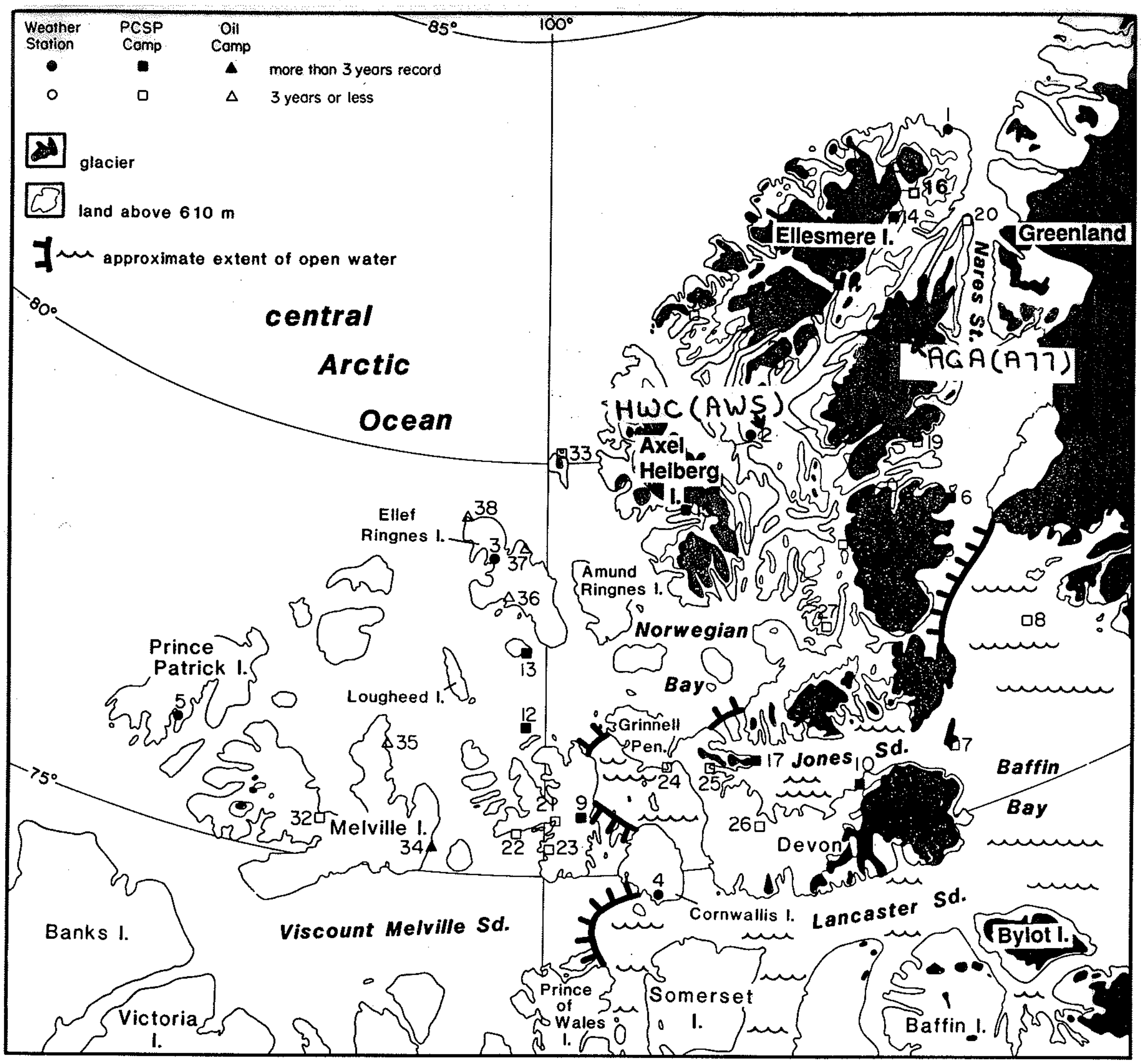
Data presented here are in some cases largely experimental and in other cases not quite standard. They do however provide considerable information about the weather during the 1991-92 season at these two interesting sites. They also provide a basis for studying instrumentation and site problems. It is the hope of the authors that their release will inspire further study and suggestions from the users and not blind acceptance (or rejection).

The final report of this series (assuming funding is available) will include the final version of the protocols developed during the project, recommendations for the future of the High Arctic IRMA automatic weather station program and complete documentation and complete data files for each station from the time of its establishment to the end of the Green Plan project. (This will cover the period 1988-1996 for the two initial stations).

Due to the large year-to-year variability in summer climate in the High Arctic, investigation of the present regional climate or of climate change (Global Change) requires at least a decade of data to produce relevant results. Based on the data which will be available at the end of this Green Plan project, a field camp climatology of the Eureka Inter-Montane Region will be initiated jointly by AES and GSC (with possible involvement from university groups active in the area). This unique, anomalously warm, inland area could then be compared to other regional climate areas in the High Arctic IRMA with a view to determining their relative response to environmental change such as global warming or Arctic haze.

The long-term records from the ice cap stations will initially be used for examination of seasonal variations in transport and deposition mechanisms of ice core parameters such as pollen, aerosols and oxygen isotopes and for development of oxygen isotope, pollen and ice layer transfer functions. The latter (eg., the change in melt layer percentage values equivalent to a 1 °C change in mean July temperature) will be used in conjunction with records from other ice caps with different melt regimes (ie., Barnes and Penny ice caps). They will also contribute to comparisons between peal records from tundra sites in the High Arctic IRMA and ice core records. Considerably more development work is needed before a true climatology of high arctic ice caps is possible.

The ice cap research has been recently expanded and become circumpolar as a result of a government/industry partnership program. Campbell Scientific Canada and the Glaciology Section of the Terrain Sciences Division of the Geological Survey of Canada have extended their initial collaboration which has resulted in an automatic weather station being established on the Academy Nauk Ice Cap on the Russian arctic island of Severnaya Zemliya. This station was established this past spring. The data management procedures developed here will be used on the Russian data which may be made available through a similar open file concept.



The Queen Elizabeth Islands: topography, modern glaciers and maximum extent of open water in a typical year (Maxwell 1982). Also shown are **Atmospheric Environment Service permanent weather stations**: 1. Alert, 2. Eureka, 3. Isachsen, 4. Resolute Bay, 5. Mould Bay; **Polar Continental Shelf Project** - supported, short-duration stations: 6. Cape Herschel, 7. Coburg Island, 8. Carey Islands, 9. Polar Bear Pass, 10. Truelove Inlet, 11. Tanquary Fiord, 12. Seymour Island, 13. King Christian Island, 14. Lake Hazen, 15. Expedition Fiord, 16. Piper Pass, 17. Cape Vera, 18. Alexandra Fiord, 19. Princess Marie Bay, 20. Judge Daly Promontory, 21. Bracebridge Inlet, 22. Bradford Island, 23. Hooker Bay, 24. Porden Point, 25. Eidsbotn Fiord, 26. Haughton River, 27. Baumann Fiord, 28. Strathcona Fiord, 29. Neil Peninsula, 30. Irish Arctic Expedition, 31. Clements Markham Inlet, 32. Nias Point, 33. Meighen North; **Oil Industry camps**: 34. Rea Point, 35. Drake Point, 36. Dome Bay, 37. Malloch Dome, 38. Cape Isachsen.

Figure 1. Location Map of Sites within the High Arctic IRMA.

AGA(A77): AGASSIZ ICE CAP, 1977 DEEP BORE-HOLE SITE [1]

Lat 80° 47.90'N, Long 72° 54.05'W, Elev approx. 1670 m. asl

Station Description [.STN]

Regional Setting and Representativeness: AGA(A77)

The Agassiz Ice Cap is roughly 16 000 km^2 in area, (Figure 2a). It has a very smooth surface topography although nunataks occur even in the highest parts. The 1977 bore hole site, AGA(A77), is located about 2030m from the top of a local dome and 1000m west of the ridge extending south from this dome. This somewhat protected site (Figure 2b) was chosen to avoid the wind scouring effect which is experienced at the site located on the top of the dome (Fisher et al., 1983). The closest nunatak is 9 kilometres away. The ice cap slopes gently down to the southeast. Some local wind and temperature effects would be expected at this site. A subsidiary station was established at the 1984 bore hole site on the top of the local dome which will allow investigation of these meso-scale phenomena. The 1977 site was chosen as the main site as it has produced the most climatically complete core record and is thus the focus of the seasonal snow studies.

General Site and Instrumentation Information: AGA(A77)

The general instrument site area is 2 kilometres to the south of the main camp area. There are several major problems when attempting to maintain a year round autostation in the accumulation area of an ice cap (Alt et al., 1991). The snow surface on Agassiz Ice Cap rises 30 to 50 cm a year in areas with no obstructions and considerably more where drifting occurs around an obstacle. This essentially lowers the screen level more than 50 cm each season (Figure 3). For this reason the sensors must be raised by digging out and repositioning the screen each spring. New techniques and standards must be developed for these regions. One of the aims of the joint CSCC/GSC cooperation is to develop such methods. As mentioned previously, this cooperation has now become circumpolar in nature with the addition of an ice cap station on Severnaya Zemliya, one of the Russian arctic islands. This new cooperation is part of an Energy Mines and Resources, Industry Partnership Programme.

Two major instrumentation problems will be addressed by the CSCC/GSC IPP cooperation. Even the best designed unventilated radiation screen experiences radiation heating due to multiple reflections from the very bright snow surface of the ice cap particularly in June. Secondly exposed sensors are subject to accumulation of rime ice, hoar frost and ice at various times during the season. This can remain until the station is visited in the spring or, more difficult to handle, it can drop off or sublimate leaving no evidence that the data is false giving apparently valid data.

Instrumentation and Site Conditions: May 1991 - March 1992

Site Conditions and Problems [.NST]

In early May 1991, the site was visited and an annual inspection and maintenance was performed on the station. The main problem with the station remains the same for this site. Heavy drifting and snow accumulation filled the Stevenson Screen with snow while icing and riming covered most external surfaces. The station was dug out and the station was re-configured with a new combination of sensors. This new instrumentation array is described in the Instrumentation Description. The general site and sensor problems (Alt et al., 1991) will be treated in more detail in a paper (Koerner et al., in preparation) inspired by the condition of the station when the field party arrived at the site in late March 1992.

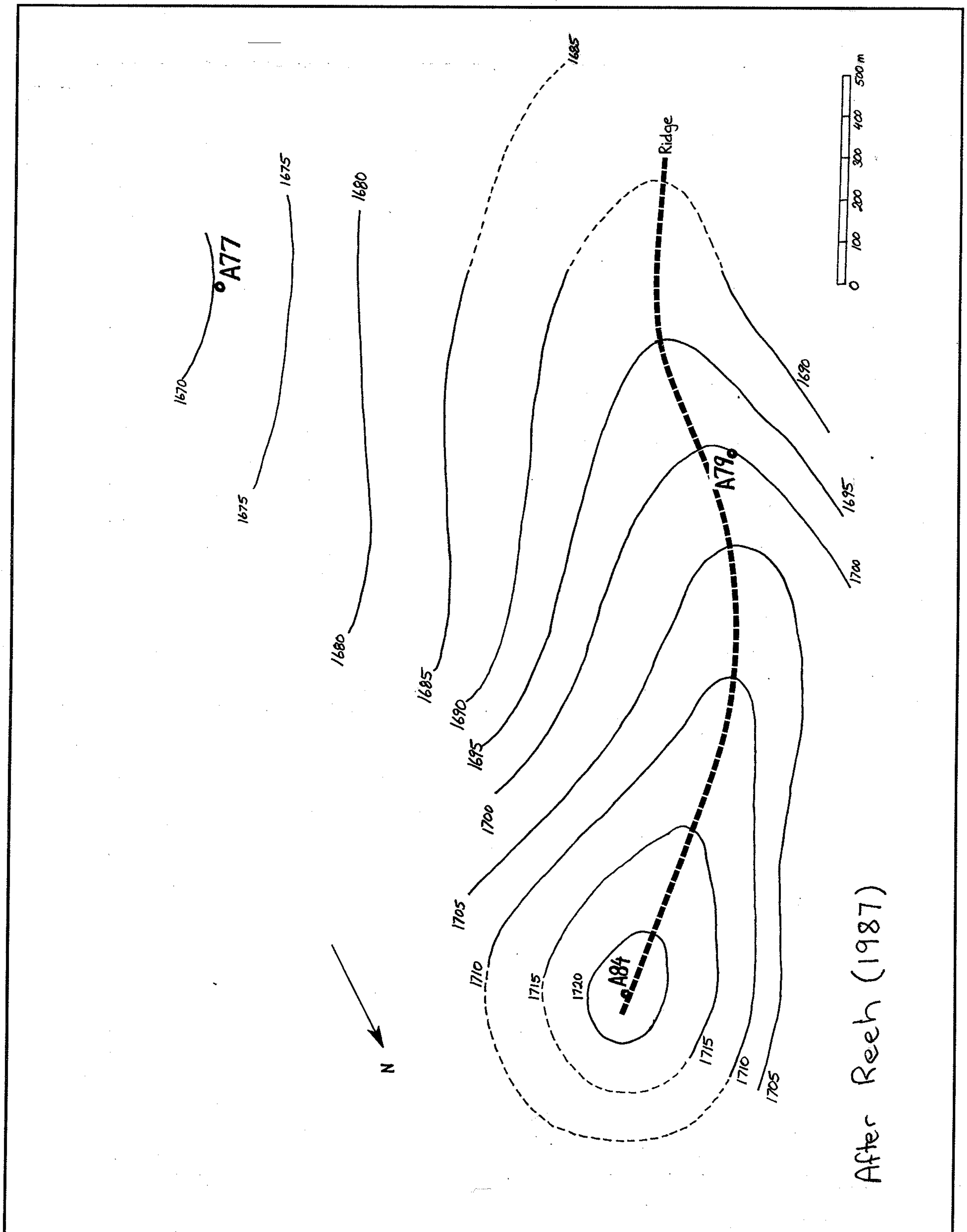


Figure 2. Agassiz Ice Cap borehole sites, 1977, 1979 and 1984.

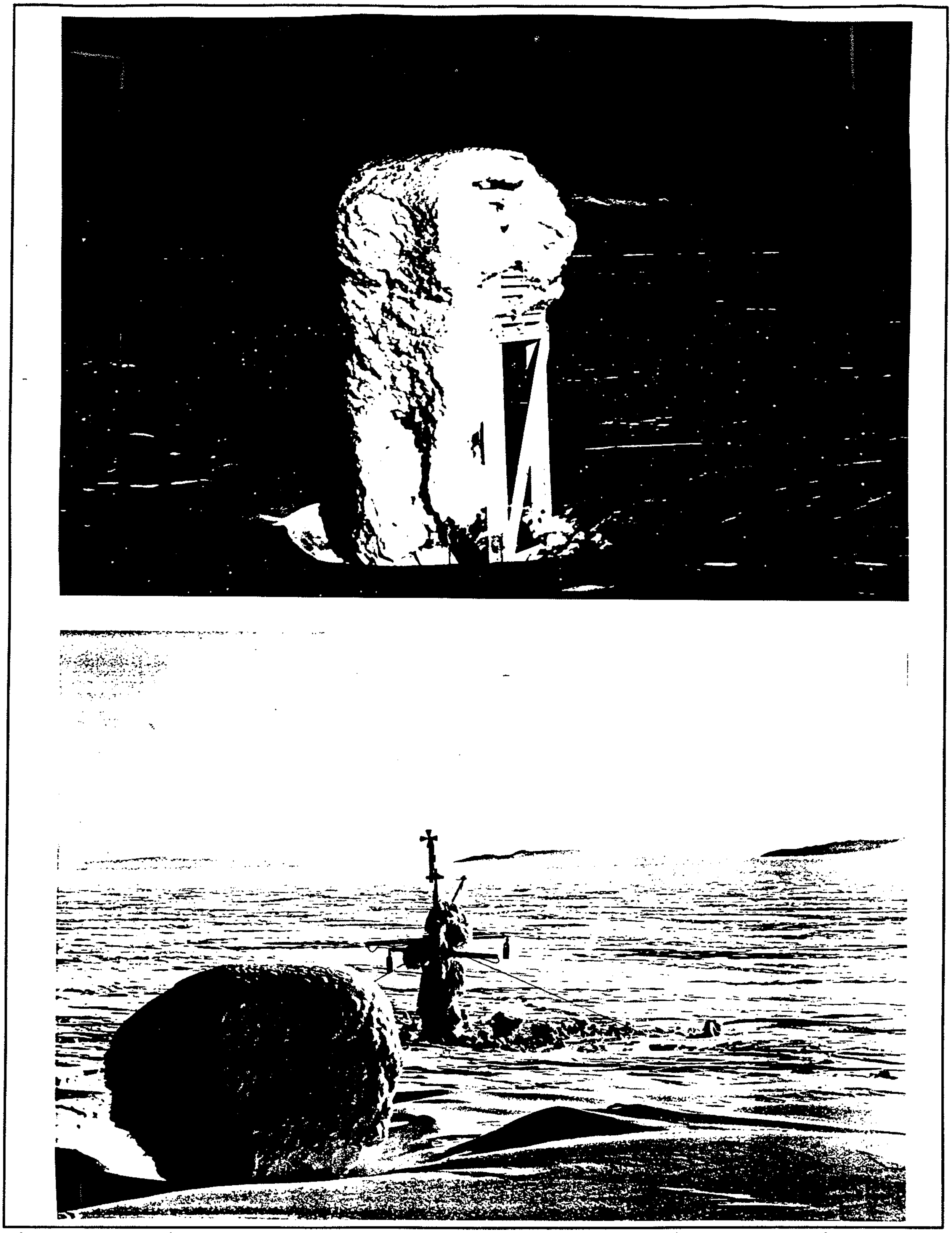


Figure 3 Rime and snow accumulation on autostation instrumentation.

Instrumentation Description [.NST]

(see Appendix 2 for technical specifications)

1)Temperature

a) Air temperature 1 is a 107F thermistor, housed in a small 6 plate Gill Radiation shield. It was originally mounted on the main mast of the station at 1.5 m. [Called Gill 107, in plots]

b) Air temperature 2 is a 107F thermistor, housed in a 12 plate Gill Radiation shield. It was originally mounted on a small separate mast at 1.5 m. This small mast was situated approximately 15 meters away from the Stevenson screen. [Called Gill 2 107, in plots]

c) Air temperature 3 is a 107F thermistor, part of the Vaisala HMP35CF temperature and humidity probe. This sensor was housed in the Stevenson screen at the standard height of 1.5m. [Called SS Vaisala in plots]

d) The humidity portion of the Vaisala HMP35CF is a Humicap sensing element.

e) The wind speed and direction sensor is a R. M. Young 05103 wind monitor. It was mounted at 3 m on the main mast.

f) The incoming solar radiation sensor is a Li-Cor LI200S silicon pyranometer. It was mounted at 2.5 m on the main mast.

g) The snow depth sensor is a CSCC UDG01, an ultrasonic distance sensor. Two sensors were mounted on the main mast. Snow sensor 1 was set at 1.318 m above the surface while the second sensor was at 1.471 m. The data obtained from the sensor was distance to the surface. By using the offset of the sensor distance to target, the raw data was converted to snow accumulation.

note "Vaisala" has been misspelled in the tables and plots of Part II.

Output Array Definitions [.ARR]

The initial file is the .DAT original data file. This file, named AGA9192.DAT starts at 0600 on Julian Day 134 (May 14), 1991, and ends at 1200 on Julian Day 106 (April 15) 1992. There are three sets of data output arrays: a daily, a six hourly and a conditional output. The conditional output is a special data set of temperature histograms when melting conditions occur. The conditional data output array is in the original .DAT file but will not be dealt with further in this report. This special output is mentioned here to fully describe the original data set. The output array elements are as follows:

Table 1.1. AGA(A77) Output Array [.ARR]

a) Six hourly outputs:	
01:	Table ID, 0133
02:	Julian Day
03:	Time (HHMM), with time set at Central Standard Time
04:	Mean Air Temperature Gill6 Shield (°C)
05:	Mean Air Temperature Gill12 Shield (°C)
06:	Mean Air Temperature Vaisala Stevenson (°C)
07:	Mean Relative Humidity (%)
08:	Mean Incoming Solar Radiation (Kwm^{-2})
09:	Snow Depth 1 (mm) with offset
10:	Snow Depth 2 (mm) with offset
11:	Mean Wind Speed (ms^{-1})
12:	Mean Wind Vector Speed (ms^{-1})
13:	Mean Wind Vector Direction (°)
14:	Standard Deviation of Direction (°)

Table 1.1. AGA(A77) Output Array [.ARR] cont'd

b) Daily outputs at 2400 (C.S.T)	
01:	Table ID, 0139
02:	Mean Air Temperature T1 Gill6 Shield (°C)
03:	Mean Air Temperature T2 Gill12 Shield (°C)
04:	Mean Air Temperature T3 Stevenson Screen Vaisala (°C)
05:	Mean Air Relative Humidity Stevenson Screen Vaisala (%)
06:	Mean Solar Radiation (Kwm^{-2})
07:	Maximum Air Temperature T1 Gill6 Shield (°C)
08:	Maximum Air Temperature T2 Gill12 Shield (°C)
09:	Maximum Air Temperature T3 Stevenson Screen Vaisala (°C)
10:	Maximum Air Relative Humidity Stevenson Screen Vaisala (%)
11:	Maximum Solar Radiation (Kwm^{-2})
12:	Minimum Air Temperature T1 Gill6 Shield (°C)
13:	Minimum Air Temperature T2 Gill12 Shield (°C)
14:	Minimum Air Temperature T3 Stevenson Screen (°C)
15:	Minimum Air Relative Humidity Stevenson Screen Vaisala (%)
16:	Minimum Solar Radiation (Kwm^{-2})
17:	Snow Depth 1 (mm) offset (1318 mm)
18:	Snow Depth 2 (mm) offset (1471 mm)
19:	Battery Voltage (Volts)
20:	Mean Wind Speed (ms^{-1})
21:	Mean Wind Speed Vector (ms^{-1})
22:	Mean Wind Direction Vector (°)
23:	Standard Deviation of Direction (°)

Table 1.1. AGA(A77) Output Array [.ARR] cont'd

c) Conditional Outputs	
01:	Table ID, 0110
02:	Julian Day
03:	Time (HHMM), with time set at Central Standard Time
04:	Histogram - -1 °C to 0 °C
05:	Histogram - 0 °C to +1 °C
06:	Histogram - +1 °C to +2 °C
07:	Histogram - +2 °C to +3 °C
08:	Histogram - +3 °C to +4 °C
09:	Histogram - +4 °C to +5 °C
10:	Incoming Shortwave Radiation (Kwm^{-2})

Data Processing Documentation:May 1991 - March 1992

Split and Organized Data File [.SOD]

The raw data file (.DAT) was run through a preliminary sort and quality control using the SPLIT feature of the PC208 software. The SPLIT parameter files are described in Appendix 7. Here is a listing of the files resulting from this process.

Table 1.2 AGA(A77) Split and Organized Data Files

FILE NAME	STARTS	STOPS
RAGA916B.WQ1	0600, 134 (MAY 14) 1991	2400, 365 (DEC 31) 1991
RAGA926A.WQ1	0600,1 (JAN 1) 1992	1200, 106(APR. 15) 1992
RAGA91DB.WQ1	134 (MAY 14), 1991	365 (DEC. 31), 1991
RAGA92DA.WQ1	1 (JAN 1), 1992	105 (APR. 14), 1992
BAGA91SD.WQ1 BAGA91SC.WQ1	134 (MAY 14), 1991	273 (SEPT. 30), 1991
AAGA91WD.WQ1 AAGA91WC.WQ1	274 (OCT. 1), 1991	365 (DEC. 31), 1991
BAGA92WD.WQ1 BAGA92WC.WQ1	1 (JAN 1), 1992	91 (MARCH 31), 1992
AAGA92SD.WQ1 AAGA92SC.WQ1	92 (APRIL 1), 1992	105 (APR. 15), 1992
BAGA9105.WQ1 *	0600 134 (MAY 14), 1991	2400 151 (MAY 31), 1991
AAGA9204.WQ1 *	0600 92 (APR.1), 1992	1200 106 (APR. 15), 1992

* These two files are the only incomplete files of the monthly files of hourly data. The rest of the monthly files are the following. They all start at 0600 on the first day of the month and end at 2400 on the last day of the month. The files are named as follows:

6AGA9106.WQ1, 6AGA9107.WQ1, 6AGA9108.WQ1, 6AGA9109.WQ1, 6AGA9110.WQ1, 6AGA9111.WQ1, 6AGA9112.WQ1, 6AGA9201.WQ1, 6AGA9202.WQ1, 6AGA9203.WQ1, and 6AGA9204.WQ1

Final Quality Control Notes [.DQC]

Although the Gill shield is subject to radiation heating (relative to the unventilated Stevenson screen) these data have been used in the plots to provide consistency with the previous seasons and with other automatic station data.

The relative humidity values for 1991-92, are suspect for a number of reasons and must be treated with caution until a final determining analysis has been performed. The humidity sensor was replaced in spring 1991. This appears to have eliminated the abrupt cut off at 94% experiences with the 207F sensor. The winter RH's follow the temperature almost too closely. The problems of autostation humidity measurements at temperatures near and below freezing will be addressed in a forthcoming paper (Koerner et al.).

The following table lists the time periods for which the data for the various parameters is either missing or has been removed because of problems with the data. These are the sensors which have produced bad data:

i) The snow depth sensors have bad data for the following reasons: the measurement was taken during a period of snowfall and/or with blowing snow or the sensor was eventually covered in snow. For these reasons, the ultrasonic snow depth sensor will not be able to detect the return signal and therefore will give a faulty reading.

ii) The wind sensors have bad or unreliable data during periods of icing or riming which will prevent the sensors from operating but also even with light riming or icing, will change the aerodynamic characteristics of the sensors.

iii) The radiation sensor has unreliable data when it becomes covered in snow.

Table 1.3 AGA(A77) Quality Control Results [.DQC]

FILE RAGA916B.WQ1

PARAMETER	TIME PERIOD
SNOW DEPTH 1	2400, Julian Day (JD) 175
"	2400, JD 259
"	1800, JD 286 TO 0600, JD 287
"	1800, JD 287 TO 1800, JD 288
"	0600, JD 296 TO 1200, JD 296
"	2400, JD 297 TO THE END OF FILE.
SNOW DEPTH 2	2400, JD 241
"	1800, JD 245
"	2400, JD 248
"	2400, JD 255 TO 0600, JD 256
"	0600, JD 284
"	1800, JD 284 TO 2400, JD 284

PARAMETER	TIME PERIOD
"	1200, JD 285
"	0600, JD 288 TO 1800, JD 288
"	2400, JD 292 TO 1800, JD 293
SNOW DEPTH 2...CONT'	2400, JD 294 TO 0600, JD 295
"	2400, JD 295 TO 0600, JD 297
"	2400, JD 301 TO 1200, JD 318
"	1200, JD 343
	1800, JD 346 TO 1800, JD 354
WIND SPEED & DIRECTION	1200, JD 302 TO 2400, JD 316
"	0600, JD 335 TO THE END OF FILE

FILE RAGA926A.WQ1

PARAMETER	TIME PERIOD
RADIATION	0600, Julian Day (JD) 57 TO 2400, JD 102
SNOW DEPTH 1	0600, JD 1 TO 0600, JD 103
"	2400, JD 103
"	1200, JD 104
SNOW DEPTH 2	1800,2400, JD 1
"	1800, JD 2
"	1800, JD 3 TO 1200, JD 5
"	1800, JD 6
"	1800 TO 2400, JD 10
"	0600, JD 12 TO 1200, JD 100
"	0600, JD 103
WIND SPEED & DIRECTION	0600, JD 1 TO 2400, JD 70
" "	0600, JD 79 TO 1800, JD 104

FILE RAGA91DB

PARAMETER	TIME PERIOD
SNOW DEPTH 1	Julian Day (JD) 175, 286 & 287

PARAMETER	TIME PERIOD
"	JD 297 TO THE END OF FILE
SNOW DEPTH 2	JD 241,248,255,284 & 292
SNOW DEPTH 2...CONT'D	JD 294 TO 296
"	JD 301 TO 317
"	JD 346 TO 353
WIND SPEED & DIRECTION	JD 276 TO 279
" "	JD 340 TO THE END OF FILE

FILE RAGA92DA.WQ1

PARAMETER	TIME PERIOD
SNOW DEPTH 1	Julian Day (JD) 1 to 103
SNOW DEPTH 2	JD 1,2,3,10
"	JD 12 TO 99
WIND SPEED & DIRECTION	JD 1 TO 70
" "	JD 80 TO 99

FILE BAGA91SD.WQ1

PARAMETER	TIME PERIOD
SNOW DEPTH 1	Julian Day (JD) 175
SNOW DEPTH 2	JD 241, 248, 255

FILE AAGA91WD.WQ1

PARAMETER	TIME PERIOD
SNOW DEPTH 1	Julian Day (JD) 286,287
"	JD 297 TO THE END OF FILE
SNOW DEPTH 2	JD 284,292,294,295,296
"	JD 301 TO 317
"	JD 346 TO 353
WIND SPEED & DIRECTION	JD 276 TO 279

" "	JD 340 TO THE END OF FILE

FILE BAGA92WD.WQ1

PARAMETER	TIME PERIOD
SNOW DEPTH 1	Julian Day (JD) 1,3,4,10
"	JD 12 TO THE END OF FILE
SNOW DEPTH 2	NO DATA FOR THE ENTIRE FILE
WIND SPEED & DIRECTION	JD 1 TO 70,74
"	JD 79 TO 91

FILE AAGA92SD.WQ1

PARAMETER	TIME PERIOD
SNOW DEPTH 1	Julian Day (JD) 92 to 103
SNOW DEPTH 2	JD 92 TO 99
WIND SPEED AND DIRECTION	JD 92 TO 99

FILE AAGA92SC.WQ1

PARAMETER	TIME PERIOD
RADIATION	Julian Day 92 to 102

FILE AAGA9204.WQ1

PARAMETER	TIME PERIOD
RADIATION	0600 Julian Day (JD) 92 to 2400 JD102
SNOW DEPTH 1	0600 JD 92 TO 0600 JD 103
SNOW DEPTH 2	0600 JD 92 TO 1200 JD 100
WIND SPEED & DIRECTION	0600 JD 92 TO 1000 JD 104

Final Spreadsheet Files and Parameter Tables [.PMT]

The following tables give information for each of the three types of graph data spreadsheets Daily(D), Calculated(C) and Hourly(H) or Six-hourly(6)

The most recent template version is given along with the graph data spreadsheets of this type and their availability. The format of the most complete version of the spreadsheet is then detailed. New parameters are added to end of existing columns in order to preserve the format of previous spreadsheets and columns for which there is no longer data recorded are left blank.

Table 1.4 : Format of Spreadsheet Templates and Graph Spreadsheets AGA(A77)

A) DAILY PLOTS	
TEMPLATES:	AGASUM2.WQT created August 1993 with CALPAR but many of graphs not completed
FILES:	AGA9090D.WQP old format [plotted in final not included here but available on request] AGA9091D.WQP old format [plotted in final, not included here but available on request] AGA9191D.WQP new format but the monthly graphs are not completed includes CALPAR [included here] AGA9192D.WQP new format with CALPAR and some monthly graphs completed [included here]
PLOTS:	For list of plots generated by these spreadsheets see Part I Table 1.5 and PART II, Tables 1.1-2
FORMAT:	Beginning in: A1-headings; A11-data; FA1-calculated parameters headings; FA11- calculated parameters; A200-list of plots; A300-graph captions and setup; A400-list of parameters (used for this table); A500-table of labelled blocks

DAILY COLUMN FORMATS OF DATA [PARTBL]		
Column in AGA9192D. Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
A	LOTUS	lotus day created by QPRO CST
B	JULIAN	julian day CST
C	HR	hour from CST date no.
D	DAY	day from CST date no.
E	MTH	month from CST date no.
F	YR	year from CST date no.
G	JULIAN U	julian day in UCT
H	YEAR	year from split of logger data
I	MONTH	month from logger split
J	CST DAY	day from logger split

DAILY COLUMN FORMATS OF DATA [PARTBL]		
Column in AGA9192D. Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
K	JULIAN L	julian day from logger CST
L	TIME	time of dump in CST
M	BAT	Battery Voltage
N	TM+.47m	Tmean air +.47m
O	TM+.34m	Tmean air +.34m
P	TM+.21m	Tmean air +.21m
Q	TM+.08m	Tmean air +.08m
R	SD+.47m	Tsd air +.47m
S	SD+.34m	Tsd air +.37m
T	SD+.21m	Tsd air +.21m
U	SD+.08m	Tsd air +.08m
V	TM GIL	Tmean air Gil
W	TM GIL2	Tmean air Gil2
X	TM SS	Tmean air SS
Y	RHM	RHmean SS Vaisala
Z	KDM	KDavg Li-Cor
AA	TX GIL	Tmax air Gil
AB	TX GIL2	Tmax air Gil2
AC	TX SS	Tmax air SS
AD	RHX	RHmax SS Vaisala
AE	KDX	KDmax Li-Cor
AF	TN GIL	Tmin air Gil
AG	TN GIL2	Tmin air Gil2
AH	TN SS	Tmin air SS
AI	RHN	RHmin SS Vaisala
AJ	KDN	KDmin Li-Cor
AK	SNAC1	SNA1 cleaned UDG01

DAILY COLUMN FORMATS OF DATA [PARTBL]		
Column in AGA9192D. Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
AL	SNAC2	SNA2 cleaned UDG01
AM	WSM	WSmean RMY
AN	WSV	WSvector mean RMY
AO	WDV	WDvector mean RMY
AP	SDWDV	WDvector sd RMY
AQ		
AR		
AS		
AT		
AU		
AV		
AW		
AX		
AY		
AZ		
BA	ZEROs	line of zeros
BB	180s	line of 180s
BC	BLANKS	line of blanks

DAILY COLUMNS OF CALCULATED PARAMETERS [CALTBL]		
Column in AGA9192D. Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
FA	TMXN GIL	Tmeanxn Gil
FB	TMXN SS	Tmeanxn SS
FC	TMGIL-SS	Dif Tmean Gil-SS
FD	TXGIL-SS	Dif Tmax Gil-SS
FE	TNGIL-SS	Dif Tmin Gil-SS
FF	TMGIL-G2	Dif Tmean Gil-Gil2

DAILY COLUMNS OF CALCULATED PARAMETERS [CALTBL]		
Column in AGA9192D. Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
FG	TXGIL-G2	Dif Tmax Gil-Gil2
FH	TNGIL-G2	Dif Tmin Gil-Gil2
FI	TRXN GIL	Trangxn Gil
FJ	TRXN SS	Trangxn SS
FK	TRXN GL2	Trangxn Gil2
FL	TMXN-M G	Dif Tmeanxn-Tmean G
FM	TMXN-M S	Dif Tmeanxn-Tmean SS

Table 1.4 : Cont'd

B) CALCULATED DAILY PLOTS	
TEMPLATES:	No templates created use AGA9090C.WQP
FILES:	AGA9090C.WQP at version 1 level [not included here but available on request] AGA9091C.WQP at version 1 level [not included here but available on request]
PLOTS:	For list of plots generated by these spreadsheets see Report 1
FORMAT:	Beginning in: A1-headings; A11-data; A200-list of plots; A300-graph captions and setup; A400-list of parameters (used for this table); A500-table of labelled blocks

Column in AGA9090C. Spreadsheet	Parameter (Abrev.) from row 10	Parameter and (used in legends of plots) from row 8
A	LOTUS	date no.in day month format CST
B	JULIAN	julian day CST
C	HR	hour from CST date no.
D	DAY	day from CST date no.
E	MTH	month from CST date no.
F	YR	year from CST date no.
G	JULIAN U	julian day in UCT
H	YEAR	year from split of logger data
I	MONTH	month from logger split
J	CST DAY	day from logger split
K	JULIAN L	julian day from logger CST
L	TIME	time of dump in CST
M	TM SS	Tmean air SS
N	TM GIL	Tmean air Gil
O	RHM GILL	RHmean Gil
P	TX SS	Tmax air SS
Q	TX GIL	Tmax air Gil
R	RHX GIL	RHmax Gil
S	TN SS	Tmin air SS
T	TN GIL	Tmin air Gil

Column in AGA9090C. Spreadsheet	Parameter (Abrev.) from row 10	Parameter and (used in legends of plots) from row 8
U	RHN GIL	RHmin Gil
V	GIL-SS TM	Diff Tmean Gil-SS
W	GILL-SS TX	Diff Tmax Gil-SS
X	GILL-SS TN	Diff Tmin Gil-SS
Y		
Z		
AA	ZEROs	line of zeros
AB	180s	line of 180s
AC	BLANKs	line of blanks

Table 1.4 : Cont'd

C) SIX-HOURLY PLOTS	
TEMPLATES:	AGAMAY62.WQT created August 1993 with CALPAR
FILES:	AGA91056.WQP AGA92036.WQP
PLOTS:	For list of plots generated by these spreadsheets see Part I PART II, Tables 1.3-4
FORMAT:	Beginning in: A1-headings; A11-data; FA1-calculated parameters headings; FA11- calculated parameters; A800-list of plots; A900-graph captions and setup; A1000-list of parameters (used for this table); A1100-table of labelled blocks

SIX-HOURLY COLUMN FORMATS [PARTBL]		
Column in AGA92036.WQP Spreadsheet	Parameter (Abrev.) From row 10	Parameter and Source (used in legends of plots) from row 8
A	LOTUS	date no.in day month format
B	JULIAN	julian day from CST date no.
C	HR	hour from CST date no.
D	DAY	day from CST date no.
E	MTH	month from CST date no.
F	YR	year from CST date no.
G	JULIAN	julian day in UCT
H	YEAR	year from split of logger data
I	MONTH	month from logger split CST
J	DAY	day from logger split CST
K	JULIAN C	julian day from logger CST
L	HHMM	hour/minute from logger UCT
M	TM SS	Tmean air SS Vaisala
N	TM GIL	Tmean Gil 107F
O	RHM GIL/SS	RHmean SS Vaisala
P	TX SS	Tmax air SS
Q	TX GIL	Tmax air Gil
R	RHX GIL/SS	RHmax Gil/SS Vaisala
S	TN SS	Tmin air SS

SIX-HOURLY COLUMN FORMATS [PARTBL]		
Column in AGA92036.WQP Spreadsheet	Parameter (Abrev.) From row 10	Parameter and Source (used in legends of plots) from row 8
T	TN GIL	Tmin air Gil
U	RHN GIL/SS	RHmin Gil/SS Vaisala
V	TM GIL2	Tmean air Gil2 107F
W	KD AVG	KD 6hr avg Li-Cor
X	SNAC1	SNA1 cleaned UDG01
Y	SNAC2	SNAC2 cleaned UDG01
Z	WS	WSmean 6hr RMY
AA	WSV	WSvector mean RMY
AB	WDV	WDvector mean RMY
AC	WDV SD	WDvector sd RMY
AD		
AE		
AF		
AG		
AH		
AI	ZEROs	line of zeros
AJ	180s	line of 180s
AK	BLANKs	line of blanks

SIX-HOURLY COLUMN FORMATS [CALTBL]		
Column in AGA92036.WQP Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
FA	R5DSD	run sd 5day (last day)
FB		
FC	TMGIL-SS	Dif Tmean Gil-SS
FD	TXGIL-SS	Dif Tmax Gil-SS
FE	TNGIL-SS	Dif Tmin Gil-SS
FF	TMGIL-G2	Dif Tmean Gil-Gil2

Table 1.5 is an example of the graphs available in the six-hourly graph data spread sheets.

SIX-HOURLY PLOTS: March 1992				
name:	Figure no.		Month Year	Figure Caption
A: Plots printed for spreadsheet AGA92036.WQF				
trhm	AGA92036.	1	March 1992	Six-hourly mean values of air temperature (°C) and relative humidity (%) from 107F probe in Gill screen (6 plate)
wswdv	AGA92036.	2	March 1992	Six-hourly mean values of wind speed and vector mean values of wind speed and direction from RM Young anemometer
wdsd	AGA92036.	3	March 1992	Six-hourly vector wind direction and standard deviation of direction (deg)
wswdsd	AGA92036.	4	March 1992	Six-hourly mean vector wind speed (KM/HR) and the standard deviation of wind direction (deg)
xtmc	AGA92036.	5	March 1992	Comparison of six-hourly mean temperatures from 107F Gill (6 plate) screen, Stevenson screen and second Gill (12 plate) screen (°C)
B: Plots available in spreadsheet but not printed for report				
C: Plots having insignificant amounts of data				
txn	AGA92036.		March 1992	Six-hourly mean values of maximum and minimum values of air temperature from 107F probe in Gill screen
rhxn	AGA92036.		March 1992	Six-hourly mean values of maximum and minimum relative humidity (%) 107F probe in Gill screen
snac12	AGA92036.		March 1992	Six-hourly sampled value of snow accumulation (spring zero reset) from two UDG01 sensors
txnc	AGA92036.		March 1992	Comparison of six-hourly maximum and minimum values of air temperature from 107F probe in Gill screen and Vaisala probe in unventilated Stevenson Screen
xkd	AGA92036.		March 1992	Six-hourly mean values of incoming solar radiation (KW/m^2) from Li-Cor pyranometer
X: eXoteric plots for use internally				
r5dsdt	AGA92036.		March 1992	Standard deviation of temperature(°C) calculated for four obs/day (six-hourly) for 5 days; plotted on last day of 20 obs. period
xdtgilm	AGA92036.		March 1992	Difference between mean six-hourly temperatures from 107F probe in main Gill screen and secondary Gill Screen

SIX-HOURLY PLOTS: March 1992				
name:	Figure no.		Month Year	Figure Caption
dtxnm	AGA92036.		March 1992	Difference between temperatures from 107F probe in Gill screen and from Vaisala probe in unventilated Stevenson Screen for mean, maximum and minimum and air temperatures
m-a sdt			1 March - 14 April 1992	Mean six-hourly temperature and 5 day running standard deviation of 20 consecutive values (5 days) plotted on last day of period for the period prior to the servicing of the station comparing the conditions in the Stevenson screen and Gill screen
m-a tsd			1 March - 14 April 1992	Mean six-hourly temperature and 5 day running standard deviation of 20 consecutive values (5 days) plotted on last day of period for the period prior to the servicing of the station comparing the conditions in the Stevenson screen and Gill screen
m-a wsrhsn			1 March - 14 April 1992	Wind speed, relative humidity and snow depth for the period prior to servicing in spring.

HWC(AWS): HOT WEATHER CREEK, AUTOMATIC WEATHER STATION

Lat 79°57'54"N, Long 84°26'33"W, Elev 105 m. asl

Station Description [.STN]

Regional Setting and Representativeness: HWC(AWS)

The Hot Weather Creek field camp is located on the Fosheim Peninsula 30 kilometres east of the permanent weather station at Eureka (Figure 4). The automatic weather station site is positioned about 20 metres from the western edge of the narrow strike valley cut by the north-south oriented Hot Weather Creek (Figures 4). The creek is small and ephemeral. East of the instrument site the valley slopes down over an old slump and several terraces to the creek bed 30 metres below. The area within a 20- to 25-kilometre radius of the site is characterized by gently rolling terrain dissected by numerous creeks. The elevation of this lowland is around 100 metres and valleys are typically 30 metres deep except to the northwest where a series of ridges rise to more than 150 metres. The site was chosen to represent this roughly 1000 square kilometre gently rolling inland lowland area. This is in contrast to the coastal fiord location of the Eureka station. There may be some minor local effects due to with the site's proximity to the edge of the creek valley and the definite north-south orientation of the valley's these would be mainly in terms of altering the wind regime. The cross-section in Figure 5 illustrates the greatest relief differences in the area. Beyond the 20-kilometre radius (area ca. 1000 m^2) mountain barriers about 1000 m. high fill the central part of the NW and S quadrants and all the SE quadrant. In the remaining quadrants the terrain slopes down to ice filled fiords (Figure 1) beyond which, at a distance of 60 to 80 kilometres, mountain ranges dominate the terrain.

To the east beyond the creek valley the 100 m asl lowland continues as gently rolling terrain cut by the Slidre River and a number of creeks until it reaches the foothills of the Sawtooth Mountains 25 kilometres to the east and southeast. The Sawtooth Mountains run in a northeast-southwest direction and rise to heights of 1200 metres 35 kilometres southeast of the site. To the northeast the terrain rises gently and then falls to Canon Fiord 20 kilometres northeast of the site. Beyond, Agassiz Ice Cap is visible on clear days. North of the site the rolling terrain rises gently for 20 kilometres to the head of Hot Weather Creek at an elevation of 140m and then falls off for another 20 kilometres to ice filled Greely Fiord.

About five kilometres northwest of the site the terrain rises to 200 metres at the top of an corrugation in the rolling terrain. These roughly 100 meter high undulations extend for 20 kilometres to the base of Black Top Ridge (ca. 770 metres). This ridge runs from due west of the site filling the northwest quadrant of the horizon. Slidre Fiord cuts 25 kilometres eastward into the Fosheim Peninsula reaching to within 15 kilometres of the site to the south of the Blacktop Ridge. Eureka the permanent AES weather station lies 30 kilometres directly to the west on Slidre Fiord (west of Black Top Ridge).

Less than 5 kilometres south of the site Hot Weather Creek joins the Slidre River which drains west into Slidre Fiord. The rolling terrain continues to Eureka Fiord in the southwest, while 30 kilometres to the south an unnamed mountain rises to 700 metres. To the southeast the terrain rises to over 300 metres some 20 kilometres from the site.

General Site and Instrumentation Information: HWC(AWS)

The instrument site was chosen to be representative of the vegetation and surface conditions of the broad area of gently rolling terrain (100 m asl); not of the valleys or the ridge tops. This terrain is covered by earth hummocks 10-100 cm in diameter and large networks of high-centre, frost fissure polygons 20 to 30 m in diameter. *Salix-Dryas* hummocky tundra is the most common plant community found on almost all moderately drained , neutral to moderately alkaline soils of the silty lowlands.

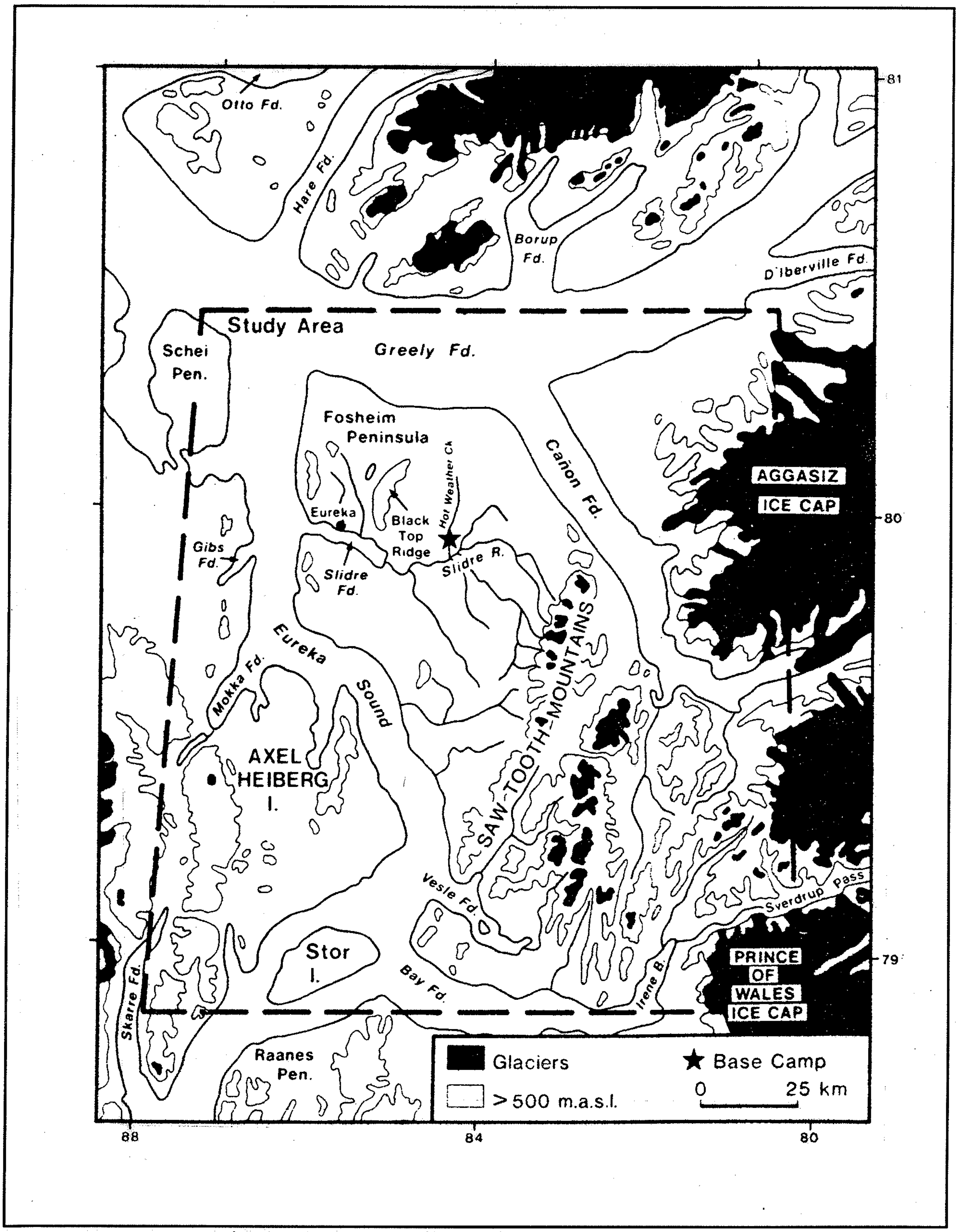


Figure 4a. Fosheim Peninsula location map.

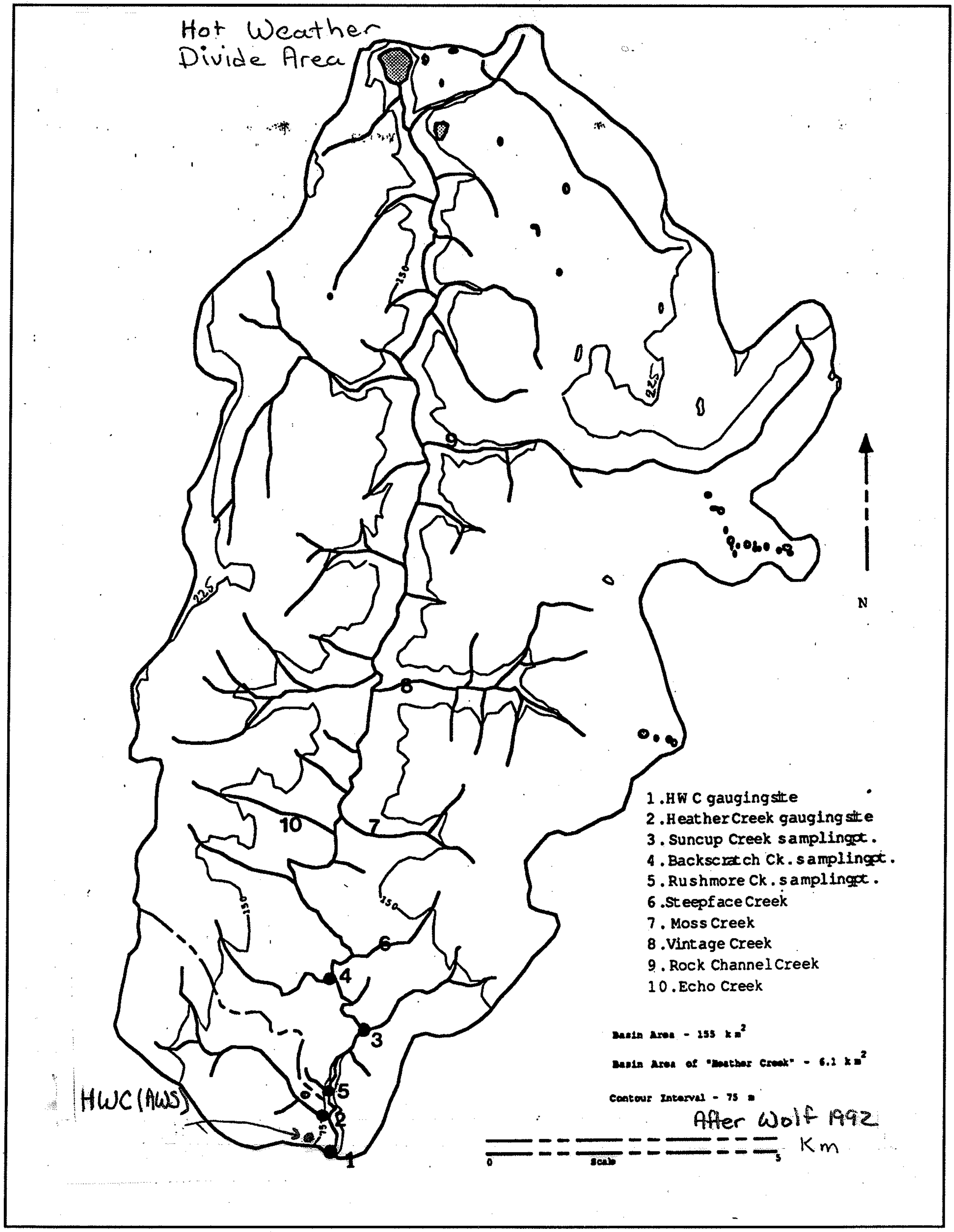


Figure 4b. Hot Weather Creek Basin.

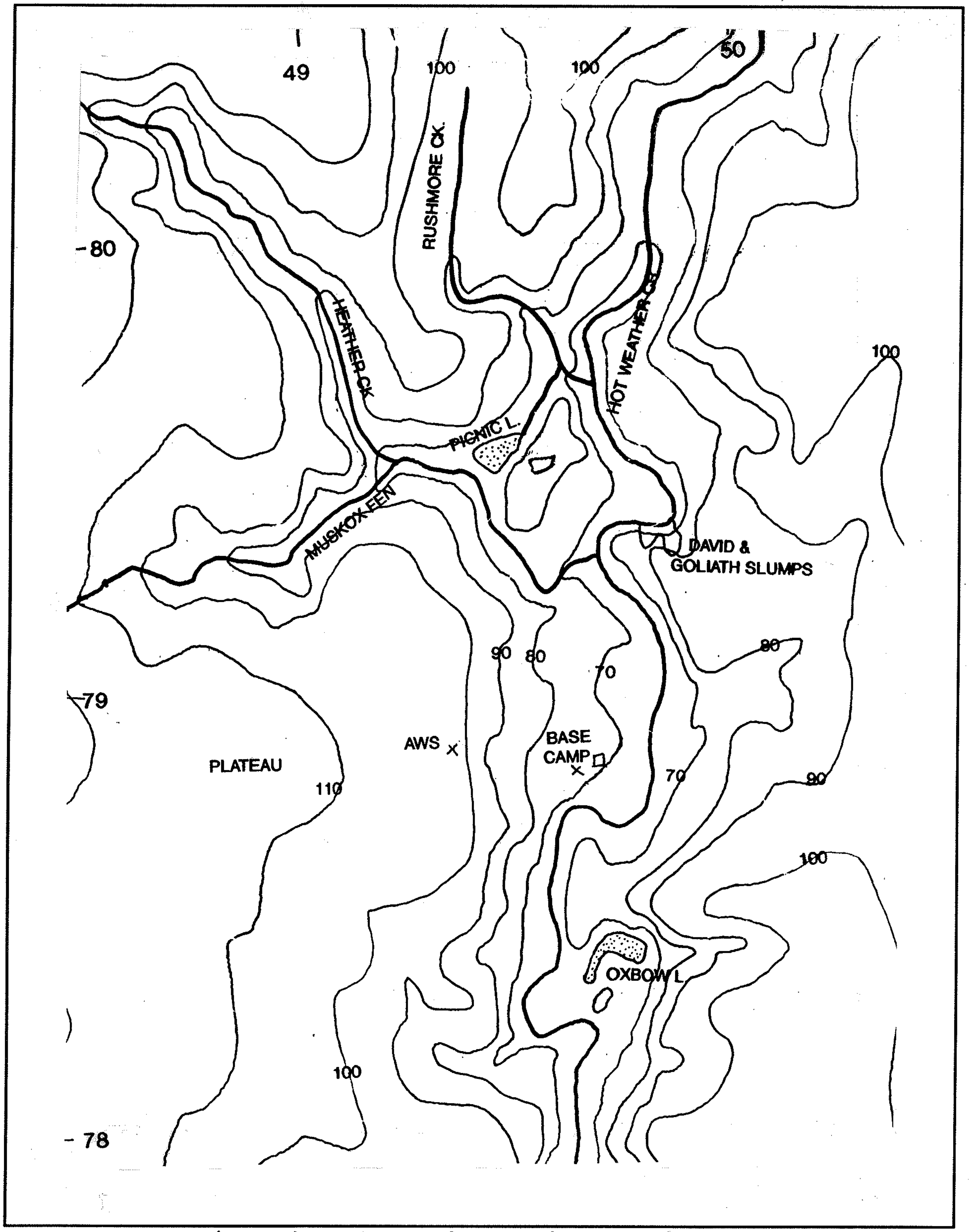


Figure 4c. Hot Weather Creek Base Camp Area.

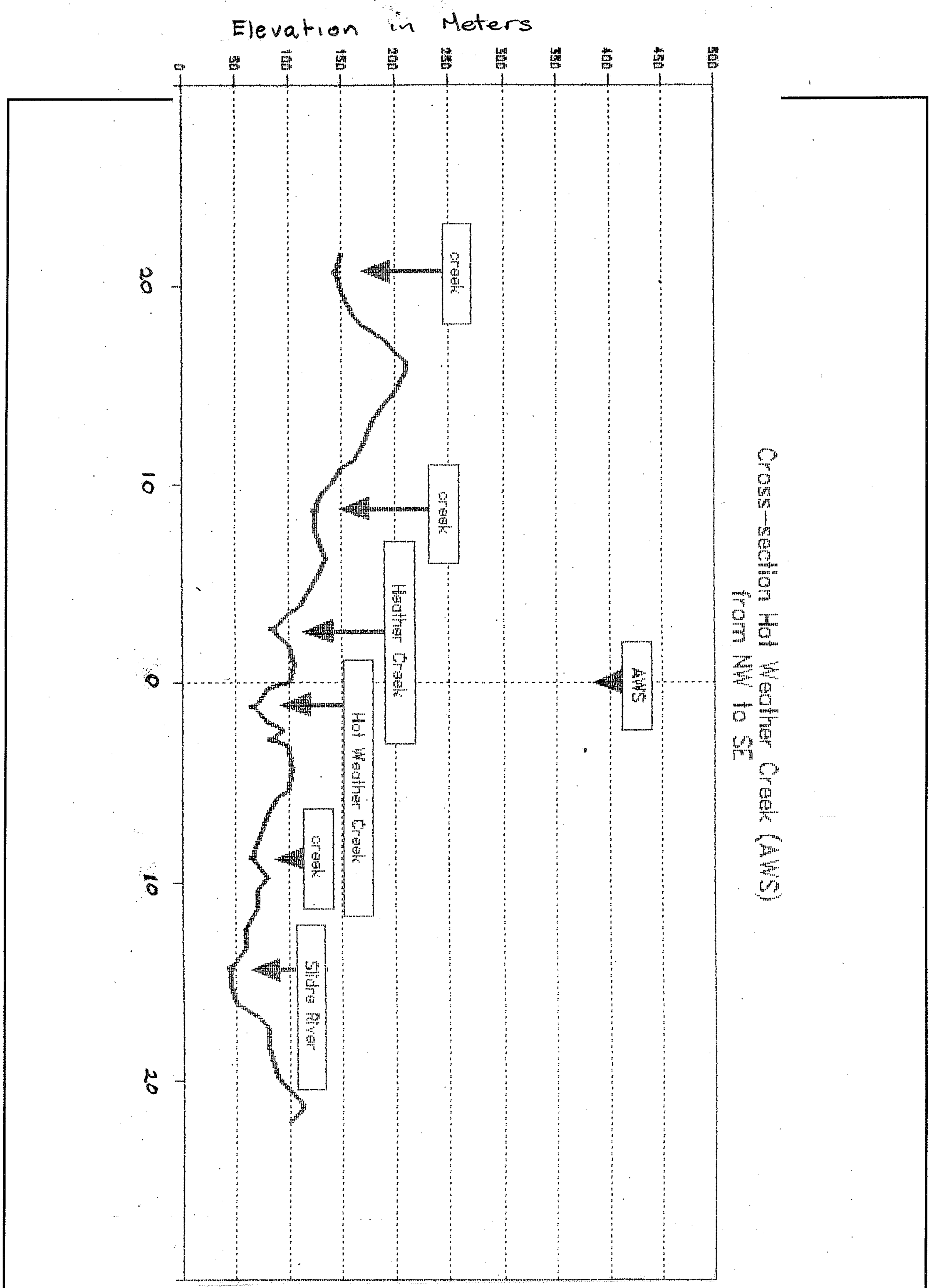


Figure 5. Cross-section in NW-SE direction through HWC(AWS) site.

The automatic weather station is located near the centre of a large polygon with the typical *Salix-Dryas* broken tundra vegetation cover.

The instrumentation was originally installed in June 1988 and has been maintained by the Arctic Adaptation Division CCC AES with field support by Terrain Sciences Division of GSC.

The instrumentation and sampling rates do not meet those set out in Version 2 of the AES autostation guidelines (1992 AES) due to power and storage limitations. It must therefore still be classed as a field camp autostation. Upgrades will proceed in the directions set out by the standards but some of these are unnecessary or impossible under these remote conditions. The station is carefully maintained and serviced every spring. At this time any sensors which have been damaged or have malfunctioned during the winter are replaced. In addition, each season, the wind speed and direction sensors and the pyranometer(s) are replaced so the sensors can be calibrated annually.

Instrumentation and site Conditions: June 1991 - June 1992

Site Conditions and Problems

The preliminary inspection of the autostation on arrival revealed several points of interest. The first feature which was noticeable was that the station had tilted due to settling of the north and southeast legs of the tripod. This settling likely occurred during the spring thaw of this year. The tilt was about 5° from normal to the east-northeast. At the time of arrival at the site, it was still very wet and soft around the station, making it necessary to delay levelling until the ground had dried.

Other points which were noted during the external inspection were that the pyranometer had a coating of dust on the dome, predominantly on the south side, and that the Met-One anemometer was squeaking slightly. This anemometer was replaced as part of the annual maintenance.

Internally, the station was in good condition. Examination of the leads at the wiring panel of the 107B thermistors revealed that the lead for the 50 cm thermistor had a crack in the heat shrink tubing. There was no obvious internal damage to the wiring so the crack was taped over with electrical tape. It is unlikely however, that this was related to the jump in the readings which has occurred for this sensor when the temperature rises above 0 °C.

Instrumentation Description [.NST]

In June 1991, the station underwent annual servicing, which means that the pyranometer and the wind sensors were replaced. Subsequent calibration of the pyranometer removed showed that it was well within specifications. The anemometer and wind vane were replaced with similar sensors which had been refurbished.

The instrumentation which was originally installed in June 1988, was upgraded in June 1992. The upgrade consisted of adding a few more sensors which meant that the data acquisition system had to be changed from the existing Campbell Scientific CR10 to the 21X which has a few more input channels.

The station upgrade was started at 13:45 EDT on June 19, 1992 when the CR10 datalogger was turned off. The original style of anemometer, the Met-One 013A was exchanged for a new one. The wind direction sensor, the 023A was removed and a separate R.M. Young 5103 anemometer and wind direction sensor was installed. The station now has two wind speed sensors and one wind direction sensor. Programming the datalogger for this change required that the mean wind vector calculations done for the Met-One wind speed sensor used the R.M. Young direction output.

The mounting pipe of the Eppley pyranometer was extended so as to avoid shading by the wind direction sensor. A new Kipp & Zonen CM11 pyranometer replaced the Eppley. A new CM11 was also installed to measure the reflected shortwave global radiation. This albedometer only received a glare shield on August 6, 1992.

A tipping bucket rain gauge was also part of this station upgrade. It was installed on the southwest side at a distance of 8.5 metres from the station.

Finally, the CSMAL01 Snow Depth Sensor was replaced with a UDG01 Ultrasonic Depth Gauge in order to save on power consumption. The UDG01 was installed on the west side of the station at a height of 2.0 meters. While verifying the operation of the sensor, the range was not reset and an offset was introduced in the snow depth data.

Details of the instrumentation wiring and programming are included in Appendix 7.

See the appendix 2 for technical specifications

1) Radiation:
Eppley pyranometer for shortwave incoming radiation, uses a thermopile sensing element. The sensor is calibrated and replaced every year. As of June 19, 1992, this sensor was replaced with a Kipp & Zonen CM11 pyranometer. A CM11 was also added to measure reflected shortwave radiation.

2) Temperature:
a) CSCC Thermistor (207C) for air temperature housed in a small Gill self-ventilating radiation shield.

b) CSCC Thermistors (107B) are also used for the temperature of the vegetation and the ground temperatures.

3) Relative Humidity:
A PhysChem polysulfanated styrene chip which is part of the air (207C) temperature and humidity probe

4) Wind Speed:
The Met-One 013A Heavy duty three cup anemometer. On June 19 1992, an R.M. Young 05103 Wind Monitor was added to the station.

5) Wind Direction:
A Met-One 023A Heavy Duty wind vane was replaced on June 19 1992 with a R.M. Young 05103 Wind Monitor.

6) Snow Depth:
An ultrasonic distance sensor, the CSMAL01 was replaced by a UDG01 Ultrasonic Depth Sensor. Both are manufactured by CSCC.

Output Array Definitions [.ARR]

The initial data file is HWC9192.DAT which starts at 1200 on Julian Day 235 (Aug. 22), 1991, and ends at 1500 on 236 (August 24), 1992. Due to annual maintenance on the station, there is a data gap starting on J.D. 171 (June 20) at 1700, to 2200 on 172 (June 21) 1992. The data output starting after the gap has the new station output. The output from the first and largest portion of HWC9192.DAT is defined as follows. The new output of the rest of the data file was produced in such a way as to append to the old output. *The new output is shown in italics*. For this report, only the data produced to June 1992 will be presented. The new data resulting from the station upgrade will be fully presented as part of the 1992-93 data set.

Table 2.1. Output Array Definitions [.ARR]

1) Hourly outputs:	
01:	Table ID 0116
02:	Julian Day (NEW DAY AT 0000)
03:	Time HHMM (Set to UCT,UNIVERSAL COORDINATED TIME)
04:	Sample of Air Temp (°C)
05:	Sample of Relative Humidity (%)
06:	2 Minute Wind Speed Vector from Met-One (KM/HR)
07:	2 Minute Wind Vector Direction (Speed Met-One, Dir. R.M. Young) (VECTOR DEGREES)
08:	Sample of Vegetative Temperature (°C)
09:	Sample of 10 cm Ground Temperature (°C)
10:	Sample of 20 cm Ground Temperature (°C)
11:	Sample of 50 cm Ground Temperature (°C)
12:	Sample of 100 cm Ground Temperature (°C)
13:	Total Radiation Incoming (MJ/M^2)
14:2	*Minute Wind Speed Vector Magnitude from Met-One (KM/HR)*
15:2	*Minute Wind Speed Vector from R.M. Young (KM/HR)*
16:2	*Minute Wind Speed Vector Magnitude from R.M. Young (KM/HR)*
17:2	*Minute Wind Vector Direction from R.M. Young (KM/HR)*
18:2	*Minute Standard Deviation of Wind Direction (DEGREES)*
19:	*Total Reflected Radiation* (MJ/M^2)
20:	*Snow Depth (MM)*
21:	*Rainfall - Hourly Total (MM)*

2) Daily Outputs at 0600 (UCT, 0000 LOCAL):	
01:	Table ID 0132
02:	Julian Day (NEW DAY AT 0000)
03:	Time (HHMM, UCT)
04:	Maximum Air Temperature (°C)
05:	Time of Maximum
06:	Minimum Air Temperature (°C)
07:	Time of Minimum
08:	Maximum Wind Speed from R.M. Young (KM/HR)
09:	Time of Maximum Wind Speed
10:	Sample Direction of Maximum Wind Speed (DEGREES)
11:	Total Incoming Shortwave Radiation (MJ/M^2)
12:	Sample of Snow Depth (MM)
13:	Sample of Battery Voltage (VOLTS)
14:	*Total Reflected Shortwave Radiation (MJ/M^2)*

Data Processing Documentation June 1991 - June 1992 [.SOD]

Split and Organized Data Files

The raw data file (.DAT) was run through a preliminary sort and quality control using the SPLIT feature of the PC208 software. The SPLIT parameter files are described in Appendix 7. Here is a listing of the files resulting from this process.

TABLE 2.2. HWC(AWS): Split and Organized Data Files

FILE NAME	STARTS	STOPS
RHWC91HB.WQ1	1200, 235 (AUG.23), 1991	0600, 1 (JAN.1), 1992
RHWC92HA.WQ1	0700, 1 (JAN.1), 1992	1700, 171 (JUN.19), 1992
RHWC91DB.WQ1	236 (AUG.24), 1991, AUG.23*	1 (JAN.1), 1992, DEC.31*
RHWC92DA.WQ1	2 (JAN.2), 1992, JAN. 1*	171 (JUN.19), 1992, JUN.18*
BHWC91SD.WQ1	236 (AUG.24), 1991, AUG.23*	274 (OCT.1), 1992, SEPT.30*
BHWC91SC.WQ1	237 (AUG.25), 1991, AUG.24*	
AHWC91WD.WQ1	275 (OCT.2), 1991, OCT.1*	1 (JAN.1), 1992, DEC.31*
AHWC91WC.WQ1		
BHWC92WD.WQ1	2 (JAN.2), 1992, JAN.1*	92 (APR.1), 1992, MAR.31*
BHWC92WC.WQ1		
AHWC92SD.WQ1	93 (APR.2), 1992, APR.1*	171 (JUN.19), 1992, JUN18*
AHWC92SC.WQ1		
BHWC9108.WQ1[2]	1200, 235 (AUG.23), 1991	0600 244 (SEP.1), 1991, AUG.31*
AHWC9206.WQ1[2]	0700, 153 (JUN.1), 1992	1700, 171 (JUN.19), 1992

* The automatic weather station's clock is set to UCT. For the daily and calculated data the station day is one day ahead of the local day. The UCT day has been converted to local day in the data set.

2 These two files are the only incomplete files of the monthly files of hourly data. The rest of the monthly files are the following. They all start at 0700 UCT (01 local) and end at 0600 UCT. The other file names are as follows:

HHWC9109.WQ1, HHWC9110.WQ1, HHWC9111.WQ1, HHWC9112.WQ1, HHWC9201.WQ1, HHWC9202.WQ1, HHWC9203.WQ1, HHWC9204.WQ1, HHWC9205.WQ1.

Quality Control Notes [.DQC]

The following table lists the data files along with the time periods when data were eliminated for various data quality control reasons. For the 1991-92 data set, the main problems occurred with the wind and the snow data. Icing of the wind sensors remains the principle problem with the wind data. For the snow depth data, measurements taken during periods of snowfall or blowing snow, will cause erroneous readings.

Table 2.3 HWC(AWS) Quality Control Results [.DQC]

FILE RHWC91HB.WQ1

PARAMETER	TIME PERIOD
WIND SPEED & DIRECTION	1100 Julian Day (JD) 271 TO 1200 JD 280
" "	1600 JD 288 TO 2200, JD 290
" "	0500 JD 310 TO 1700, JD 315
" "	2200 JD 326 TO THE END OF FILE

FILE RHWC92HA.WQ1

PARAMETER	TIME PERIOD
WIND SPEED & DIRECTION	0700, Julian Day 1 TI 2300 JD 124

FILE RHWC91DB.WQ1

PARAMETER	TIME PERIOD
WIND DIRECTION & SPEED	Julian Day 271 TO 280
" "	JD 288 to 290
" "	JD 310 to 315
" "	JD 326 TO THE END OF FILE
SNOW DEPTH	JD 237,238,240 TO 246
"	JD 249, 251 TO 255
"	JD 259 TO 262
"	JD 281,354 TO 358, 362, 365

FILE RHWC92DA.WQ1

PARAMETER	TIME PERIOD
WIND SPEED & DIRECTION	Julian Day 2 TO 123
SNOW DEPTH	JD 9 TO 12, 22,23,27,28,39,52,53,84
"	JD 95 TO 98
"	JD 146,147,149,150
"	JD 152 TO THE END OF FILE

FILE BHWC91SD.WQ1

PARAMETER	TIME PERIOD
WIND SPEED & DIRECTION	Julian Day 272 TO 274
SNOW DEPTH	JD 237,238,240 TO 246
"	JD 249, 251 TO 255, 259 TO 262

FILE BHWC91SC.WQ1

PARAMETER	TIME PERIOD
WIND SPEED & DIRECTION	Julian Day 271 TO 274

FILE AHWC91WD.WQ1

PARAMETER	TIME PERIOD
WIND SPEED & DIRECTION	Julian Day 275 TO 280
" "	JD 288 TO 290
" "	JD 311 TO 315
" "	JD 326 TO THE END OF FILE
SNOW DEPTH	JD 281, 354 TO 358, 362, 365

FILE AHWC91WC.WQ1

PARAMETER	TIME PERIOD
WIND SPEED & DIRECTION	Julian Day 275 TO 280
" "	JD 288 TO 290
" "	JD 310 TO 315
" "	JD 326 TO THE END OF FILE

FILE BHWC92WD.WQ1

PARAMETER	TIME PERIOD
WIND SPEED & DIRECTION	NO DATA FOR ENTIRE PERIOD
SNOW DEPTH	Julian Day 9 TO 12, 22,23,27,28
"	JD 39, 52,53, 84

FILE BHWC92WC.WQ1

PARAMETER	TIME PERIOD
WIND SPEED & DIRECTION	NO DATA FOR ENTIRE PERIOD

FILE AHWC92SD.WQ1

PARAMETER	TIME PERIOD
WIND SPEED & DIRECTION	Julian Day 93 TO 123
SNOW DEPTH	JD 95 TO 98, 146,147,149,150
"	JD 152 TO THE END OF FILE

FILE AHWC92SC.WQ1

PARAMETER	TIME PERIOD
WIND SPEED & DIRECTION	Julian Day 93 TO 124, 146.

Files BHWC9108.WQ1 AND AHWC9208.WQ1 have no missing data.

Final Spreadsheet Files and Parameter Tables [.PMT]

The following tables give information for each of the three types of graph data spreadsheets Daily(D), Calculated(C) and Hourly(H) or Six-hourly(6)

The most recent template version is given along with the graph data spreadsheets of this type and their availability. The format of the most complete version of the spreadsheet is then detailed. New parameters are added to end of existing columns in order to preserve the format of previous spreadsheets and columns for which there is no longer data recorded are left blank.

Table 2.4 : Format of Spreadsheet Templates and Graph Spreadsheets HWC(AWS)

A) DAILY PLOTS	
TEMPLATES:	HWCWILD2.WQT for winter with leap year in Feb. (created July,1993 not including CALTBL:- make new from HWC9292D.WQP) HWCWIND1.WQT for winter with no leap year in Feb.(created 1992, amended Feb 1993) HWCSUMD1.WQT for summer (created 1992, amended Feb 1993)
FILES:	HWC9091D.WQF old [Report 1] HWC9192D.WQP new but no CALTBL [included here] HWC9292D.WQP newest, use to create new templates [included here] HWC9191D.WQP old [Report 1 and Draft Report 2] HWC9090D.WQP old [Report 1]
PLOTS:	For list of plots generated by these spreadsheets see Part I Table 2.5 and PART II, Tables 2.1-2
FORMAT:	Beginning in: A1-headings; A11-data; FA1-calculated parameters headings; FA11- calculated parameters; A200-list of plots; A300-graph captions and setup; A400-list of parameters (used for this table); A500-table of labelled blocks

DAILY COLUMN FORMATS OF DATA [PARTBL]: Hot Weather Creek HWC(AWS)		
Column in DAILY Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
A	LOTUS	date no.in day month format CST
B	JULIAN	julian day CST
C	HR	hour from CST date no.
D	DAY	day from CST date no.
E	MTH	month from CST date no.
F	YR	year from CST date no.
G	JULIAN U	julian day in UCT
H	YEAR	year from split of logger data

DAILY COLUMN FORMATS OF DATA [PARTBL]: Hot Weather Creek HWC(AWS)		
Column in DAILY Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
I	MONTH	month from logger split
J	CST DAY	day from logger split
K	JULIAN U	julian day from logger UCT
L	TIME	time of dump in UCT
M	TX AIR	Tmax air Gill
N	TIME TX	time UCT of TX
O	TN AIR	Tmin air Gill
P	TIME TN	time UCT of TN
Q	WSX	WSmax 2 minute
R	TIME WSX	time UCT of wind speed max
S	WD of WSX	WD of WSmax
T	RAD KD	KD total Eppley
U	SNDC	SND cleaned CSMAL01
V	BAT	Battery Voltage
W		0
X		
Y		
Z		
AA	ZERO's	line of 0s
AB	180's	line of 180s
AC	BLANK	leave blank

DAILY COLUMNS OF CALCULATED PARAMETERS [CALTBL]		
Column in HWC9292D. Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
FA	TMXN GIL	Tmeanxn air Gil

Table 2.4 cont'd

B) CALCULATED DAILY PLOTS	
TEMPLATES:	HWCSUMC1.WQT for Summer (created in Feb 1993)
FILES:	HWC9191C.WQP version 1 but not changed in August 1993 HWC9292C.WQP newest August 1993:-use to make new template
PLOTS:	for a complete list of plots generated by these spreadsheets see PART I Table 2.5 and PART II, Table 2.3
FORMAT:	Beginning in: A1-headings; A11-data; A200-list of plots; A300-graph captions and setup; A400-list of parameters (used for this table); A500-table of labelled blocks

Column in HWC9292C. Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
A	LOTUS	date no.in day month format
B	JULIAN C	julian day from CST date no.
C	HR	hour from CST date no.
D	DAY	day from CST date no.
E	MTH	month from CST date no.
F	YR	year from CST date no.
G	JULIAN U	julian day in UCT
H	YEAR	year from split of logger data
I	MONTH	month from logger split
J	CST DAY	day from logger split
K	JULIAN U	julian day from logger
L	TIME	time of first ob in mean UCT
M	TM GIL	Tmeam24 air Gil
N	RHM GIL	RHmean24 Gil
O	WSM	WSmean24 2 minute
P	TVEGX	TVEGmax24 Vs
Q	TGX -.1m	TGmax24 -.1m
R	TGX -.2m	TGmax24 -.2m
S	TGX -.5m	TGmax24 -.5m
T	TGX -1.m	TGmax24 -1.m

Column in HWC9292C. Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
U	TVEGM	TVEGmean24 Vs
V	TGM -.1m	TGmean24 -.1m
W	TGM -.2m	TGmean24 -.2m
X	TGM -.5m	TGmean24 -.5m
Y	TGM -1.m	TGmean24 -1.m
Z	TVEGN	TVEGmin24 Vs
AA	TGN -.1m	TGmin24 -.1m
AB	TGN -.2m	TGmin24 -.2m
AC	TGN -.5m	TGmin24 -.5m
AD	TGN -1.m	TGmin24 -1.m
AE		
AF		
AG		
AH		
AI		
AJ		
AK		
AL		
AM		
AN		
AO		
AP		
AQ		
AR		
AS		
AT		
AU		
AV		

Column in HWC9292C. Spreadsheet	Parameter (Abrev.) from row 10	Parameter and Source (used in legends of plots) from row 8
AW		
AX		
AY		
AZ		
BA	ZEROs	line of zeros
BB	180's	line of 180's
BC	BLANK	leave blank

Table 2.4 cont'd

C) HOURLY PLOTS	
TEMPLATES:	HWCJULH1.WQT for July (created in Feb 1993) HWCJUNH1.WQT for June " " " " HWCAUGH1.WQT for August " " " " HWCMAYH2.WQT for May (created July 1993, amended Aug 1993)
FILES:	HWC9107H.WQP old [draft report 2] HWC9106H.WQP old [draft report 2] HWC9108H.WQP old [draft report 2] HWC9205H.WQP new using version 2 [included here]
PLOTS:	For lists of plots generated by this template and spreadsheet see Part II, Tables 2.4
FORMAT:	Beginning in: A1-headings; A11-data; A800-list of plots; A900-graph captions and setup; A1000-list of parameters (used for this table); A1100-table of labelled blocks

HOURLY COLUMN FORMATS

Column in .WQP Spreadsheet	Parameter (Abrev.) From row 10	Parameter and Source (used in legends of plots) from row 8
A	LOTUS	date no.in day month format
B	JULIAN	julian day from CST date no.
C	HR	hour from CST date no.
D	DAY	day from CST date no.
E	MTH	month from CST date no.
F	YR	year from CST date no.
G	JULIAN	julian day in UCT
H	YEAR	year from split of logger data
I	JULIAN U	julian day from logger
J	HHMM	hour/minute from logger UCT
K	TAIR	Tsamp air Gil
L	RHAIR	RHsamp air Gil
M	WS	WS 2 minute MO
N	WD	WD 2 minute MO
O	TVEG	TVEGsamp Vs
P	TG -.1m	TGsamp -.1m
Q	TG -.2m	TGsamp -.2m

HOURLY COLUMN FORMATS		
Column in .WQP Spreadsheet	Parameter (Abrev.) From row 10	Parameter and Source (used in legends of plots) from row 8
R	TG -.5m	TGsamp -.5m
S	TG -1.0m	TGsamp -1.0m
T	RAD	KDtolal Eppley
U		
V		
W		
X		
Y		
Z		
AA	ZERO	line of zeros
AB	180's	line of 180's
AC	BLANKS	line of blanks

Table 2.5

DAILY PLOTS: Summer 1992 (April 1992 - September 1992)					
name:	Figure no.		Season/ Month	Years	Figure Caption
A: Plots printed for spreadsheet HWC9292D.WQF					
6tm	HWC9292D.		Summer	1992	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
6txn	HWC9292D.		Summer	1992	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
6wsxwd	HWC9292D.		Summer	1992	Daily maximum wind speed (Km/hr) and direction of that maximum speed (deg)
6rad	HWC9292D.		Summer	1992	Daily total incomming solar radiation (KJ/m^2) from Eppley pyranometer
6sndc	HWC9292D.		Summer	1992	Daily cleaned snow depth (mm) with all questionable data removed
5txnm	HWC9292D.		Melt Season	1992	Daily maximum, minimum and mean air temperature (°C) from 207F in Gill screen
4txn	HWC9292D.		May - August	1992	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
aprtxn	HWC9292D.		April	1992	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
aprsndc	HWC9292D.		April	1992	Daily cleaned snow depth (mm) with all questionable data removed
maytm	HWC9292D.		May	1992	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
maytxn	HWC9292D.		May	1992	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
maywsxwd	HWC9292D.		May	1992	Daily maximum wind speed (Km/hr) and direction of that maximum speed (deg)
mayrad	HWC9292D.		May	1992	Daily total incomming solar radiation (KJ/m^2) from Eppley pyranometer
maysndc	HWC9292D.		May	1992	Daily cleaned snow depth (mm) with all questionable data removed
juntm	HWC9292D.		June	1992	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
juntxn	HWC9292D.		June	1992	Daily maximum and minimum air temperature (°C) from 207F in Gill screen

DAILY PLOTS: Summer 1992 (April 1992 - September 1992)					
name:	Figure no.		Season/ Month	Years	Figure Caption
junwsxwd	HWC9292D.		June	1992	Daily maximum wind speed (Km/hr) and direction of that maximum speed (deg)
junrad	HWC9292D.		June	1992	Daily total incomming solar radiation (KJ/m^2) from Eppley pyranometer
note: absolute scales in monthly plots may vary though range remains the same					
B: Additional plots available in spreadsheet not printed for report					
6bat	HWC9292D.		Summer	1992	Daily battery power (volts)
5wsxwd	HWC9292D.		Melt Season	1992	Daily maximum wind speed (Km/hr) and direction of that maximum speed (deg)
aprtm	HWC9292D.		April	1992	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
aprwsxwd	HWC9292D.		April	1992	Daily maximum wind speed (Km/hr) and direction of that maximum speed (deg)
aprrad	HWC9292D.		April	1992	Daily total incomming solar radiation (KJ/m^2) from Eppley pyranometer
C: Spreadsheets having insufficient data					
junsndc	HWC9292D.		June	1992	Daily cleaned snow depth (mm) with all questionable data removed
jultm	HWC9292D.		July	1992	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
jultxn	HWC9292D.		July	1992	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
julwsxwd	HWC9292D.		July	1992	Daily maximum wind speed (Km/hr) and direction of that maximum speed (deg)
julrad	HWC9292D.		July	1992	Daily total incomming solar radiation (KJ/m^2) from Eppley pyranometer
julsndc	HWC9292D.		July	1992	Daily cleaned snow depth (mm) with all questionable data removed
augtm	HWC9292D.		August	1992	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
augtxn	HWC9292D.		August	1992	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
augwsxwd	HWC9292D.		August	1992	Daily maximum wind speed (Km/hr) and direction of that maximum speed (deg)

DAILY PLOTS: Summer 1992 (April 1992 - September 1992)					
name:	Figure no.		Season/ Month	Years	Figure Caption
augrad	HWC9292D.		August	1992	Daily total incomming solar radiation (KJ/m²) from Eppley pyranometer
augsndc	HWC9292D.		August	1992	Daily cleaned snow depth (mm) with all questionable data removed
septm	HWC9292D.		September	1992	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
septxn	HWC9292D.		September	1992	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
sepwsxwd	HWC9292D.		September	1992	Daily maximum wind speed (Km/hr) and direction of that maximum speed (deg)
seprad	HWC9292D.		September	1992	Daily total incomming solar radiation (KJ/m²) from Eppley pyranometer
sepsndc	HWC9292D.		September	1992	Daily cleaned snow depth (mm) with all questionable data removed
6radtm	HWC9292D.		Summer	1992	Daily total incomming solar radiation (KJ/m²) from Eppley pyranometer and mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
X: eXoteric spreadsheets for internal use					
5rad	HWC9292D.		Melt Season	1992	Daily total incomming solar radiation (KJ/m²) from Eppley pyranometer
6battm	HWC9292D.		Summer	1992	Daily battery power (volts) and mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
4radtm	HWC9292D.		May - August	1992	Daily total incomming solar radiation (KJ/m²) from Eppley pyranometer and mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
5wsxtm	HWC9292D.		Melt Season	1992	Daily maximum wind speed (km/hr) and mean air temperature (deg) [(Tmax +Tmin)/2] from 207F probe in Gill screen

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1987: Re-surveying of the strain net at Agassiz Ice Cap, Field Work and Data Reduction April-May-June 1987. Contract Report to Polar Continental Shelf Project, Ottawa.

Wolfe, P.M.
1992: Suspended Sediment and Solute Transport in Hot Weather Creek, Fosheim Peninsula, Ellesmere Island, Northwest Territories, 1990-1991. B.Sc. Honours Thesis Department of Geography, Erindale College University of Toronto.

APPENDIX 1

EXTENDED BIBLIOGRAPHY HIGH ARCTIC Autostation area 1988-91

Alt, B.T.
1990: Climate; Abstract, Workshop on Arctic Observatory Sites, Geological Survey of Canada, November 1990.

A review of preliminary automatic weather station results from Hot Weather Creek and Agassiz Ice Cap.

Alt, B.T., Fisher, D.A., and Koerner, R.M.
1992: Climatic conditions for the period surrounding the Tambora Signal in ice cores from the Canadian High Arctic islands; in The Year Without a Summer? World Climate in 1816, (ed.) C.R. Harington; Canadian Museum of Nature p. 307-327.

Analyses core parameters (i.e., oxygen isotopes and melt layers) associated with Tambora volcanic signal and discusses synoptic analog for the period.

Alt, B., Labine, C., Headley, A., Koerner, R.M., Edlund, S.A.
High Arctic IRMA (Integrated Research and Monitoring ARea) automatic weather station field data 1990-91, Parts 1&3, Geological Survey of Canada, Open File 2562, Part 1 & 2, 101p., Part 3, 173p.

Presents standardized plots of the data from two High Arctic IRMA regional automatic weather stations for the period ending in the field season of 1991. Two accompanying volumes contain station descriptions and instrumentation details, data processing documentation including quality control notes, and extensive appendices of information of use to users of the data and to production of subsequent such reports.

Alt, B.J., Labine, C., Koerner, R.M., and Fisher, D.A.
1991: Developing techniques for Global Change monitoring of High Arctic Ice Caps (abstract); in Program with abstracts, Geological Survey of Canada.

Alt, B.T., Kuchin, V.A. and Maxwell, J.B.
1993: Investigations into the Applicability of the AARI Positive Anomaly Position Classification Catalogue to Mass Balance and Climate Change Studies in the Queen Elizabeth Islands. Canadian Climate Centre Report No. 93-5, pp. 25.

Shows that the 80 year catalogue of monnthly positive pressure anomalies produced by AARI can be used to study the interaction of atmospheric circulation with climate and paleoenvironmental indicators in the QEI particularly with regards to warm periods. Presents in appendix proposal for future joint GSC, AES, AARI reports and initiatives in the area of relating subjective and objective circulation classification to paleoenvironmental studies.

Alt, B.T. and Maxwell, B.

1990: The Queen Elizabeth Islands: A case study for Arctic climate data availability and regional climate analysis; in the Canadian Arctic Islands; Canada's missing dimension, Special Publication of National Museum of Natural Sciences, v. 1, p. 294-326.

A study of the regional climate of the Queen Elizabeth Islands defining the distinctive S-shape of the mean monthly climate patterns and identifying the intermontane region of Central Ellesmere Island. Gaps in the data network were identified. Alt carried out the climate work and prepared the manuscript.

Bourgeois, J.C.

1990: Seasonal and annual variation of pollen content in the snow of a Canadian High Arctic ice cap; Boreas, v. 19, p. 313-322.

The changes in pollen concentration in the snow of the Agassiz Ice Cap, during an eight-year period, are presented and tentatively related to climatic events during the same period. 'Cooperative work in the High Arctic IRMA', Bourgeois J. et al. GSC Forum, Jan., 1993, co-author.

Burn, C.R. and Lewkowicz, A.G.

1990: Canadian Landforms Examples-17: Retrogressive thaw slumps; Canadian Geographer, v. 34, no. 3, p. 273-276.

Duchesneau, M. and Jones, H.G., in press: LaCalotte de Glace Agassiz: profil physico-chimique et échange neige-atmosphere; The Musk Ox.

Edlund, S.A.

1989: Vegetation patterns assist in identifying potentially thaw-sensitive terrain on central Ellesmere Island, Arctic Canada; Abstract, in Proceedings, 40th Arctic Science Conference, Fairbanks, Alaska, 14-16 September 1989, p. 24.

This abstract covers a talk on the sensitivity of terrain underlain by massive ice bodies to periods of extended summer warmth, and suggests that vegetation patterns can help in delineating areas with such ice bodies.

Edlund, S.A.

1989: The coincidence of regional vegetation distribution patterns and summer temperatures in Arctic Canada; Abstract of Poster, in Proceedings, 40th Arctic Science Conference, Fairbanks, Alaska, 14-16 September, 1989, p. 53.

This abstract covers a poster, illustrating the detailed zonation of Canada's north that has been developed as a result of 15 years of mapping arctic vegetation. The utility of these zones for interpreting past climates from fossil plant remains was also demonstrated.

1989: Vegetation indicates potentially unstable arctic terrain; GEOS, v. 18, no. 3, p. 9-13.

This report describes the response of vegetation and geomorphic processes to warm dry summer of 1988 on Fosheim Peninsula, and suggests that some small, anomalous vegetation patterns may indicate the presence of massive ground ice, and therefore potentially unstable terrain.

Edlund, S.A.

1990: Arctic bioclimatic indicators, a key to understanding northern paleoenvironments; Abstract, GSC Forum of Activities, 1990.

This talk discusses the recently described vegetation zones in northern Canada, and how many species serve as bioclimatic indicators, and can be used to reconstruct climates from fossil records.

Edlund S.A.
1990: Woody plants as bioclimatic indicators in Arctic Canada; Abstract, in Proceedings, Symposium: Climate of Northern Latitudes: Past, Present and Future, University of Tromso, Tromso, Norway, April 2-4, 1990.

This abstract summarizes the 5 broad bioclimatic zones in Arctic Canada based on the growth form and plant community structures of tundra communities. The role of woody plants in this zonation scheme is emphasized.

Edlund, S.A., Alt, B.T., Harry, D.G., and Luckman, B.H.
1989: Plant distribution indicators of potential terrain instability (abstract); in Program with abstracts, Geological Survey of Canada, Forum 1989, Ottawa.

This presents a summary of unusual vegetation patterns which show potential at indicating the presence of regularly occurring, massive ground-ice melt. This work is based on field observations made by Edlund and Alt during summer 1988.

Edlund, S.A., Alt, B.T., Harry, D.G., and Luckman, B.H.
1989: Plant distribution indicators of potential terrain instability; Abstract, Geological Survey of Canada, Forum 1989.

This presents a summary of unusual vegetation patterns which show potential at indicating the presence of regularly occurring, massive ground ice melt.

Edlund, S.A., Alt, B.T., Harry,D.G., and Luckman, B.H.
1989: Plant distribution indicators of potential terrain instability; Abstract, Geological Survey of Canada Forum 1989.

This presents a summary of unusual vegetation patterns which show potential at indicating the presence of regularly occurring, massive ground-ice melt.

Edlund, S.A., Alt, B., Taylor, A.E., and Young, K.L.
1990: Multidisciplinary research in the intermontane zone, Ellesmere Island, N.W.T.; Poster, Geological Survey of Canada Forum 1990.

This poster describes the multidisciplinary nature of scientific work carried out at Terrain Sciences Global Change Observatory on Fosheim Peninsula.

Edlund, S.A., Alt, B.T., and Young, K.L.
1989: Interaction of climate, vegetation and soil hydrology at Hot Weather Creek, Fosheim Peninsula,

Ellesmere Island, Northwest Territories; in Current Research, Geological Survey of Canada, Paper 89-D, p. 125-133.

This paper documents the preliminary findings of the first year of a multidisciplinary study initiated on Fosheim Peninsula, 80°N. An unusually warm summer led to significant ground ice melting, as manifested by the recharge of creeks and thaw ponds, surface seepage, activation of active layer detachment slides and rapid headwall retreat of ground ice slumps. This paper also describes the preliminary regional vegetation zonation.

Edlund, S.A. , Alt, B.T., and Young, K.L.
1989: Vegetation, hydrology and climate at Hot Weather Creek, Ellesmere Island, Northwest Territories; Abstract, in Program, Canadian Committee on Climate Fluctuations and Man, Annual Meeting, Ottawa, Ontario, 25-27 January 1989, CCCFM Newsletter, v. 5, p. 65.

This abstract describes the 1988 activities in the Hot Weather Creek area, including vegetation studies, local regional climate, and some surprising geomorphic processes that were triggered by a warm dry summer.

Edlund, S.A., Alt, B.T., and Young, K.L.
1990: Multidisciplinary research in the intermontaine zone of Ellesmere Island, N.W.T. (abstract); in Program with abstracts, Geological Survey of Canada, Forum 1990, Ottawa.

The abstract describes the anomalously warm, well vegetated zone of the northeastern Queen Elizabeth Islands, and describes vegetation, climate, hydrology, and geomorphic process studies underway to document the impact of climate variability on the terrain around Hot Weather Creek.

Edlund, S.A., Woo, M.-K., and Young, K.L.
1990: Climate, hydrology and vegetation patterns, Hot Weather Creek, Ellesmere Island, Arctic Canada; in The Eight International Northern Research Basins Symposium and Workshop, Abisko, Sweden, v. 1, p. 8-23.

This paper summarizes the presentation at this Symposium in which the climate, vegetation and hydrology patterns found at Hot Weather Creek are summarized. It discusses the regional anomalous vegetation patterns (rich tundra communities in an area climatically defined as polar desert and semi-desert) and suggests reasons for this anomaly.

1990: Vegetation patterns, climate and hydrology at Hot Weather Creek,
Ellesmere Island, Arctic Canada; Journal of Nordic Hydrology, v. 15, no. 4.

This paper proposes the theory that there are two potential sources of moisture for major areas of Fosheim Peninsula in summer: precipitation and ground ice melt. These two sources vary in importance depending on the summer climate regime. They provide a fail-safe delivery system of moisture to vegetation on Fosheim Peninsular and permit a denser vegetation than precipitation alone could.

Edlund, S.A., Woo, M-K., Young, K.L., Alt, B.T., and Headley, A.N.
1991: Three years of environmental monitoring at GSC's Global Change Observatory, Hot Weather Creek, Ellesmere Island; Abstract, Geological Survey of Canada, Forum 1991.

This poster to demonstrates the multidisciplinary aspects of the Global Change Observatory project and the ongoing monitoring of climate and environmental responses at Hot Weather Creek, Ellesmere Island. It shows that this area is extremely sensitive to climatic change, even on a seasonal basis. Two dramatic geomorphic processes, the triggering active layer detachements slides and the rapid headwall retreat of ground ice slumps, are triggered by the very prolonged warm, dry summers when there is a deepening of the active layer sufficiently to melt the surface of buried ice bodies.

Egginton, P.A. and Hodgson, D.A.
1990: Preliminary assessment of selected drainage basins in western Fosheim Peninsula, Ellesmere Island, as sites for global change studies. in: Current Research, Part D, Geological Survey of Canada Paper 90-1D, p. 71-77.

This paper documents the depths along transects and July surface temperatures of four lakes on western Fosheim Peninsula. Holocene marine limit of western and central Fosheim Peninsula is also outlined.

Fisher, D.A. and Koerner, R.M.
1987: The effects of wind on $\delta(^{18}O)$ and accumulation give an inferred record of seasonal δ amplitude from the Agassiz Ice Cap. Ellesmere Island Canada; Bern Symposium on Ice Core Analysis, March/April 1987, Annals of Glaciology v. 10, p. 34-37.

Fyles, J.G.
1989: High terrace sediments of Neogene age, west central Ellesmere Island, Northwest Territories; In: Current Research Part D, Geological Survey of Canada, Paper 89-1D, p. 101-104.

This paper describes materials representing boreal forest to forest tundra environments from high terrace sediments. The macrofossils are compared to Kap Kobenhavn Fm. of N. Greenland and Beaufort Fm. Meighen and Prince Patrick islands.

Headley, A.
1990: A comparison of Wind speeds recorded simultaneously at three metres and ten metres above the ground, Canadian climate Centre Report No. 90-1. Atmospheric Environment Service Downsview, Ontario, 36 p.

This study examines the relationship between the wind speeds recorded at 3 metres and 10 metres, at Hot Weather Creek, Ellesmere Island. A mean variation of wind speed with height, based on a simplified form of Hellman's formula, is used to adjust the 3 m wind speeds to provide an estimate of 10 m speeds.

Hodgson, D.A.
1985: The last glaciation of west-central Ellesmere Island, Arctic Archipelago, Canada; Canadian Journal of EarthSciences v. 22, no. 3, p. 347-368.

This paper describes aspects of the late Pleistocene history of the region, and suggests that much of the Fosheim Peninsula was not glaciated during late Wisconsinan times.

Hodgson, D.A. and Edlund, S.A.
1978: Surficial materials and biophysical regions, eastern Queen Elizabeth Islands: part II; Geological Survey of Canada, Open File 501.

Map (1:125,000 scale) and extended legend of surficial materials and processes on Fosheim Peninsula.

Hodgson, D.A., St-Onge, D.A., and Edlund, S.A.
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Koerner, R.M.
1989: Queen Elizabeth Islands glaciers; in Chapter 6 of Quaternary Geology of Canada and Greenland, (ed.) R.J. Fulton; Geological Survey of Canada, Geology of Canada, no. 1, p. 464-473.

A review of all our ice core work to date reconciled to mass balance results. Also a brief review of the various velocity rates, ice thicknesses and properties of the Canadian High Arctic ice masses.

1989: Arctic ice cores: Putting present climate into perspective; in Arctic Islands, Canada's missing dimension; Syllogeus, National Museum of Natural Sciences.

Warmth of present climate is relative: cold wrt last 10 000 years, warm wrt to last 100 000 and 2000 years.

Koerner, R.M., Alt, B.T., Bourgeois, J.C., and Fisher, D.A.
1991: Canadian polar ice caps as sources of paleoenvironmental data: advantages and disadvantages, in Proceedings of Conference on "The Role of Polar Regions in Global Change", Alaska, June 1990. (in press).

The thin ice caps (100-600 m) provide simple drilling conditions for study of ice dynamics down a flow line and long period (100,000 yr.) climatic recrods with the restriction of poor resolution in ice more than 10,000 years old.

Koerner, R.M., Bourgeois, J.C., and Fisher, D.A.
1991: Canadian polar ice caps as sources of paleoenvironmental data: advantages and disadvantages; in Proceedings of Conference on 'The Role of Polar Regions in Global Change', Alaska, June 1990.

The thin ice caps (100-600 m) provide simple drilling conditions for study of ice dynamics down a flow line and long period (100 000 yr.) climatic records with the restriction of poor resolution in ice more than 10 000 years old.

Koerner, R.M., Dubey, R., and Parnandi, P.S.N.
1989: Scientists monitor climate and pollution from ice caps and glaciers; GEOS, v. 18, no. 3, p. 33-38.

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Koerner, R.M. and Fisher, D.A.
1990: Climatic warming, glaciers and sea level; Annals of Glaciology, v. 14, p. 345.

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Koerner, R.M. and Fisher, D.A.
1990: A record of Holocene summer climate from a Canadian high-Arctic ice core; Nature, v. 343, no. 6259, p. 630-631.

The concentration of summer melt layers in cores from the Agassiz Ice Cap gives evidence for maximum summer warmth in the early Holocene reaching its coldest level only 150 years ago. The modern warming is unique only in terms of the last 2000 years.

Labine, C.L.

"Arctic Meteorology and Climatology, Present State and Future Direction", Canada's Missing Dimension, Science and History in the Canadian Arctic Islands, Volume 1, Ottawa, Canadian Museum of Nature, 1990.

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1989: Active-layer detachments on the Fosheim Peninsula, Ellesmere Island: the importance of the summer of 1988. Canadian Association of Geographers, Ontario Division Conference, University of Guelph, October, 1989.

1990: Frequency and magnitude of active-layer detachments on the Fosheim Peninsula, Ellesmere Island: past, present and future. Abstract. 19th Annual Arctic Workshop, Institute for Arctic and Alpine Research, University of Colorado, March 1990.

1990: Morphology, frequency and magnitude of active-layer detachment slides, Fosheim Peninsula, Ellesmere Island, N.W.T. In: Permafrost-Canada: Proceedings of the Fifth Canadian Permafrost Conference, Quebec City, June 1990, Universite Laval, Quebec. p. 111-118.

1990: Active-layer detachments, Fosheim Peninsula, Ellesmere Island. Abstract, Canadian Association of Geographers, Annual Meeting, University of Alberta, June 1990.

1990: Climatic change and permafrost slope processes. Abstract; Canadian Association of Geographers, Annual Meeting. University of Alberta, June 1990.

1992: Slope hummocks on Fosheim Peninsula, Ellesmere Island; in: Current Research, Part B; Geological Survey of Canada, Paper 92-1B.

This paper describes the internal morphology of several types of slope hummocks in the Fosheim Peninsula region and attributes their origin to a combination of dessication cracking, wash processes, niveoeolian deposition and mass movement.

Luckman, B.H., Edlund, S.A., and Harry, D.G.

1988: Active-Layer detachments during late summer, 1988, Fosheim Peninsula, Ellesmere Island; CAGONT '88 Permafrost Abstracts; Programme and Abstracts, Annual meeting Canadian Association of Geographers Ontario Division, p. 13.

Abstract submitted and paper presented by Luckman. Describes the large number of geomorphic processes triggered by the unusually warm summer on Fosheim Peninsula, particularly active layer detachment slides.

Luckman, B.H., Harry, D.G., Edlund, S.A., and Alt, B.

1989: Global change, ground ice and geomorphic processes: some observations from the Fosheim Peninsula, Ellesmere Island, N.W.T., Canada; in Abstracts, 18th Annual Arctic Workshop, April 13-15, 1989, Global Environmental change and the Arctic, Lethbridge, Alberta.

This abstract summarizes work by Edlund, Alt, harry and Young on Fosheim Peninsula in 1988.

Luckman, B.H., Harry, D.G., Edlund, S.A., and Alt, B.T.
1989: Global change, ground ice and geomorphic processes: some observations from the Fosheim Peninsula, Ellesmere Island, N.W.T., Canada (abstract); in Abstracts, 18th Annual Arctic Workshop, April 13-15, 1989, Global Environmental Change and the Arctic, Lethbridge, Alberta.

This abstract summaries work by Edlund, Alt, Harry and Young on Fosheim Peninsula in 1988. Alt provided meteorological data and advice.

Peters, B. and Headley, A.
1992: A comparison of winds at Hot Weather Creek and Eureka, N.W.T. Canadian Climate Centre Report No. 92-2. Atmospheric Environment Service, Downsview, Ontario. 21 p.

Pollard, W.H.
1991: Observations on massive ground ice on Fosheim Peninsula, Ellesmere Island, Northwest Territories; in: Current Research Part E, Geological Survey of Canada, Paper 91-1E, p. 223-231.

This paper describes ground ice observations at 3 sites on Fosheim Pen. It describes some massive ice bodies and suggests that ice segregation during permafrost aggredation could be the primary process in thier formation.

Sutherland, P.D.
1984: A reassessment of Independence I: Some Observations from the Eureka Upland, High Arctic Canada.

Abstract of paper presented at the 17th Annual Meeting of the Canadian Archaeological Association, Victoria.

1989: An inventory and assessment of the Prehistoric Archaeological resources of Ellesmere Island National Park Reserve. In Press. Canadian Parks Service.

1990: A piece of the Palaeoeskimo Mosaic: Continuity and Change on Northern Ellesmere Island.

Abstract, Paper presented at the 23rd Annual Meeting of the Canadian Archaeological Association, Whitehorse, Yukon.

Waddington, E.D., Fisher, D.A., and Koerner, R.M.
In press: Microclimate at Agassiz Ice Cap Ellesmere Island, and implications for ice core studies; American Geological Union.

This paper deals with the "unusual" 10 m firn temperatures at the top of the Agassiz ice cap. Normally they reflect the mean annual air temperature but on Agassiz there is more a complexes pattern with the warmest temperatures near the top where they should be coldest. In addition to the mean annual temperature there are three possible processes at work. These are discussed and present and future automatic measuring described.

Wolfe, P.M.
1992: Suspended Sediment and Solute Transport in Hot Weather Creek, Fosheim Peninsula, Ellesmere Island, Northwest Territories, 1990-1991. B.Sc. Honours Thesis Department of Geography, Enndale College University of Toronto.

Woo, M-K., Young, K.L., and Edlund, S.A.
1990: 1989 observations of soil, vegetation and microclimate and effects on slope hydrology, Hot Weather Creek basin, Ellesmere Island, N.W.T.; in Current Research, Geological Survey of Canada, Paper 90-1D, p. 85-94.

This paper describes the effects of the slightly cooler than normal and extremely west summer of 1989 had on soil hydrology and vegetation at the Hot Weather Creek site. Vegetation, site and methods descriptions written by Edlund.

Woo, M-K., Edlund, S.A., and Young, K.L.
1991: Occurrence of early snow-free zones on the lowlands of Fosheim Peninsula, Ellesmere Island, Northwest Territories; in Current Research, Geological Survey of Canada, Paper 91-1D, p. 9-14.

This paper describes the appearance of snow-free areas on Fosheim Peninsula, Ellesmere Island in early May 1990, shows how these areas are detectable on NOAA satellite imagery, and describes the monitoring of the active layer development throughout the summer in areas within and outside a major snow-free zone. Vegetation at the sites is also compared.

Woo, M-K, Rowsell, R.D. and Edulund, S. A.,
1993: Effects of manipulations of climate factors on arctic snowmelt. Proceedings 9th International Northern Research Basins Symposium Workshop, NHRI: Symposium No. 10, p 627-641

APPENDIX 2

INSTRUMENTATION TECHNICAL SPECIFICATIONS

MODEL HMP35CF VAISALA PROBE

TEMPERATURE AND RELATIVE HUMIDITY PROBE

1. GENERAL

The Model HMP35CF probe contains a Vaisala capacity relative humidity sensor and the YSI 44002A thermistor. The probe is designed to be housed in the 41002-2 12 Plate Gill Radiation Shield, or equivalent; a ten foot lead length is standard. Longer lead lengths are available up to 1000 feet. Voltage drop in the longer lead lengths will lower the RH reading by approximately 0.6% RH per 100 feet of cable. Do not extend lead lengths by adding wire to the pigtail (connection) end or measurement errors will result.

2. ACCURACY - TEMPERATURE SENSOR

The overall sensor accuracy is a combination of YSI's interchangeability specification, the precision of the bridge resistors and the linearization error (Figure 1). In a "worst case" example, all of the errors add in one direction to yield a ± 0.4°C accuracy over the range of -53°C to +48°C. NOTE: It is emphasized that this is "worst case" and is CSC's experience the overall accuracy is typically better than ±0.2°C.

The major error component is the ± 0.2°C thermistor specification. Although the thermistor interchangeability is typically better than this, any existing error is predominantly offset and can be determined with a single point calibration. The error can then be compensated for by entering an offset in the measurement instruction.

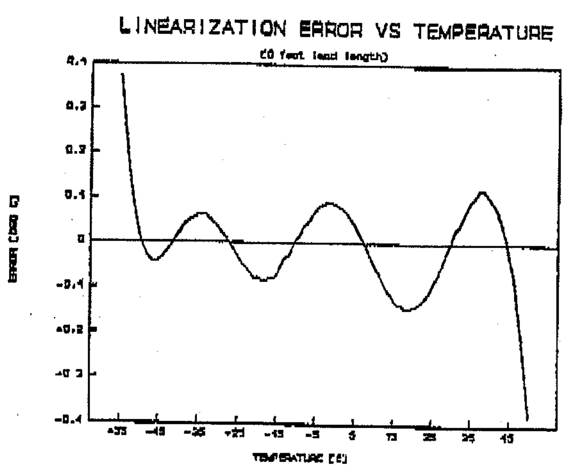


FIGURE 1. Temperature Probe Polynomial Error Curve (0 ft lead) Linearization Range from -55 to 50°C

The bridge resistors are 0.1% tolerance with a 10ppm temperature coefficient.

3. RH SENSOR - SPECIFICATIONS

The following relative humidity sensor specifications are provided by Vaisala, Inc.

TABLE 1. RH Sensor Specifications

Measurement Range	0 to 100% RH
Output Signal Range	0.002 to 1VDC
Accuracy (at 20°C, including nonlinearity and hysteresis	
against factory references	± 1% RH
against field references	± 2% RH, 0 to 90% ± 3% RH, 90 to 100%
Temperature dependence	± 0.04% RH/°C
Typical long term stability	better than 1% RH per year
Response time (at 20°C, 90% response)	15 s with membrane filter
Settling time	0.15 s
Supply voltage (via CSI switching circuit)	12 VDC
Current consumption	≤ 4 mA
Operating temperature	-20 to +60°C

4. WIRING

Connections to the datalogger for the HMP35CF are shown in Figure 2. The probe requires two single ended analog measurements, the green (RH) and the orange (temp.) leads can be inserted into either HI or LO inputs.

The black thermistor excitation lead connects to any excitation channel. The yellow lead is used to control switching 12 volts to the relative humidity sensor and is normally connected to an excitation channel, although a control port could be used with a different program in the datalogger. The number of HMP35CF probes per excitation channel is physically limited by the number of lead wires that can be inserted into a single excitation terminal (approximately ten).

TABLE 2: COEFFICIENTS FOR USE WITH 22 AWG CABLE

(For use with 107F SN C1233 and greater, all HMP35CF and all 207F sensors)

LEAD LENGTH (feet)	CABLE RESISTANCE (ohms)	COEFFICIENTS C0	C1	C2	C3	C4	C5
10	0.30	-74.146	645.35	-3837.9	16039	-34037	29809
25	0.75	-74.154	645.68	-3842.1	16065	-34108	29885
30	0.90	-74.157	645.78	-3843.4	16073	-34130	29909
35	1.05	-74.159	645.87	-3844.6	16081	-34152	29933
50	1.50	-74.168	646.22	-3848.9	16107	-34225	30009
75	2.25	-74.181	646.76	-3855.7	16149	-34341	30134
100	3.00	-74.194	647.28	-3862.4	16191	-34458	30258
125	3.75	-74.207	647.81	-3861.9	16232	-34573	30383
150	4.50	-74.221	648.34	-3875.8	16274	-34691	30508
175	5.25	-74.235	648.88	-3882.7	16317	-34810	30636
200	6.00	-74.248	649.41	-3889.5	16359	-34927	30762
225	6.75	-74.261	649.94	-3896.3	16401	-35045	30889
250	7.50	-74.276	650.51	-3903.4	16446	-35168	31020
275	8.25	-74.289	651.04	-3910.2	16488	-35287	31148
300	9.00	-74.301	651.55	-3916.8	16529	-35403	31274
325	9.75	-74.316	652.10	-3923.8	16573	-35525	31405
350	10.50	-74.329	652.64	-3930.7	16616	-35646	31535
375	11.25	-74.343	653.20	-3937.8	16660	-35768	31666
400	12.00	-74.356	653.73	-3944.6	16703	-35888	31796
425	12.75	-74.369	654.26	-3951.4	16745	-36009	31926
450	13.50	-74.384	654.83	-3958.8	16791	-36135	32061
475	14.25	-74.397	655.35	-3965.4	16833	-36254	32191
500	15.00	-74.410	655.89	-3972.3	16876	-36376	32323

TABLE 3: Temperature VS Thermistor Resistance for YSI44002A

° C	OHMS						
-56.0	13170.0	-32.0	3400.0	-4.0	919.0	24.0	310.8
-54.0	11650.0	-30.0	3069.0	-2.0	844.8	26.0	289.7
-52.0	10330.0	-28.0	2775.0	0.0	777.5	28.0	270.3
-50.0	9171.0	-26.0	2512.0	2.0	716.3	30.0	252.4
-48.0	8158.0	-24.0	2276.0	4.0	660.6	32.0	235.9
-46.0	7270.0	-22.0	2068.0	6.0	609.9	34.0	220.6
-44.0	6489.0	-20.0	1880.0	8.0	563.6	36.0	206.5
-42.0	5803.0	-18.0	1712.0	10.0	521.5	38.0	193.4
-40.0	5198.0	-16.0	1561.0	12.0	482.9	40.0	181.4
-38.0	4663.0	-14.0	1424.0	14.0	447.6	42.0	170.2
-36.0	4191.0	-12.0	1302.0	16.0	415.4	44.0	159.8
-34.0	3772.0	-10.0	1191.0	18.0	385.8	46.0	150.1
		-8.0	1091.0	20.0	358.6	48.0	141.2
		-6.0	1001.0	22.0	333.7	50.0	132.9

```
02: P   55        Polynomial
 01:     1        Rep
 02:     1 *      X Loc Air Temp.
 03:     1 *      F (X) Loc [Air Temp.]
 04: ???? ****    C0
 05: ???? ****    C1
 06: ???? ****    C2
 07: ???? ****    C3
 08: ???? ****    C4
 09: ???? ****    C5

03: P    4        Excite, Delay Volt(SE)
 01:     1        Rep
 02:     5 ***    5000 mV slow Range
 03:     2 *      IN Chan
 04:     2 *      Excite all reps w/EXchan 2
 05:    15        Delay (units .01 sec)
 06: 5000 ***     mV Excitation
 07:     2 *      Loc [RH   ]
 08:    .1        Mult
 09:     0        Offset
```

* Proper entries will vary depending on the program and datalogger channel usage.

** On CR10 the 250 mV input range and 250 mV excitation with a multiplier of 0.002 are used. On CR7 program like the 21X except for range code of 6 instead of 4 and specify card numbers.

*** On CR10 the 2500 mV input range and 2500 mV excitation are used.

**** Refer to Table 2 for coefficients.

6. MAINTENANCE

The HMP35CF Probe requires minimal maintenance. Monthly, check to make sure the radiation shield is free from debris. The screen on the sensor should also be checked as often. Annually, check the calibration of the probe. (It should be sent to Campbell Scientific Canada Corp. when recalibration is required and facilities to do so are unavailable.)

COMPENSATION FOR ERROR DUE TO LEAD LENGTH

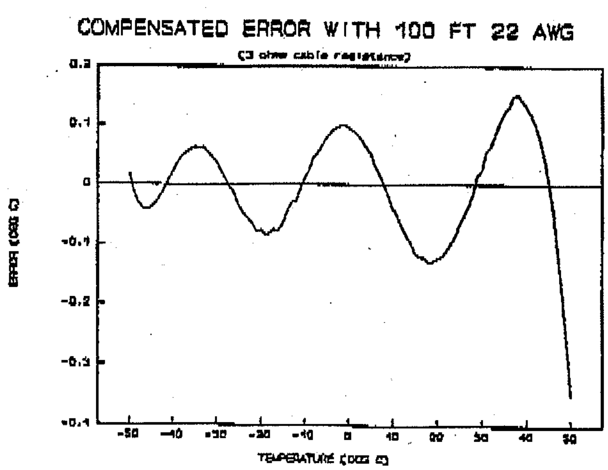


Figure 3: Compensated Error (100 ft 22 AWG)

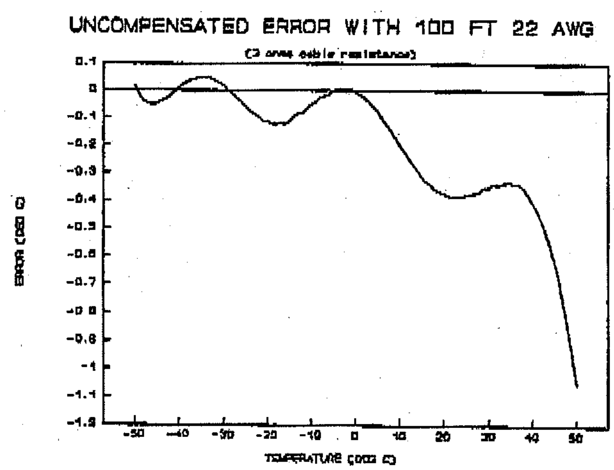


Figure 4: Uncompensated Error (100 ft 22 AWG)

APPENDIX 3

PROCEDURES FOR DATA REDUCTION

revised March 1994

1) Continued development of procedures for quality control, documentation and presentation of data in cooperation with GSC TSD and AES as well as university and industry users

Revise procedures for the cleaning and organizing of the High Arctic field camp Autostation (AWS) data to reflect new problems, techniques and other insights gained during processing of the current years field data. The final version of this report will serve as documentation of the field protocol for high arctic field camp autostation data processing.

NOTE: These protocols are not to be considered official AES quality control techniques but rather a first step in making the logger data available to field camp users. Official AES Quality Control procedures will be developed by AES CCC to be applied to the data before it is incorporated into the Canadian Meteorological Data Archive.

CAUTION and field camp common sense must be applied to all data produced by the following procedures.

PROGRESS NOTES will be added as revisions are made to indicate the status of various development and collection phases of the program.

Output: Report
File: **PROMMYY.AP3 (PROMMYY.DFT)**
Use: Protocol for Field Camp AWS Data Processing

2) Documentation of logger programs, logger output array elements, sensors, sensor deployment, station description, SPLIT.PAR files, data quality problems, data file names, data and plot file formats, QPRO macros and all other useful information.

PROGRESS NOTE: For report 2 the documentation information has been placed into the following individual files which appear as units of the report and will be available for release as file to accompany the data files.

a) The **.STN** file : Compile complete station descriptions following guide lines set out by AES where possible. Note availability of photos. Store this information in **.STN** file and include in the draft report.

b) The **.NTS** file: Assemble all instrumentation information regarding the site for the current years data. This should include the make and model of all sensors, information on their deployment if non standard (ie. height of wind sensors), additions to the power source (ie extra batteries) and any other information which might be necessary to study anomalies in the data etc. Add any visual comments on condition of instrumentation or site before data dump (ie., sensor icing, drifting around instrumentation or obvious damage). Similarly note the change in height and depth of sensors due to snow accumulation at ice cap stations. Note also availability of photos of site conditions etc.

c) The **.ARR** and **.LWP** files Assemble and print **.DLD** files from beginning of dump period (ie., from previous season's field documentation - Y1) and where these do not exist recreate them as far as possible. Compare **.DLD** file dumped at time of data dump (Y2) to that in of Y1 and to the dumped data as it appears in **.DAT** file. Record any inconsistencies in the **Y2.DLD**. Make "Output Array Definitions" from **Y2.DLD** into file **.ARR**. Include the remaining information in the **Y2.DLD** file under the heading "Logger Wiring and Programming" **.LWP** for Appendix 6.

d) The **.DQM** file: Document QPRO data handling and plot macros libraries (_____**MCO.WQ2**) giving a brief description of use. WP macro libraries may also be created for production of the report.

The Documentation files will also include the following tables and notes produced during the data reduction process.

- **.PAR** The SPLIT parameter tables captured from **.PAR** files used to split data
- **.SOD** The table of split and organized files
- **.DQC** The quality control notes for all data and spreadsheet files consolidated from all steps of the data reduction and presentation process
- **.PMT** The tables of file and parameter formats for **.WQP,.WQF,** graph data files
- **.PM9** The table of parameter formats to accompany **.WQ9 (.PR9)** final cleaned data files
- **.PLT** The table of plots available in various spreadsheets

Output: Documentation Files
File: **STN.STN, STNY1Y2.DLD, .NST,. ARR and .DQM**
Use: In production of data report and as a files to accompany data file release

3) Initial documentation and consolidation of data dumped from remote tundra and ice cap stations.

From Module or Logger .DAT files

a) Consolidate the various **.DAT** files into one file for the whole period since the last normal (major) data dump (using Word Star or other applicable editor which does not add any characters or change the **.DAT** file). There should be only one **.DAT** file between maintenance visits (ie., the time at which changes are made to logger program or sensors) regardless of how often the data has been dumped during that period.

b) Store these combined **.DAT** files permanently as the original logger data and document beginning and end dates (YY,DD(CST),JJJlogger,HHMM) as notes accompanying the **.SOD** file.

Output: Consolidated logger data files
Files: **STNY1Y2.DAT**
Use: For SPLIT into manageable files and for reference to original logger data condition.

4) SPLIT, initial cleaning, calibration and standardization of data format of consolidated logger .DAT files to produce initial .PAR files for import into QPRO spreadsheet.

From Consolidated logger data files

a) Use the relevant SPLIT **.PAR** files documented in the **.PAR** file for the same station for the previous year or in the case of a new station choose the example which most resembles the new station. These **.PAR** files perform the following:

i) Extract hourly (**h**) or daily (**D**) data for each calendar year (ie. dump to end December and January to dump). See NOTE on SMALL RAM. Months begin on the first day (eg., 1 January) at 0700 UCT which is 0100 CST and end at 0600 UCT or 0000(2400) CST (or when data ends).

ii) Add year. Translate logger julian day into MM/DD in CST for **D** and **C** files (the **h** file is already so big that it is not practical to add parameters). Leave logger julian day and HHMM in logger time (eg., for HWC that is UMT and for AGA it is CST). See NOTE: TIME for table of local and universal times.

iii) Put YY/(MM/DDCST)/JJJlogger(/HHMM)/ and blanks where observations are missing (see NOTE: BLANKS) and document missing periods in **.DQC**.

iv) Check for out of range values and replace with blanks (see NOTE: Blanks). Range delimiters are used can be ascertained from **.PAR** table. Document out of range values in **.DQC** file.

v) Organize the parameters into the following format:
"YY/(MM/DD)/JJJ/(HHHH)" then the parameters in the order they appear in the 1990-91 record with additional parameters added to the file as needed and blanks entered in the columns of parameters no longer recorded. Thus the number of columns may increase each time a new season's data is processed (this will not necessarily be in chronological order). The format of the parameters will be different for each station (STN). The format for each station will be updated in the .PMT table of the **STNY1Y2.DOC** file each year (see 2 above).

vi) Apply any calibration factors not included in logger programming (eg.,correction for misaligned wind vane, conversion to standard units; °C, KM/HR,mm,etc)

<u>b) Save these Initial **.PRN** files</u> as **ISTNYYhx.PRN** and **ISTNYYDx.PRN** where **x=A** indicates the start of the calendar year, Jan-dump, and **B** indicates the end of the year, dump-Dec. **D** indicates daily data and **h** indicates hourly data where **H** = one hourly, **6** = six hourly, **3** = three hourly and **Z** = twelve hourly. (For computers with RAM less than 4MB see NOTE: Small RAM).

<u>c) Capture **.PAR** files</u> The SPLIT parameter files can be printed as shown by capturing a Print Screen of the file; otherwise, the entire file would have to be typed into the report. The capture feature of the Novell network system was used for this. The capture command is issued to capture output from the computer to the printer port while doing a Print Screen command. This then generates a file which can be incorporated into the text.

Output: **Initial Raw SPLIT Data** (by dump and year)
Files: **ISTNYYhx.PRN and STNYYDx.PRN**
Use: internal only, and to be used in next step

5) <u>Further cleaning and partitioning</u> of data by importing into QPRO spreadsheets. From quick plots, identification and elimination of obvious periods of sensor malfunction and environmental problems such as icing, animal damage and snow accumulation. From the cleaned hourly data, calculation of daily values.

<u>a) Import Initial Raw SPLIT.**PRN** files</u> into Initial QPRO spreadsheet called **ISTNYYnx.WQ1** and for each spreadsheet carry out the following.

i) Replace all " ' " from the **.PRN** files by real blanks.

ii) Do a quick plot of each parameter to look for obvious instrument problems.

iii) Replace sections of obviously questionable data with blanks and document in **.DQC** file. See Appendix__ for guide lines on what problems to look for.

iv) Where possible correct data by hand based on knowledge of specific problems such shading of pyranometer at low sun angle by anemometer, etc. Document changes in **.DQC** file.

v) Save these Revised spreadsheets and quick plots as **RSTNYYnx.WQ1**

b) For **Daily** data, eXtract files from these Revised daily spreadsheets files by six month seasons (s) and calendar year (**YY**). The six month seasons are summer (s = **S**) defined as April to September and winter (s = **W**) defined as October to March. This will give the following files for data dumped in the spring or summer:

B	dump - September
A	October - January
B	January - March
A	April - dump

These partitioned spreadsheet files **pSTNYYsD.WQ1** where **p**= **A** or **B** as shown above will be used to create six month spreadsheets (see next section) for plotting and final data examination. This is accomplished by combining:

a) the winter spreadsheets **A** and **B** to make the six-month winter spreadsheet
b) the **B** file of **Y1**, the first year of the current data being processed, with the last file of the previous years data to make a complete summer six-month file for year **Y1**.
c) the **A** file for **Y2** will eventually be combined with the subsequent data years first file to make a complete six-month spreadsheet for **Y2**; in the mean time the second half of the **Y2** summer will be left blank

for example:

STN9090D.WQP { **ASTN90SD.WQ1** -previous data year

BSTN90SD.WQ1 - **Y1** of present data year }

STN9091D.WQP { **ASTN90WD.WQ1**
BSTN91WD.WQ1 - **Y2** of present data year }

STN9091D.WQP { **ASTN91SD.WQ1**

BSTN91SD.WQ1 -subsequent data year }

c) For **hourly** data, eXtract files from the Revised spreadsheets as months **hSTNYYMM.PRN** where **h**= **(H,6,3,z)** for whole months and **A** or **B** for partial months.

d) Produce Calculated daily files from hourly (six hourly) Revised spreadsheets by the following steps:

i) Print to File the hourly (six hourly) spreadsheet as **RSTNYYhx.PRN**

ii) Run SPLIT to calculate mean, total, max and min values of the hourly (6 hourly) values (where appropriate). Use the examples of **STNYYxC.PAR** files given in SPLITPAR table as guidelines. Put the **ISTNYYxC.PRN** files created by this SPLIT run into spreadsheets **ISTNYYxC.WQ1**.

iii) Partition these spreadsheets into "summer" and "winter" as in (b) above with the names **pSTNYYsC.WQ1**.

iv) Capture SPLIT **.PAR** files for SPLITPAR table and document in **STNY1Y2.PAR**.

<u>d) Save the cleaned Revised spreadsheets</u> **RSTNYYhx.WQ1, RSTNYYxC.WQ1** and **RSTNYYDx.WQ1** until the final plots and data examination has been done after which they can be deleted.

<u>e) Save the hard copy</u> of the quick plots.

Output: **Partitioned Revised Cleaned Data**
Files: **pSTNYYsn.WQ1, pSTNYYsn.WQ1,** where **n= D** or **C** ;
and **hSTNYYMM.WQ1, xSTNYYMM.WQ1**
Use: internal only for copying into graph data spreadsheet templates

<u>6) Creation of standardized spreadsheets and preliminary plots</u> of the partitioned revised data by incorporation into monthly templates of (h) hourly and six month season templates of (D) daily and (C) calculated spreadsheet files.

PROGRESS NOTE: Detailed documentation of the steps involved in executing the following procedures are presently being developed and tested. The first version of STEPS will be included in the 9394 data report.

<u>a) Use spreadsheet templates,</u> **STNSSSnv.WQT and .WQE**, created at the end of the previous years data processing. Set up these templates for the current year and copy the partitioned revised cleaned data from the spreadsheets **pSTNY1Y2n.WQ1** and **hSTNYYMM.WQ1** to create spreadsheets containing standardized graphs in the following manner.

i) Change the year (month) information in the label template **.WQE** and copy this into the graph data template **.WQT**. Save these as **STNY1Y2n.WQB &.WQP** and **STNYYMMh.WQB & .WQP** respectively. Fill the "date number" , (HH/DD/MM/YY will fill automatically), CST Julian day and UCT julian day in **.WQP** the graph data spreadsheet using macros.

ii) Modify the template to include new parameters added in the current year. This may involve moving the columns of 0s, 180s and Blanks used as base lines in the plots to make room additional data columns.

iii) Copy the data into the graph data spreadsheet (see NOTE for small RAM). In the case of partial months or six month periods first data record must be positioned in exactly the correct cell in the graph data spreadsheet. It can not be moved after copying as this will mess up the graphs. Rather, erase the whole data portion of the file (being careful to get it all but not the baselines) and recopy in the correct location. Portions of months or six month periods from previous dump years are to be combined at this stage to make full a month or six month file. Where part of a month is not available leave blank.

iv) Check that the "date number" and generated CSTJJJ/HH/DD/MM/YY/UCTJJJ match the logger dates, taking account of the time programming of that station. Correct any misalignments by recopying the misaligned data (not by moving the data). Examine the data for problems and blank any calculated values obtained from missing data (eg., Tmean calculated from Tmax and Tmin). Document any changes in **.DQC**.

v) Set up PARTBL the table of parameters and check.

vi) Copy GRAPHTTL and GRAPHPAR the graph title and graph parameter tables as values into **.WQP** from the label file **.WQB**

vii) Create graphs for new parameters being careful to start with the appropriate existing graph as a base to ensure size, scale and title compatibility. Make necessary changes to GRAPHPAR, GRAPHTTL and PLOTLIST (list of plots and captions) blocks in the graph data and label spreadsheets.

viii) Copy the PLOTLIST table as values into **.WQP** from the label file. Check each graph using the Slide feature. Sort the PLOTLIST block to put any empty graphs (due to missing data) at the end of the list after the heading "B:Graphs available in spreadsheet but not filled".

<u>b) Plot draft copies of all graphs</u> and create accompanying WP tables as follows:

i) Plot all the graphs which contain any data in landscape orientation on dot matrix printer with same scaling as the Glaciology Section HP Paint Jet Printer (such as the Fujitsu dot matrix printer in Epson FX80/100 mode). (Step 18)

ii) Import the PARTBL and PLOTTBL named blocks from the graph data spread sheet into Word Perfect as tables.

iii) Examine graphs for data problems such as screen heating, stabilizing of newly installed thermistors (snow or ground), testing and dig out periods not identified by first data validity check etc.

iv) Examine tables PARTBL and PLOTTBL for errors.

<u>c) Circulate plots and tables</u> in form of draft Report to other authors and to field camp personnel (ie., Koerner, Edlund and Headley etc) for comment on plot format, data reliability, and other problems. Compare **h, D** and **C** plots. Choose plots to be released in Open File Report based on feedback from draft Report. Keep the full set of graphs, with notes on suggested changes, for internal use and future reference. Make any necessary changes to data (eg., remove daily values where hourlies were missing), graphs (eg.,scale changes) or tables (eg., changes of instrumentation or units). Save these working spreadsheets as **STNYYMMh.WQP and STNY1Y2n.WQP** for internal use.

<u>d) Make new templates</u> if any changes or additions were made to the spreadsheets. These could include new parameter columns, new graphs, changes to headings or other refinements of the spreadsheet. (Step 22-23)

Output: **Preliminary graph data spreadsheets and draft plots**
Files: **STNY1Y2n.WQP,& .WQB** and **STNYYMMh.WQP,& .WQB**. (new templates if needed **.WQT & .WQE**)
Use: For internal use. Plots circulated internally with draft Report. Data (**.WQP**) can be released internally prior to completion of reviewed Open File Data Report to people having a connection with the project. Draft plots could be used as is for analysis or be prettied up for quick publications or Forum posters.

7) <u>Release of Final Cleaned Data</u> as graph data spreadsheets, ASCII files and plots for analysis by users.

<u>a) Create spreadsheet of final cleaned field camp data</u> by the following steps.

i) Eliminate <u>all</u> questionable data based on careful examination and on comments from circulating the draft plots as in 6c above. Be over cautious. Replace with blanks.

ii) Do not use average vector wind directions except as 2 minute spot readings.

iii) Eliminate vegetation temperatures from HWC final spreadsheet until screen problems are solved. Use Gill Screen air temperatures to ensure standardization (even though other screens may indicate lower radiation heating).

iv) Document snow temperatures which are at changing depth. Document decreasing height of screen temperatures on ice caps due to snow accumulation. If can not accurately document remove from final spreadsheet.

v) Document snow depth measurement problems. Remove further data if necessary.

vi) Other questionable data such as RH values which follow the TEMP exactly or mirror it exactly should be discussed in the Data Report.

vii) Document everything in **.DQC** table in **STNY1Y2.DOC** file.

b) Prepare final parameter format and plot list tables to accompany data as PARTBL(9) and PLOTTBL in **.DOC** and for open file report.

i) Check the PARTBL in **.WQP** and recreate if any changes were made to graph legends or column headings in 6c or 7a above.

ii) Create a new or amend the appropriate existing **.PMT** file in Word Perfect. This **.PMT** will include all the graph data files and templates so far created that have the same format and parameter list. From this **.PMT** create **.PM9** to go with the **.WQ9 & .PR9** data files by removing the appropriate columns from the parameter list and the named blocks from the Format description and changing the file names appropriately.

iii) Reassign priorities to plots based on the examination in 6biii above and feedback from the draft plots. Re-sort the plot list block. Place heading "B:Plots available in spreadsheet but not printed" before the plots which because of problems, duplication or lack of interest from users are not to be plotted in the final open file report. Place "C:Graphs available in spreadsheet but not filled" before the graphs for which there was no data in this particular data set.

iv) Put figure numbers in the plot list up to the end of the plots to be printed for the open file report. The plots just listed (ie after the "B:.." will not be assigned numbers.

v) Create table of list of plots for each graph data spreadsheet by importing PLOTTBL into Word Perfect as a table (file **.PLT**) and adjusting the column size and making any other changes necessary to produce a table suitable for publication.

c) Create the final cleaned spreadsheets and the supporting label files by eXtracting as values from **.WQP & .WQB** to files **STNY1Y2n.WQF & .WQL** and **STNYYMMh.WQF & .WQL**. Be sure to include whole file (ie., out past base lines and down to table of named blocks. (Step 24)

d) Create ASCII data file from final cleaned spreadsheets (**.WQF**). Replace blanks with -9999 in the data portion of the final spreadsheets to get a completely numeric file **.WQ9**. Print to File this spreadsheet to get **.PR9** an ASCII file for use in FORTRAN and PASCAL programs and future runs of SPLIT.

e) From **D, C and h .QWF** files plot standardized parameter graphs on the following time scales. Ensure that both vertical and horizontal graph dimensions and scale intervals match within a time scale (although the ranges of the y-axis may have to vary from station to station and month to month). This will allow visual comparison of plots on a light table. Plot only on one side of the paper. Bind plots along the top of the graph (printed in landscape). Use HP Paint Jet printer. Print in colour and the photocopy for best definition of lines.

i) **D,C** six month time series (with comparison to AES stations where appropriate)

ii) **D,C** melt season and field season time series (including multiple station plots where appropriate)

iii) **D,C** monthly time series (each month for at least May - August) and **h** monthly time series (initially only May- August but each month of year if there is a demand)

Output: **Final Cleaned Data files and Standardized Plots of these data**
Files: **STNY1Y2n.WQF, .WQL, .WQ9 & .PR9** and **STNYYMMh.WQF, .WQL, .WQ9 & .PR9** and WP files **STNnv.PMT & STNY1Y2n.PLT, STNYYMMh.PLT**
Use: Final cleaned graph data files for release along with documentation **.DOC, .DST and .PMT**. Standardized Plots for Open File Data Report accompanied by **.PLT** tables. Plots in the **.WQFs** can also be prettied up and used in publications (with appropriate reference to GSC Open File)
Note: These data cannot be viewed as AES quality controlled data but can be used with care and common sense by field researchers.

8) Climate calculations on final cleaned data ; including basic diurnal, monthly and annual mean

From Final cleaned ASCII (.PR9) files

a) Calculate monthly diurnal means, monthly means and totals and annual means and put into file **STNCn.PRN**. Use format YY/12 monthly means (totals) /annual means (totals). In each subsequent season add to this file in chronological order (beginning in 1988).

b) Put **STNCn.PRN** into **MEAN** template and plot time series of monthly and annual values

Output: **Climate Data (by station and n)**
Files: **STNCn.PRN**
Use: Presentation as tables and graphs

9) Preparation of field camp data report including station descriptions, lists of available data parameters and data files, documentation of all steps in data processing, graphical presentation of data, tables of climate calculations, update of procedure report and recommendations for following field season servicing and sensor replacement. Where appropriate comments on the data plots can also be included.

The general format of the report will undergo change as the procedures are developed and as the quantity of data increases. The draft report prepared by the principal author(s) will contain the draft copies of the graphs based on the **.WQP** preliminary files and the documentation of the data reduction procedures 2-5 above. This will be circulated to the other authors for their contributions and comments and to allow their input into the final choice of plots to be included in the Open File Report. When the procedures and graph templates become more complete it will be possible to produce the draft report soon after the end of the field season. However in the development years the target date for the draft report will be the end of the fiscal year with the Open File ready by the end of the summer.

SMALL RAM: If a full season dump is being processed on a field computer with less than 5MB RAM the **h** file will have to be further SPLIT to avoid a file too big to import into the spreadsheet in the next step. This SPLIT should be along the lines: dump-Sept (**A**), Oct-Dec (**AA**), Jan-Mar (**BB**) and Apr-dump (**B**).
In loading the data spreadsheets into the templates it may be necessary to use the Tools Combine feature rather than opening the data spreadsheet and copying from it into the template.
BLANKS: When blanks are entered from SPLIT they appear in the **.PRN** file as" " when TYPEd or looked at in Word Star or other word processing program. When imported into a QPRO spread sheet they look like blanks in the body of the spread sheet but are actually a single quote"'". This "'" is plotted as a blank but it is counted as zero not as missing in functions such as @AVG giving an incorrect answer. These "'" s must be replaced in the spread sheet file. They have to remain in the **.PRN** file however because otherwise it is imported all crooked (ie. everything moves over into the blanks). Before exporting the files to ASCII **.PR9** files for use in FORTRAN , PASCAL or other languages the blanks must be replaced by a number like -9999.

APPENDIX 4

ABREVIATIONS AND ACRONYMS

STATION AND SITE NAMES

general

STN	station name one for each climate or regional scale autostation
(STE)	site name to further define location of autostation or to define a subsidurary instrumented or manned observation site

specific field stations

AGA	Agassiz Ice cap main regional autostation
AGA(A77)	Agassiz Ice Cap 1977 Bore Hole Site
HWC	Hot Weather Creek main regional autostation
HWC(AWS)	Hot Weather Creek Automatic Weather Station Site on plateau above camp: first and most complete autostation
HWC(CMP)	Hot Weather Creek Camp site location of PCSP weather reports
HWC(RBP)	Hot Weather Creek RBR logger in pond near AWS
HWC(RBC)	Hot Weather Creek RBR logger in Camp mini screen
HWD	Hot Weather Creek Divide main regional autostation

specific permanent weather stations

EU	Eureka
IC	Isachsen
LT	Alert
MD	Mould Bay
RB	Resolute Bay

SEASONS

6 summer	six months April to September
6 winter	six months October to March
5 melt season	15 May to 15 September
5 dark season	15 November to 15 February
4 summer field	May to August

PARAMETERS

graph names	graph legends	graph titles	SS headings	
t	Tsamp	TEMP		sampled temperature
t ta	Tsamp air T +.1 ?	AIR TEMP		sampled temperature in air height in meters

tg tg-.1m	TG TGsamp-.1M		TG -.1m	(sampled) temperature in ground depth in meters
tv	TVEG	VEG TEMP	TVEG	vegetation temperature
rh	RH	RH	RH	Relative Humidity
rad kd	? KD	RAD	RAD	incomming solar radiation
ws ws2 wd wd2	WS (WS 2 minute) WD (WD 2 minute)	WIND ?	WS WD	wind speed wind direction (2 minute vector mean)
bat	Battery Voltage	BAT	BAT	logger battery power
sndc	SND cleaned	SNDC	SNDC	cleaned snow depth
The following can be applied to any parameter. Temperature is used as an example. When there is no such designation or when the samp is added to the parameter abreviation it means a sampled value .				
x	Tmax	TMAX	TMAX	maximum temperature
n	Tmin	TMIN	TMIN	minimun temperature
m	Tmean (Tmean24) (Tmeanxn)	TMEAN	TMEAN	mean temperature (method of calculation)
sd	Tsd			standard deviation of temperature
rk	T?	RMK SNOW DEPTH ARRAY	?	verticle array of thermisters RMK design

INSTRUMENTATION

Gil	unventilated 12? plate Gill screen
SS	Stevenson screen
Vs	vegetation screen
VSS	Ventilated Stevenson Screen
Ms	mini screen (PCSP design)
CSMAL01	snow depth sounder
MO	Met-One wind sensor
Eppley	Eppley Pyranometer

DATES AND TIMES

HHMM	hour minute
DD	day
MM	month
YY	year
Y1, Y2	first year , second year of data in period between dumps
JJJ, J.D.	Julian Day
CST	central standard time

FILE EXTENSIONS

.AP#	appendix where # is a number .AP1 or .A12 if over 10
.DFT	draft report or file- WP
.DAT	logger data file- ASCII?
.DLD	logger documentation and program file-WP?
.DOC	data processing documentation- WP
.DQM	Macro documentation- WP
.DST	station documentation- WP
.PAR	SPLIT parameter file- SPLIT
.PMT	graph data spreadsheet parameters and format- WP
.PRN	data file out of SPLIT and into spreadsheet- ASCII?
.PR9	data file print to file from spreadsheet- ASCII
.RPT	report
.WQ1	spreadsheet file (data)- SS
.WQ2	spreadsheet (macro library)- SS
.WQE	label templet- SS
.WQB	label preliminary file with labels as formulae- SS
.WQL	label final file values- SS
.WQT	graph data templet- SS
.WQP	graph data preliminary file with some formulae- SS
.WQF	graph data final file values- SS
.MMO	memo- WP

.LET	letter- WP
.TBL	table- WP
.TXT	text- WP

FILE TYPE

n=D,C	file type Daily data or Calculated daily data
h=H,6,3,Z	file type Hourly data, 6-hourly data, 3-hourly data and Z= 12-hourly data
s=S,W	season Summer(April-September), Winter (October-March)
x=AA,AA, B,BB	part of a year or month: A=first part; B=second part; AA=second part of firts part; BB=second part of second part
p=A,B	first or second part of a season (ie S or W)
I	Initial data spreadsheet
R	Revised after examination of quick plots
v	version of templet

COMPUTER SOFTWARE

QPRO	Quatro Pro spreadsheet
WP	Word Perfect
SS	spreadsheet (usually QPRO)
PC208	?logger data handling CSCC
SPLIT	?subprogram within PC208 extracts data given criteria
WS	Word Star word processing
LOTUS	LOTUS 123 spreadsheet
FREELANCE	LOTUS plotting program

ACRONYMS

TSD,GSC	Terrain Sciences Division, Geological Survey of Canada
CCC,AES	Canadian Climate Centre, Atmospheric Environment Services
CSCC	Campbell Scientific Canada Corp.
WMO	World Meteorological Organization

JAWS	Joint Arctic Weather Stations
IRMA	Integrated Research and Monitoring Areas

APPENDIX 5

QPRO Macros and Techniques

PRODUCT :	Quattro Pro		NUMBER :	129
VERSION :	All			
OS :	DOS			
DATE :	September 11, 1991		PAGE :	1/3

TITLE : A Macro For Printing a Block of Named Graphs

The Graph Print macro allows you to automatically print a batch of named graphs located in the current spreadsheet.

To use Graph Print:

1. Enter the macro as it is listed on page 3 into your macro library spreadsheet. If you do not have a macro library sheet already in use, perform the following steps:

   a. Open a blank spreadsheet.
   b. Type in the macro.
   c. Select: /Tools ¦ Macro ¦ Library ¦ Yes.
   d. Save the new spreadsheet with a .WQ1 extension.

2. Open the file containing the Graph Print Macro.

3. Open the file containing the graphs you wish to print.

4. Enter the names of the graphs you wish to print in the current sheet as labels into a block of cells.

   Use /Graph ¦ Name ¦ Create to define the names of the graphs.

5. Select: /Tools ¦ Macro ¦ Execute.

6. Type: GRAPH_PRINT, and press [Enter].

   If you wish to assign a hotkey to the macro, use /Edit ¦ Names ¦ Create and enter a backslash (\) followed by a letter on the keyboard (e.g., \G assigns Alt-G as the hotkey). Designate cell B11 to take the name. If a hotkey is assigned to the macro, steps 5 and 6 listed above can be skipped and simply press Alt-G to execute the macro.

7. The macro will then ask you to highlight the block containing the names of the graphs you wish to print. Highlight the block, and press [Enter].

8. Graph Print will then step through the graphs and print to the default printer automatically.

The Graph Print Macro
(As Displayed)

```
PROMPT              Enter
                    Block
                     of
                    Named
                    Graphs
                     to
                    Print

COUNTER
COUNTER2
Graph_Print         {MESSAGE PROMPT,0,0,0}
                    {/ Name;Create}_GRAPHS~
                    {?}~{/ GraphPrint;DestIsPtr}
                    {FOR COUNTER,0,@ROWS([]_GRAPHS)-1,1,print_row}
                    {/ Name;Delete}_graphs~{QUIT}

print_row           {FOR COUNTER2,0,@cols([]_graphs)-1,1,output_graph}
output_graph        {IF @CELLINDEX("type",[]_graphs,counter2,counter)<>"l"}
                      {RETURN}
                    {LET gph,@CELLINDEX("contents",[]_graphs,counter2,
                      counter)&"~"}
                    {/ GraphPrint;Use}
gph                 GRAPH1~
                    {/ GraphPrint;Go}
```

This is an "L"

PRODUCT : Quattro Pro
VERSION : All
OS : DOS
DATE : September 11, 1991

NUMBER : 129

PAGE : 3/3

TITLE : A Macro For Printing a Block of Named Graphs

The Graph Print Macro
(Cell-Formula)

```
A1:  'PROMPT
A9:  'COUNTER
A10: 'COUNTER2
A11: 'Graph_Print
A17: 'print_row
A19: 'output_graph
A22: 'gph
B1:  ^Enter
B2:  ^Block
B3:  ^of
B4:  ^Named
B5:  ^Graphs
B6:  ^to
B7:  ^Print
B11: '{MESSAGE PROMPT,0,0,0}
B12: '{/ Name;Create}_GRAPHS~
B13: '{?}~{/ GraphPrint;DestIsPtr}
B14: '{FOR COUNTER,0,@ROWS([]_GRAPHS)-1,1,print_row}
B15: '{/ Name;Delete}_graphs~{QUIT}
B17: '{FOR COUNTER2,0,@COLS([]_graphs)-1,1,output_graph}
B19: '{IF @CELLINDEX("type",[]_graphs,counter2,counter)<>"l"}{RETURN}
B20: '{LET gph,@CELLINDEX("contents",[]_graphs,counter2,counter)&"~"}
B21: '{/ GraphPrint;Use}
B22: 'GRAPH1~
B23: '{/ GraphPrint;Go}
```

This is an "L"

After entering in the macro, select /Edit | Names | Labels | Right. Define the range A1..A22 when prompted and press [Enter]. This will create all named blocks necessary to execute the macro.

Finally, select /Edit | Names | Create and assign the name PROMPT to block B1..B7. This named block is used to display the message defined in cell B11.

Macro Library: SETUPMCO.WQ2

note: macro records and bits of code in column M
table of named blocks in cell F1

call macros in QPRO /TME and name

MACROS names	macro code	description
WINTER and GENERAL SPREADSHEET SETUP		
datefil	{GOTO}[]j9~ @date([]B6,[]C6,[]D6)~ {GOTO}[]a11~ {/ Block;Erase}[]a11.a193~ {/ Math;Fill}[]a11.a193~ []g7~1~ 100000~ {HOME}	puts the datenumber in first colmn
julfilc	{if []c7="LY"}{branch ly1c} {if []f7="LY"}{branch ly2c} {branch nlyc}	puts CST julian day in second column taking leap years into account
ly1c	{GOTO} []b11~ {/ Math;Fill}[]b11.b102~ 275~1~366~ {/ math;fill}[]b103.b192~ 1~1~90~	a leap year in year 1 of the data
ly2c	{GOTO} []b11~ {/ Math;Fill}[]b11.b102~ 274~1~365~ {/ math;fill}[]b103.b193~ 1~1~91~	a leap year in year 2 of the data
nlyc	{GOTO} []b11~ {/ Math;Fill}[]b11.b102~ 274~1~365~ {/ math;fill}[]b103.b192~ 1~1~90~	no leap years in the data
julfilu	{if []c7="LY"}{branch ly1u} {if []f7="LY"}{branch ly2u} {branch nlyu}	puts UCT julian day in second column taking leap years into account
ly1u	{GOTO} []g11~ {/ Math;Fill}[]g11.g101~ 276~1~366~ {/ math;fill}[]g102.g192~ 1~1~91~	a leap year in year 1 of the data
ly2u	{GOTO} []g11~ {/ Math;Fill}[]g11.g101~ 275~1~365~ {/ math;fill}[]g102.g193~ 1~1~92~	a leap year in year 2 of the data

```
nlyu        {GOTO}                                        no leap years in the
            []g11~                                        data
            {/ Math;Fill}[]g11.g101~
            275~1~365~
            {/ math;fill}[]g102.g192~
            1~1~91~

partrsp     {/ Block;Transpose}[]a2ttl~                   transposes headings
            []a409.a499~                                  into parameter files
            {/ Block;Transpose}[]a10ttl~
            []b409.b499~
            {/ Block;Transpose}[]a8ttl~
            []d409.d499~

L           {HOME}                                        lock titles in
            {GOTO}b2~                                     1st row and column
            {/ Titles;Both}

U           {/ Titles;Clear}                              unlock (clear) titles


Tmean       {MESSAGE Msg,0,0,0}{?}
            {GETNUMBER enter number of cols to right to be blanked  ,COLRT}
            {}
Tmean2      {IF @CELLPOINTER("type")="b"}{BRANCH tmb}
            {IF @CELLPOINTER("row")>193}{QUIT}
            {DOWN}                                        checks a column for
            {BRANCH Tmean2}                               blanks, delets same row
                                                          of another col.
tmb         {RIGHT COLRT}                                 use to remove mean temps

            {DEL}                                         if tx and/or tn missing
            {DOWN}{LEFT COLRT}{IF @CELLPOINTER("row")>193}{QUIT}
            {BRANCH tmean2}

COLRT                                          8


Msg         press enter
            and move to
            top of col to be checked
            press entre


SUMMER SPREADSHEET SETUP

julfilsc    {if []c7="LY"}{branch lylsc}                  same as julfilc but
            {branch nlysc}                                for summer six
                                                          months
lylsc       {GOTO}
            []b11~
            {/ Math;Fill}[]b11.b193~
            92~1~274~

nlysc       {GOTO}
            []b11~
            {/ Math;Fill}[]b11.b193~
            91~1~273~

julfilsu    {if []c7="LY"}{branch lylsu}                  same as julfilu
            {branch nlysu}                                but for summer
                                                          months
lylsu       {GOTO}
            []g11~
```

```
             {/ Math;Fill}[]g11.g193~
             93~1~275~

nlysu        {GOTO}
             []g11~
             {/ Math;Fill}[]g11.g193~
             92~1~274~


HOURLY SPREADSHEET SETUP

datefilh     {GOTO}[]a11~                                  same as datefil but
             {/ Block;Erase}[]a11.a754~                    for hourly data
             {/ Math;Fill}[]a11.a754~
             []g7~.0416666666666~
             100000~
             {HOME}

julfilhc     {GOTO}[]b11~                                  same as julfilc but for
             {if []c7="LY"}{branch lyhc}                   hourly data
             {branch nlyhc}


nlyhc        {LET julday,
             @choose([]c6,0,1,32,60,91,121,152,182,213,244,274,305,335):value}
             {/ Block;Erase}b11.b754~
             {/ Math;Fill}[]b11.b34~
             @choose([]c6,0,1,32,60,91,121,152,182,213,244,274,305,335)~0~366~
             {FOR COUNTER,1,
             @choose([]c6,0,30,27,30,29,30,29,30,30,29,30,29,30),1,jul24}


lyhc         {LET julday,
             @choose([]c6,0,1,32,61,92,122,153,183,214,245,275,306,336):value}
             {/ Block;Erase}b11.b754~
             {/ Math;Fill}[]b11.b34~
             @choose([]c6,0,1,32,61,92,122,153,183,214,245,275,306,336)~0~366~
             {FOR COUNTER,1,
             @choose([]c6,0,30,28,30,29,30,29,30,30,29,30,29,30),1,jul24}

jul24        {/ Math;Fill}
             {ESC}
             {END}
             {DOWN 2}
             .{DOWN 23}~
             +[setupmco.wq2]counter+[setupmco.wq2]julday~
             0~366~

counter                                                31
julday                                                122

julfilhu     {GOTO}[]g11~                                  to fill hourly ss with
             {if []c7="LY"}{branch lyhu}                   with UCT julian day
             {branch nlyhu}                                with new date at
                                                           00 UCT
                                                           to correspond with HWC
                                                           logger 1990-92

nlyhu        {LET julday,
             @choose([]c6,0,1,32,60,91,121,152,182,213,244,274,305,335):value}
             {/ Block;Erase}g11.g754~
             {/ Math;Fill}[]g11.g27~
```

```
              @choose([]c6,0,1,32,60,91,121,152,182,213,244,274,305,335)~0~366~
              {FOR COUNTER,1,
              @choose([]c6,0,30,27,30,29,30,29,30,30,29,30,29,30),1,jul24}
              {/ Math;Fill}
              {ESC}{END}{D 2}.{D 6}~
              +[setupmco.wq2]counter+[setupmco.wq2]julday~
              0~366~

lyhu          {LET julday,
              @choose([]c6,0,1,32,61,92,122,153,183,214,245,275,306,336):value}
              {/ Block;Erase}g11.g754~
              {/ Math;Fill}[]g11.g27~
              @choose([]c6,0,1,32,61,92,122,153,183,214,245,275,306,336)~0~366~
              {FOR COUNTER,1,
              @choose([]c6,0,30,28,30,29,30,29,30,30,29,30,29,30),1,jul24}
              {/ Math;Fill}
              {ESC}{END}{D 2}.{D 6}~
              +[setupmco.wq2]counter+[setupmco.wq2]julday~
              0~366~

partrsph      {/ Block;Transpose}[]a2ttl~              same as partrsp
              []a1009.a1099~                           but for
              {/ Block;Transpose}[]a10ttl~             hourly data
              []b1009.b1099~
              {/ Block;Transpose}[]a8ttl~
              []d1009.d1099~
```

Notes:

Some long lines have been split to display here in word perfect. They need to be typed all on one line in code. See actual macro library spreadsheet for correct code arrangement.

this word perfect file uses TAB rather than columns so changes must be made with reveal codes on and with care.

APPENDIX 6

LOGGER WIRING AND PROGRAMS

Program: AGASSIZ,A77 SITE, 1991/92 SEASON
Flag Usage:FLAG 0, OUTPUT FLAG
Wiring Channel Usage:

1H: RED 107F PROBE
1L: RED 107F PROBE
2H: ORANGE HMP35CF
2L: GREEN HMP35CF
3H: RED LI200S PYRANOMETER
3L: BLACK LI200S "
4H: GREEN 05103 DIRECTION

E1: BLACK 107F (2)
E2: YELLOW HMP35CF
E3: BLACK 05103 WIND MONITOR

P1: RED 05103 WIND MONITOR SPEED

C1: GREEN UDG01 SNOW DEPTH
C2: WHITE UDG01 SNOW DEPTH
C3: BLACK w/WHITE SNOW DEPTH

GROUND CONNECTIONS:
BLACK BATTERY GND
CLEAR HMP35CF
BLACK UDG01
BLACK OF RED&BLACK 05103
CLEAR 107F
CLEAR LI200S

ANALOG GROUND CONNECTIONS:
BLACK OF GREEN&BLACK 05103
PURPLE HMP35CF

```
*    1       Table 1 Programs
 01: 60      Sec. Execution Interval

01:  P4      Excite,Delay,Volt(SE)
 01: 3       Reps
 02: 4       250 mV slow Range
 03: 1       IN Chan
 04: 1       Excite all reps w/EXchan 1
 05: 0       Delay (units .01sec)
 06: 250     mV Excitation
 07: 10      Loc :
 08: .002    Mult
 09: 0       Offset
```

```
02:  P55      Polynomial
 01: 3        Reps
 02: 10       X Loc
 03: 10       F(X) Loc :
 04: -74.143 C0
 05: 645.21  C1
 06: -3835.8 C2
 07: 16025   C3
 08: -33996  C4
 09: 29763   C5

03:  P4       Excite,Delay,Volt(SE)
 01: 1        Rep
 02: 5        2500 mV slow Range
 03: 4        IN Chan
 04: 2        Excite all reps w/EXchan 2
 05: 80       Delay (units .01sec)
 06: 2500     mV Excitation
 07: 13       Loc :
 08: .1       Mult
 09: 0        Offset

04:  P2       Volt (DIFF)
 01: 1        Rep
 02: 2        7.5 mV slow Range
 03: 3        IN Chan
 04: 14       Loc :
 05: .1661    Mult
 06: 0        Offset

05:  P3       Pulse
 01: 1        Rep
 02: 1        Pulse Input Chan
 03: 11       Low level AC
 04: 15       Loc :
 05: .0016    Mult
 06: 0        Offset

06:  P4       Excite,Delay,Volt(SE)
 01: 1        Rep
 02: 5        2500 mV slow Range
 03: 7        IN Chan
 04: 3        Excite all reps w/EXchan 3
 05: 2        Delay (units .01sec)
 06: 2500     mV Excitation
 07: 16       Loc :
 08: .142     Mult
 09: 0        Offset

07:  P10      Battery Voltage
 01: 17       Loc :

08:  P92      If time is
 01: 0        minutes into a
 02: 60       minute interval
 03: 30       Then Do

09:  P89      If X<=>F
 01: 11       X Loc
```

```
 02: 3       >=
 03: -1      F
 04: 30      Then Do

10: P86      Do
 01: 10      Set high Flag 0 (output)

11: P77      Real Time
 01: 120     Day,Hour-Minute

12: P75      Histogram
 01: 1       Rep
 02: 7       No. of Bins
 03: 1       Closed form
 04: 11      Bin Select Value Loc
 05: 0       Frequency Distribution
 06: -1      Low Limit
 07: 6       High Limit

13: P71      Average
 01: 1       Rep
 02: 14      Loc

14: P95      End

15: P95      End

16: P92      If time is
 01: 0       minutes into a
 02: 360     minute interval
 03: 30      Then Do

17: P86      Do
 01: 1       Call Subroutine 1

18: P87      Beginning of Loop
 01: 0       Delay
 02: 3       Loop Count

19: P86      Do
 01: 75      Pulse Port 5

20: P95      End

21: P86      Do
 01: 44      Set high Port 4

22: P86      Do
 01: 75      Pulse Port 5

23: P86      Do
 01: 54      Set low Port 4

24: P86      Do
 01: 75      Pulse Port 5

25: P86      Do
 01: 75      Pulse Port 5

26: P86      Do
 01: 2       Call Subroutine 2
```

```
27: P86      Do
 01: 1       Call Subroutine 1

28: P87      Beginning of Loop
 01: 0       Delay
 02: 6       Loop Count

29: P86      Do
 01: 75      Pulse Port 5

30: P95      End

31: P86      Do
 01: 45      Set high Port 5

32: P86      Do
 01: 2       Call Subroutine 2

33: P86      Do
 01: 10      Set high Flag 0 (output)

34: P77      Real Time
 01: 210     Day,Hour-Minute

35: P71      Average
 01: 5       Reps
 02: 10      Loc

36: P70      Sample
 01: 2       Reps
 02: 8       Loc

37: P69      Wind Vector
 01: 1       Rep
 02: 360     Samples per sub-interval
 03: 2       Polar Sensor/(S, U, DU, SDU)
 04: 15      Wind Speed/East Loc
 05: 16      Wind Direction/North Loc

38: P95      End

39: P92      If time is
 01: 0       minutes into a
 02: 1440    minute interval
 03: 10      Set high Flag 0 (output)

40: P71      Average
 01: 5       Reps
 02: 10      Loc

41: P73      Maximize
 01: 5       Reps
 02: 0       Value only
 03: 10      Loc

42: P74      Minimize
 01: 5       Reps
 02: 0       Value only
 03: 10      Loc

43: P70      Sample
 01: 2       Reps
```

```
 02: 8      Loc

44: P70     Sample
 01: 1      Reps
 02: 17     Loc

45: P69     Wind Vector
 01: 1      Rep
 02: 1440   Samples per sub-interval
 03: 2      Polar Sensor/(S, U, DU, SDU)
 04: 15     Wind Speed/East Loc
 05: 16     Wind Direction/North Loc

46: P96     Serial Output
 01: 71     SM192/SM716

47: P       End Table 1


*    2      Table 2 Programs
 01: 0      Sec. Execution Interval

01: P       End Table 2
*    3      Table 3 Subroutines

01: P85     Beginning of Subroutine
 01: 1      Subroutine Number

02: P4      Excite,Delay,Volt(SE)
 01: 1      Rep
 02: 14     250 mV fast Range
 03: 1      IN Chan
 04: 1      Excite all reps w/EXchan 1
 05: 0      Delay (units .01sec)
 06: 250    mV Excitation
 07: 1      Loc :
 08: .002   Mult
 09: 0      Offset

03: P55     Polynomial
 01: 1      Rep
 02: 1      X Loc
 03: 1      F(X) Loc :
 04: -74.143 C0
 05: 645.21  C1
 06: -3835.8 C2
 07: 16025   C3
 08: -33996  C4
 09: 29763   C5

04: P34     Z=X+F
 01: 1      X Loc
 02: 273.15 F
 03: 1      Z Loc :

05: P20     Set Port(s)
 01: 9913   C8..C5=nc/nc/high/1ms
 02: 999    C4..C1=low/nc/nc/nc

06: P86     Do
 01: 75     Pulse Port 5
```

```
07:  P86      Do
 01: 44       Set high Port 4

08:  P86      Do
 01: 75       Pulse Port 5

09:  P86      Do
 01: 54       Set low Port 4

10:  P95      End

11:  P85      Beginning of Subroutine
 01: 2        Subroutine Number

12:  P86      Do
 01: 45       Set high Port 5

13:  P86      Do
 01: 54       Set low Port 4

14:  P22      Excitation with Delay
 01: 1        EX Chan
 02: 1        Delay w/EX (units=.01sec)
 03: 0        Delay after EX (units=.01sec)
 04: 0        mV Excitation

15:  P86      Do
 01: 56       Set low Port 6

16:  P86      Do
 01: 46       Set high Port 6

17:  P22      Excitation with Delay
 01: 1        EX Chan
 02: 8        Delay w/EX (units=.01sec)
 03: 0        Delay after EX (units=.01sec)
 04: 0        mV Excitation

18:  P20      Set Port(s)
 01: 9999     C8..C5=nc/nc/nc/nc
 02: 8999     C4..C1=input/nc/nc/nc

19:  P30      Z=F
 01: 1        F
 02: 0        Exponent of 10
 03: 3        Z Loc :

20:  P30      Z=F
 01: 0        F
 02: 0        Exponent of 10
 03: 4        Z Loc :

21:  P87      Beginning of Loop
 01: 0        Delay
 02: 16       Loop Count

22:  P86      Do
 01: 75       Pulse Port 5

23:  P91      If Flag/Port
 01: 44       Do if port 4 is high
 02: 30       Then Do
```

```
24:  P33      Z=X+Y
 01: 3       X Loc
 02: 4       Y Loc
 03: 4       Z Loc :

25:  P95      End

26:  P37      Z=X*F
 01: 3       X Loc
 02: 2       F
 03: 3       Z Loc :

27:  P95      End

28:  P30      Z=F
 01: 291     F
 02: 0       Exponent of 10
 03: 2       Z Loc :

29:  P38      Z=X/Y
 01: 1       X Loc
 02: 2       Y Loc
 03: 5       Z Loc :

30:  P39      Z=SQRT(X)
 01: 5       X Loc
 02: 6       Z Loc :

31:  P36      Z=X*Y
 01: 4       X Loc
 02: 6       Y Loc
 03: 7       Z Loc :

32:  P37      Z=X*F
 01: 7       X Loc
 02: .52176  F
 03: 7       Z Loc :

33:  P34      Z=X+F
 01: 7       X Loc
 02: -16     F
 03: 7       Z Loc :

34:  P20      Set Port(s)
 01: 9900    C8..C5=nc/nc/low/low
 02: 999     C4..C1=low/nc/nc/nc

35:  P31      Z=X
 01: 8       X Loc
 02: 9       Z Loc :

36:  P31      Z=X
 01: 7       X Loc
 02: 8       Z Loc :

37:  P95      End

38:  P        End Table 3
```

Loggger Wiring and Programming

The documentation here will also reflect the changes which have occurred with the new programming. Both sets of wiring diagrams are shown.

Program: HOT WEATHER CREEK 1991 AND 1992

Flag Usage: 0 FOR OUTPUT AND 1 FOR 2 MINUTE MEASUREMENT

1a) Wiring for CR10:

Input Channel Usage:

1H- AIR TEMP
1L- AIR RH
2H- WIND DIRECTION
2L- VEGETATIVE TEMPERATURE
3H- 10 CM GROUND TEMPERATURE
3L- 20 CM GROUND TEMPERATURE
4H- 50 CM GROUND TEMPERATURE
4L- 100 CM GROUND TEMPERATURE
5H- GLOBAL RADIATION (INCOMING SHORTWAVE)

Excitation Channel Usage:E1 - 207C TEMP
E2 - 207 RH AND 107B'S
E3 - WIND DIRECTION

Control Port Usage: C1 - SNOW DEPTH SENSOR
C2 - 12 VOLT RELAY DRIVER

Pulse Input Channel Usage: P1 - WIND SPEED 013A
P2 - SNOW DEPTH CSMAL01

1a) Wiring for CR10:

Input Channel Usage for 21X:

1H- AIR TEMP
1L- AIR RH
2H- VEGETATIVE TEMPERATURE
2L- 10 CM GROUND TEMPERATURE
3H- 20 CM GROUND TEMPERATURE
3L- 50 CM GROUND TEMPERATURE
4H- 100 CM GROUND TEMPERATURE
4L- WIND DIRECTION (R.M. YOUNG)
5H- GLOBAL INCOMING SHORTWAVE RADIATION
5L- " " " "
6H- GLOBAL REFLECTED SHORTWAVE RADIATION
6L- " " " "
7H- UDG01 SNOW DEPTH

Excitation Channel Usage: EX1 - 207C TEMP
EX2 - 207C RH
EX3 - 107B TEMP'S
EX4 - WIND DIRECTION

Control Port Usage: C1 - UDG01 SNOW DEPTH SENSOR
C2 - " " " "
C3 - " " " "

Pulse Input Channel Usage: P1 - MET ONE WIND SPEED
P2 - R.M. YOUNG WIND SPEED
P3 - TIPPING BUCKET RAIN GAUGE

2a) Program for CR10:

```
*     1        Table 1 Programs
 01: 60        Sec. Execution Interval

01:  P3        Pulse
 01: 1         Rep
 02: 1         Pulse Input Chan
 03: 2         Switch closure
 04: 4         Loc [:WND SPD  ]
 05: .04799    Mult KM/HR
 06: 2.4142    Offset KM/HR

02:  P3        Pulse
 01: 1         Rep
 02: 2         Pulse Input Chan
 03: 0         High frequency
 04: 11        Loc [:SNW DEPTH]
 05: 1         Mult MILLIMetres
 06: 0         Offset

03:  P4        Excite,Delay,Volt(SE)
 01: 1         Rep
 02: 5         2500 mV slow Range
 03: 1         IN Chan
 04: 1         Excite all reps w/EXchan 1
 05: 0         Delay (units .01sec)
 06: 2000      mV Excitation
 07: 1         Loc [:AIR TEMP ]
 08: .09866    Mult
 09: -67.3     Offset

04:  P12       RH 207 Probe
 01: 1         Rep
 02: 2         IN Chan
 03: 2         Excite all reps w/EXchan 2
 04: 1         Temperature Loc AIR TEMP
 05: 2         Loc [:RH       ]
 06: 1         Mult
 07: 0         Offset

05:  P11       Temp 107 Probe
 01: 5         Reps
 02: 4         IN Chan
 03: 2         Excite all reps w/EXchan 2
 04: 5         Loc [:107 TEMPS]
 05: 1         Mult
 06: 0         Offset

06:  P4        Excite,Delay,Volt(SE)
 01: 1         Rep
 02: 5         2500 mV slow Range
 03: 3         IN Chan
 04: 3         Excite all reps w/EXchan 3
 05: 2         Delay (units .01sec)
 06: 900       mV Excitation
```

```
 07: 3       Loc [:WIND DIR ]
 08: .78000  Mult
 09: 0       Offset

07:  P1       Volt (SE)
 01: 1       Rep
 02: 3       25 mV slow Range
 03: 9       IN Chan
 04: 10      Loc [:MJ/M/M   ]
 05: .00582  Mult
 06: 0       Offset

08:  P89      If X<=>F
 01: 10      X Loc MJ/M/M
 02: 4       <
 03: 0       F
 04: 1       Call Subroutine 1

09:  P10      Battery Voltage
 01: 12      Loc [:BATT VOLT]

10:  P92      If time is
 01: 0       minutes into a
 02: 60      minute interval
 03: 21      Set low Flag 1

11:  P92      If time is
 01: 58      minutes into a
 02: 60      minute interval
 03: 11      Set high Flag 1

12:  P91      If Flag/Port
 01: 11      Do if flag 1 is high
 02: 30      Then Do

13:  P31      Z=X
 01: 3       X Loc WIND DIR
 02: 17      Z Loc :

14:  P31      Z=X
 01: 4       X Loc WND SPD
 02: 18      Z Loc :

15:  P95      End

16:  P92      If time is
 01: 0       minutes into a
 02: 60      minute interval
 03: 10      Set high Flag 0 (output)

17:  P77      Real Time
 01: 110     Day,Hour-Minute

18:  P70      Sample
 01: 2       Reps
 02: 1       Loc AIR TEMP

19:  P76      Wind Vector (Pre OS10 0.1)
 01: 1       Rep
 02: 20      WS, Dir (Polar Sensor)
 03: 18      Wind Speed/East Loc
 04: 17      Wind Direction/North Loc
```

```
20: P70      Sample
 01: 5       Reps
 02: 5       Loc 107 TEMPS

21: P72      Totalize
 01: 1       Rep
 02: 10      Loc MJ/M/M

22: P92      If time is
 01: 354     minutes into a
 02: 1440    minute interval
 03: 30      Then Do

23: P86      Do
 01: 42      Set high Port 2

24: P95      End

25: P92      If time is
 01: 359     minutes into a
 02: 1440    minute interval
 03: 30      Then Do

26: P20      Set Port(s)
 01: 9999    C8..C5=nc/nc/nc/nc
 02: 9995    C4..C1=nc/nc/nc/100ms

27: P86      Do
 01: 71      Pulse Port 1

28: P95      End

29: P92      If time is
 01: 360     minutes into a
 02: 1440    minute interval
 03: 30      Then Do


30: P86      Do
 01: 52      Set low Port 2

31: P95      End

32: P92      If time is
 01: 360     minutes into a
 02: 1440    minute interval
 03: 10      Set high Flag 0 (output)

33: P77      Real Time
 01: 110     Day,Hour-Minute

34: P73      Maximize
 01: 1       Rep
 02: 10      Value with Hr-Min
 03: 1       Loc AIR TEMP

35: P74      Minimize
 01: 1       Rep
 02: 10      Value with Hr-Min
 03: 1       Loc AIR TEMP

36: P73      Maximize
```

```
 01: 1        Rep
 02: 10       Value with Hr-Min
 03: 4        Loc WND SPD

37:  P79      Sample on Max or Min
 01: 1        Rep
 02: 3        Loc WIND DIR

38:  P78      Resolution
 01: 1        High Resolution

39:  P72      Totalize
 01: 1        Rep
 02: 10       Loc MJ/M/M

40:  P78      Resolution
 01: 0        Low Resolution

41:  P70      Sample
 01: 2        Reps
 02: 11       Loc SNW DEPTH

42:  P96      Serial Output
 01: 71       SM192/SM716

43:  P        End Table 1

*    2        Table 2 Programs
 01: 0.0000   Sec. Execution Interval

01:  P        End Table 2

*    3        Table 3 Subroutines

01:  P85      Beginning of Subroutine
 01: 1        Subroutine Number

02:  P37      Z=X*F
 01: 10       X Loc MJ/M/M
 02: 0        F
 03: 10       Z Loc [:MJ/M/M   ]

03:  P95      End

04:  P        End Table 3
```

APPENDIX 7

SPLIT .PAR FILES

The SPLIT process (PC208 software package) is the initial tool of the data processing which, as the name implies, splits or partitions the data but also sorts it and performs an initial filtering of any out-of-range values. The following SPLIT.PAR files were used to do an initial quality control on the data. As the filenames imply the files were used for either 1991 or 1992. The only differences between these files are the "Start" and "Stop" conditions as well as the year which is inserted into the file. When selecting elements, range delimiters were used to replace obvious bad data with blanks.

1) Six Hourly Data:

AGA91BH.PAR and AGA92AH.PAR - Used to extract six hourly data for 1991 (dump to december) and 1992 (january to dump) data respectively, insert the year into the PRN file, and perform a verification of range limits on the data: eg. temp (-55 to +20) and humidity (0 to 100). The wind speeds were also converted from m/sec to km/hr. The snow depth readings which were initially only the distance to surface were also adjusted to actual snow depth, using the original distance to target as an offset. These .PAR files initially produced IAGA916B.PRN AND IAGA926A.PRN files respectively. These I*.PRN files were imported into Quatro Pro for the initial verification of the data.

F1=Help F2=Commands Insert is Off Param file is AGA91BH.PAR

Name(s) of input DATA FILES(s): AGA91921.DAT
Name of OUTPUT FILE to generate: IAGA916B.PRN/[""]
START reading in AGA9192.DAT:
STOP reading in AGA9192.DAT: 2[1.]
COPY from AGA9192.DAT: 1[0133]
SELECT element #(s) in AGA9192.DAT:y=1991.,y,DATE(2;1991.),2,3,6[-55..20],
[-55..20],7[0..100],"""","""","""","""","""","""","""",4[-55..20],8[0..900],1318.-
9,1471.-10,11*3.6,12*3.6,13,14
HEADING for report: AGASSIZ 1991/1992\INTERNAL FILE

HEADINGS for AGA9192.DAT, col. # 1:	YEAR
column # 2:	DATE
column # 3:	JULIAN\DAY
column # 4:	TIME\CST
column # 5:	MEAN\AIR\VAISALA\STEV.\SCREEN
column # 6:	MEAN\AIR\TEMP\GILL2
column # 7:	MEAN\AIR\R.H.\VAISALA
column # 8:	EMPTY
column # 9:	EMPTY
column # 10:	EMPTY
column # 11:	EMPTY
column # 12:	EMPTY
column # 13:	EMPTY
column # 14:	MEAN\AIR\TEMP\GILL1
column # 15:	MEAN\Kdown\KWM^{-2}
column # 16:	SNOW DEPTH 1
column # 17:	SNOW DEPTH 2
column # 18:	WIND\SPEED
column # 19:	WIND\SPEED\VECTOR
column # 20:	WIND\DIRECTION\VECTOR
column # 21:	STAND\DEVIATION\DIRECTION

```
F1=Help  F2=Commands          Insert is Off   Param file is AGA92AH.PAR
---------------------------------------------------------------------------
                    Name(s) of input DATA FILES(s): AGA9192.DAT
                 Name of OUTPUT FILE to generate: IAGA926A.PRN/[""]
                          START reading in AGA9192.DAT: 2[1.]
                            STOP reading in AGA9192.DAT:
                           COPY from AGA9192.DAT: 1[0133]
SELECT element #(s) in AGA9192.DAT: y=1992.,y,DATE(2;1992.),2,3,6[-55..20],5
                                    [-55..20],7[0..100],"""","""","""","""","""",
          """","""",4[-55..20],8[0..900],1318.-9,1471.-10,11*3.6,12*3.6,13,14
                    HEADING for report: AGASSIZ 1991/1992\INTERNAL FILE
          HEADINGS for AGA9192.DAT, col. # 1:   YEAR
                                 column # 2:   DATE
                                 column # 3:   JULIAN\DAY
                                 column # 4:   TIME\CST
                                 column # 5:   MEAN\AIR\VAISALA\STEV.\SCREEN
                                 column # 6:   MEAN\AIR\TEMP\GILL2
                                 column # 7:   MEAN\AIR\R.H.\VAISALA
                                 column # 8:   EMPTY
                                 column # 9:   EMPTY
                                column # 10:   EMPTY
                                column # 11:   EMPTY
                                column # 12:   EMPTY
                                column # 13:   EMPTY
                                column # 14:   MEAN\AIR\TEMP\GILL1
                                column # 15:   MEAN\Kdown\KWM-2
                                column # 16:   SNOW DEPTH 1
                                column # 17:   SNOW DEPTH 2
                                column # 18:   WIND\SPEED
                                column # 19:   WIND\SPEED\VECTOR
                                column # 20:   WIND\DIRECTION\VECTOR
                                column # 21:   STAND\DEVIATION\DIRECTION
```

2) Daily Data

AGA91BD.PAR and AGA92AD.PAR - Used to extract the daily data for 1991 and 1992 respectively, insert the year and the Julian Day into the PRN file and perform a verification of range limits on the data as previously discussed. These .PAR files produce IAGA91DB.PRN and IAGA92DA.PRN files. These I*.PRN files were then imported into Quatro Pro for the initial verification of the data.

```
F1=Help  F2=Commands          Insert is On   Param file is AGA91BD.PAR
---------------------------------------------------------------------------
                 Name(s) of input DATA FILES(s): AGA9192.DAT,AGA9192.DAT
                   Name of OUTPUT FILE to generate: IAGA91DB.PRN/[""]
                            START reading in AGA9192.DAT:
                            START reading in AGA9192.DAT:
     STOP reading in AGA9192.DAT:1[133]and2[1.]and3[0600]
     STOP reading in:1[133]and2[1.]and3[0600]
                            COPY from AGA9192.DAT: 1[033]
               COPY from : 1[0139]or1[133]and3[0100..2300]
SELECT element #(s) in AGA9192.DAT:jd=smpl(2;4),date(jd;1991.)
SELECT element #(s) in : Y=1991.,smpl(y,jd,19[10..16],2..4[-55..20],5[0..100],6[0..1000],7..9[-55..20],10
              [0..100],11,12..14[-55..20],15[0..100],16,17..18[0..2000],20[0..40],22[0..360],
```

```
,23[0..80];4)
                    HEADING for report: AGASSIZ 1991/1992 DAILY DATA
     HEADINGS for AGA9192.DAT, col. # 1:    YEAR
                             column # 2:    DATE
                             column # 3:    JULIAN\DAY
                             column # 4:    BATTERY\VOLTS
                             column # 5:    EMPTY
                             column # 6:    EMPTY
                             column # 7:    EMPTY
                             column # 8:    EMPTY
                             column # 9:    EMPTY
                            column # 10:    EMPTY
                            column # 11:    EMPTY
                            column # 12:    EMPTY
                            column # 13:    MEAN\GILL1
                            column # 14:    MEAN\GILL2
                            column # 15:    MEAN\SS\VAISALA
                            column # 16:    MEAN\RH\VAISALA
                            column # 17:    MEAN\Kdown
                            column # 18:    MAX\GILL1
                            column # 19:    MAX\GILL2
                            column # 20:    MAX\SS\VAISALA
                            column # 21:    MAX\RH\VAISALA
                            column # 22:    MAX\Kdown
                            column # 23:    MIN\GILL1
                            column # 24:    MIN\GILL2
                            column # 25:    MIN\SS\VAISALA
                            column # 26:    MIN\RH\VAISALA
                            column # 27:    MIN\Kdown
                            column # 28:    SNOW DEPTH1
                            column # 29:    SNOW DEPTH2
                            column # 30:    MEAN\WIND\VECTOR
                            column # 31:    MEAN\WIND\SPEED\VECTOR
                            column # 32:    MEAN\WIND\DIRECT\VECTOR
                            column # 33:    STAND\DEVIATION\DIRECT
_______________________________________________________________________
F1=Help  F2=Commands          Insert is On   Param file is AGA92AD.PAR
-----------------------------------------------------------------------
                  Name(s) of input DATA FILES(s): AGA9192.DAT,AGA9192.DAT
                     Name of OUTPUT FILE to generate: IAGA92DA.PRN/[""]
                     START reading in AGA9192.DAT:1[133]and2[1.]and3[0600]
                     START reading in AGA9192.DAT:1[133]and2[1.]and3[0600]
    STOP reading in AGA9192.DAT:
    STOP reading in:
                              COPY from AGA9192.DAT: 1[033]
               COPY from : 1[0139]or1[133]and3[0100..2300]
SELECT element #(s) in AGA9192.DAT:jd=smpl(2;4),date(jd;1992.)
SELECT element #(s) in : Y=1992.,smpl(y,jd,19[10..16],2..4[-55..20],5[0..100],6[0..1000],7..9[-55..20],10
        [0..100],11,12..14[-55..20],15[0..100],16,17..18[0..2000],20[0..40],22[0..360],
        ,23[0..80];4)
                    HEADING for report: AGASSIZ 1991/1992 DAILY DATA
     HEADINGS for AGA9192.DAT, col. # 1:    YEAR
                             column # 2:    DATE
                             column # 3:    JULIAN\DAY
                             column # 4:    BATTERY\VOLTS
                             column # 5:    EMPTY
                             column # 6:    EMPTY
                             column # 7:    EMPTY
                             column # 8:    EMPTY
                             column # 9:    EMPTY
                            column # 10:    EMPTY
```

column # 11: EMPTY
column # 12: EMPTY
column # 13: MEAN\GILL1
column # 14: MEAN\GILL2
column # 15: MEAN\SS\VAISALA
column # 16: MEAN\RH\VAISALA
column # 17: MEAN\Kdown
column # 18: MAX\GILL1
column # 19: MAX\GILL2
column # 20: MAX\SS\VAISALA
column # 21: MAX\RH\VAISALA
column # 22: MAX\Kdown
column # 23: MIN\GILL1
column # 24: MIN\GILL2
column # 25: MIN\SS\VAISALA
column # 26: MIN\RH\VAISALA
column # 27: MIN\Kdown
column # 28: SNOW DEPTH1
column # 29: SNOW DEPTH2
column # 30: MEAN\WIND\VECTOR
column # 31: MEAN\WIND\SPEED\VECTOR
column # 32: MEAN\WIND\DIRECT\VECTOR
column # 33: STAND\DEVIATION\DIRECT

3) Calculated Data

AGA91BC.PAR and AGA92AC.PAR - Used to calculate the daily data from the six hourly data and insert the year into the PRN file.

```
F1=Help  F2=Commands          Insert is On   Param file is AGA91BC.PAR
-----------------------------------------------------------------------------
                          Name(s) of input DATA FILES(s): RAGA916B.PRN
                          Name of OUTPUT FILE to generate: AGA91BC.PRN
                                START reading in RAGA916B.PRN:
                                 STOP reading in  RAGA916B.PRN:
                                  COPY from RAGA916B.PRN:
SELECT element #(s) in RAGA916B.PRN:          SMPL(1..5;4),AVG(6..8;4),RAD=(AVG(17;4)*86.4),RAD
                          HEADING for report: 1991/1992\CALCULATED\DAILIES
          HEADINGS for RAGA916B.PRN, col. # 1:    YEAR
                                  column # 2:    MONTH
                                  column # 3:    DAY
                                  column # 4:    JULIAN\DAY
                                  column # 5:    TIME\CST
                                  column # 6:    MEAN\SS\VAISALA
                                  column # 7:    MEAN\GILL2
                                  column # 8:    MEAN\R.H.
                                  column # 9:    TOT\Kdown
```

```
F1=Help  F2=Commands          Insert is On   Param file is AGA92AC.PAR
-----------------------------------------------------------------------------
                          Name(s) of input DATA FILES(s): RAGA926A.PRN
                          Name of OUTPUT FILE to generate: AGA92AC.PRN
                                START reading in RAGA926A.PRN:
                                 STOP reading in RAGA926A.PRN:
                                  COPY from RAGA926A.PRN:
SELECT element #(s) in RAGA926A.PRN: SMPL(1..5;4),AVG(6..8;4),RAD=(AVG(17;4)*86.4),RAD
                          HEADING for report: 1991/1992\CALCULATED\DAILIES
          HEADINGS for RAGA926A.PRN, col. # 1:    YEAR
```

column # 2:	MONTH
column # 3:	DAY
column # 4:	JULIAN\DAY
column # 5:	TIME\CST
column # 6:	MEAN\SS\VAISALA
column # 7:	MEAN\GILL2
column # 8:	MEAN\R.H.
column # 9:	TOT\Kdown

Six Hourly Data

The original data file, AGA9192.DAT was processed using AGA91BH and AGA92AH to produce the initial .PRN files IAGA916B.PRN and IAGA926A.PRN. These files were imported into Quatro Pro in order to produce the quick plots for data quality control. These spreadsheets, for internal use only, were kept as IAGA916B.WQ1 and IAGA926A.WQ1 and contain the saved quick plots.

With the analysis of the plots and correction of any problem data, the final cleaned files were saved as RAGA916B.WQ1 and RAGA926A.WQ1. From these cleaned files, the 6 hourly data were partionned into monthly files (Table 3).

Daily Data

The original data file, AGA9192.DAT was processed using AGA91BD.PAR and AGA92AD.PAR to produce the initial .PRN files IAGA91DB.PRN and IAGA92DA.PRN which were then imported into Quatro Pro. The spreadsheets produced IAGA91DB.WQ1 and IAGA92DA.WQ1 contained the initial quick plots for the quality control process following which the final cleaned files became RAGA91DB.WQ1 and RAGA92DA.WQ1. These files of daily data were broken down further into "summer" and "winter" periods and named BAGA91SD.WQ1, AAGA91WD.WQ1, BAGA92WD.WQ1 AND AAGA92SD.WQ1 .

Calculated Data

The six hourly data found in the cleaned files RAGA916B.WQ1 and RAGA926A.WQ1 were printed to .PRN files RAGA916B.PRN and RAGA926A.PRN in order to be processed by SPLIT. The .PAR files used were AGA91BC.PAR and AGA92AC.PAR. The .PRN file produced were AGA91BC.PRN and AGA92AC.PRN which were then imported into the spreadsheets IAGA91BC.WQ1 AND IAGA92AC.WQ1 for quality control graphing purposes. The resulting spreadsheet files were also organized in the "summer" and "winter" periods and were called BAGA91SC.WQ1, AAGA91WC.WQ1, BAGA92WC.WQ1 and AAGA92SC.WQ1 .

HWC(AWS):HOT WEATHER CREEK,AUTOMATIC WEATHER STATION

SPLIT Parameter Files (.PAR)

The SPLIT process (using PC208 software package) is the initial tool of the data proessing which, as the name implies, splits or partitions the data and also sorts it and performs an initial filtering of any out-of-range values. The following SPLIT.PAR files were used to do an initial quality control on the data. As the filenames imply, the files were used for either 1991 or 1992. The only differences between these files are the "Start" and "Stop" conditions as well as the year which is inserted into the file. When selecting elements, range delimetres were used to replace obvious "bad data" with blanks.

HWC91HB.PAR and HWC92HA.PAR - Used to extract hourly data for 1991 (data dump to december) and 1992 (january to dump) data respectively, insert the year into the PRN file, and perform a verification of range limits on the data. These .PAR files initially produced IHWC91HB.PRN and IHWC92HA.PRN. These .PRN files were then imported into Quatro Pro for the initial verification of the data.

```
F1=Help    F2=Commands                         Insert is On      Param file is hwc91hb.par
--------------------------------------------------------------------------------------------
                      Name(s) of input DATA FILES(s): HWC9192.DAT
                    Name of OUTPUT FILE to generate: IHWC91HB.PRN/[""]
                             START reading in HWC9192.DAT:
                       STOP reading in HWC9192.DAT: 2[1.]:3[0700]
                            COPY from HWC9192.DAT: 1[0116]
SELECT element #(s) in HWC9192.DAT: y=1991.,y,2,3,4[-55..20],5[0..100],
                                              6[2.415..100],7[0..360],8..
                                              12[-50..20],13[0..40]
                  HEADING for report: HOT\WEATHER\1991\INTERNAL FILE
                                              HEADINGS for HWC9192.DAT, col. # 1:YEAR
                                              column # 2:JULIAN\DAY
                                              column # 3:TIME
                                              column # 4:SMPL\AIR\TEMP
                                              column # 5:SMPL\AIR\RH
                                              column # 6:2MIN\WIND\SPEED
                                              column # 7:2MIN\WIND\DIR
                                              column # 8:SMPL\VEG\TEMP
                                              column # 9:SMPL\10CM\GND
                                              column # 10:SMPL\20CM\GND
                                              column # 11:SMPL\50CM\GND
                                              column # 12:SMPL\100CM\GND
                                              column # 13:TOTAL\RAD\MJ/M2
```

```
F1=Help  F2=Commands          Insert is On   Param file is hwc92ha.PAR
--------------------------------------------------------------------------------------------
                      Name(s) of input DATA FILES(s): HWC9192.dat
                    Name of OUTPUT FILE to generate: IHWC92HA.PRN/[""]
                     START reading in HWC9192.dat: 2[1.]:3[0700.]
                              STOP reading in HWC9192.dat:
                            COPY from HWC9192.dat: 1[0116]
SELECT element #(s) in HWC9192.dat: y=1992.,y,2,3,4[-55..25],5[0..100],6[2.4
                                              15..100],7[0..360],8..12[-50..30],
                                              13[0..40]
                  HEADING for report: HOT\WEATHER\1992\INTERNAL FILE
                                              HEADINGS for HWC9192.dat, col. # 1:YEAR
                                              column # 2:JULIAN\DAY
                                              column # 3:TIME
                                              column # 4:SMPL\AIR\TEMP
                                              column # 5:SMPL\AIR\RH
                                              column # 6:2MIN\WIND\SPEED
                                              column # 7:2MIN\WIND\DIR
                                              column # 8:SMPL\VEG\TEMP
                                              column # 9:SMPL\10CM\GND
                                              column # 10:SMPL\20CM\GND
                                              column # 11:SMPL\50CM\GND
                                              column # 12:SMPL\100CM\GND
                                              column # 13:TOTRAD\MJ/M2
```

HWC91DB.PAR AND HWC92DA.PAR - Used to extract the daily data for 1991 and 1992 respectively, insert the year into the .PRN file and perform a verification of range limits on the data as previously discussed. These .PAR files produce IHWC91DB.PRN and IHWC92DA.PRN files. These I*.PRN files were then imported into Quatro Pro for the initial verification of the data.

```
F1=Help  F2=Commands            Insert is On   Param file is hwc91db.PAR
------------------------------------------------------------------------------------------
                    Name(s) of input DATA FILES(s): HWC9192.DAT
                 Name of OUTPUT FILE to generate: IHWC91DB.PRN/[""]
                          START reading in HWC9192.DAT:
                         STOP reading in HWC9192.DAT: 2[2]
                          COPY from HWC9192.DAT: 1[132]
SELECT element #(s) in HWC9192.DAT: y=1991.,y,date(2-1.;1991.),2,3,4[-50..30],
                               5,6[-50..30],7,8[2.415..90],9,10[0..360],11[0..35],
                               12[0..1000],13
                          HEADING for report: TEST
                               HEADINGS for HWC9192.DAT, col. # 1:YEAR
                               column # 2:DATE
                               column # 3:JULIAN\DAY
                               column # 4:TIME\HHMM
                               column # 5:MAX\AIR
                               column # 6:TIME\MAX
                               column # 7:MIN\AIR
                               column # 8:TIME\MIN
                               column # 9:MAX\WIND
                               column # 10:TIME\MAX
                               column # 11:DIR\MAX\WIND
                               column # 12:TOTAL\RAD
                               column # 13:SNOW\DEPTH
                               column # 14:BATT\VOLT
```

```
F1=Help  F2=Commands            Insert is On   Param file is hwc92da.PAR
------------------------------------------------------------------------------------------
                    Name(s) of input DATA FILES(s): HWC9192.DAT
                 Name of OUTPUT FILE to generate: IHWC92DA.PRN/[""]
                         START reading in HWC9192.DAT: 2[2]
                          STOP reading in HWC9192.DAT:
                          COPY from HWC9192.DAT: 1[132]
SELECT element #(s) in HWC9192.DAT: y=1992.,y,date(2-1.;1992.),2,3,4[-55..30],
                               5,6[-55..30],7,8[2.415..100],9,10[0..360],11[0..35],
                               12[0..1000],13
                          HEADING for report: TEST
                               HEADINGS for HWC9192.DAT, col. # 1:YEAR
                               column # 2:DATE
                               column # 3:JULIAN\DAY
                               column # 4:TIME\HHMM
                               column # 5:MAX\AIR
                               column # 6:TIME\MAX
                               column # 7:MIN\AIR
```

column # 8:TIME\MIN
column # 9:MAX\WIND
column # 10:TIME\MAX
column # 11:DIR\MAX\WIND
column # 12:TOTAL\KIN
column # 13:SNOW\DEPTH
column # 14:BATT\VOLT

HWC91BC.PAR and HWC92AC.PAR - Used to calculate daily data from the hourly data and insert the year into the PRN file.

```
F1=Help  F2=Commands          Insert is On   Param file is hwc91bc.par
------------------------------------------------------------------------------------------------
                              Name(s) of input DATA FILES(s): rhwc91HB.prn
                            Name of OUTPUT FILE to generate: HWC91BC.prn/[""]
                                START reading in hwc9192.dat: 2[236]:3[0700]
                                    STOP reading in hwc9192.dat:
                                      COPY from hwc9192.dat:
SELECT element #(s) in hwc9192.dat: y=1991.,SMPL(y;24),SMPL(date(2-1.;1991.);
                                      24),SMPL(2;24),SMPL(3;24),AVG(4[-55..35];
                                      24),AVG(5[0..100];24),AVG(6[2.415..30];24),
                                      MAX(8..12[-50..35];24),AVG(8..12[-50..35];
                                      24),MIN(8..12[-50..35];24)
                                      HEADING for report: test
                                      HEADINGS for hwc9192.dat, col. # 1:YEAR
                                      column # 2:DATE
                                      column # 3:JULIAN\DAY
                                      column # 4:TIME\HHMM
                                      column # 5:AVG\AIR TEMP
                                      column # 6:AVG\RH
                                      column # 7:AVG\WIND
                                      column # 8:MAX\VEG\TEMP
                                      column # 9:MAX\10CM
                                      column # 10:MAX\20CM
                                      column # 11:MAX\50CM
                                      column # 12:MAX\100CM
                                      column # 13:AVG\VEG\TEMP
                                      column # 14:AVG\10CM
                                      column # 15:AVG\20CM
                                      column # 16:AVG\50CM
                                      column # 17:AVG\100CM
                                      column # 18:MIN\VEG\TEMP
                                      column # 19:MIN\10CM
                                      column # 20:MIN\20CM
                                      column # 21:MIN\50CM
                                      column # 22:MIN\100CM
```

```
F1=Help  F2=Commands          Insert is On   Param file is hwc92ac.PAR
------------------------------------------------------------------------------------------------
                              Name(s) of input DATA FILES(s): rhwc92HA.prn
                            Name of OUTPUT FILE to generate: HWC92AC.prn/[""]
                                START reading in hwc9192.dat: 2[1]:3[0700]
```

```
STOP reading in hwc9192.dat:
COPY from hwc9192.dat:
SELECT element #(s) in hwc9192.dat: y=1992.,SMPL(y;24),SMPL(date(2-1.;1992.);
    24),SMPL(2;24),SMPL(3;24),AVG(4[-55..35];
    24),AVG(5[0..100];24),AVG(6[2.415..30];24),
    MAX(8..12[-50..35];24),AVG(8..12[-50..35];24),MIN(8..12[-50..35];24)
HEADING for report: TEST
    HEADINGS for hwc9192.dat, col. # 1:YEAR
    column # 2:DATE
    column # 3:JULIAN\DAY
    column # 4:TIME\HHMM
    column # 5:AVG\AIR
    column # 6: AVG\RH
    column # 7:AVG\WIND
    column # 8:MAX\VEG\TEMP
    column # 9:MAX\10CM
    column # 10:MAX\20CM
    column # 11:MAX\50CM
    column # 12:MAX\100CM
    column # 13:AVG\VEG\TEMP
    column # 14:AVG\10CM
    column # 15:AVG\20CM
    column # 16:AVG\50CM
    column # 17:AVG\100CM
    column # 18:MIN\VEG\TEMP
    column # 19:MIN\10CM
    column # 20:MIN\20CM
    column # 21:MIN\50CM
    column # 22:MIN\100CM
```

Hourly Data

The original data file, HWC9192.DAT was processed using the SPLIT parameter files to produce the initial .PRN files IHWC91HB.PRN AND IHWC92HA.PRN. These files were imported into Quatro Pro in order to produce the quick plots for data quality control. These spreadsheets, for internal use only, were kept as IHWC91HB.WQ1 and IHWC92HA.WQ1 and contain the saved quick plots.

With the analysis of the plots and correction of any problem data, the final cleaned files were saved as RHWC91HB.WQ1 and RHWC92HA.WQ1. From these cleaned files, the hourly data were partitionned into monthly files.

Daily Data

The original data file, HWC9192.DAT was processed using HWC91BD.PAR and HWC92BA.PAR to produce the initial .PRN files IHWC91DB.PRN and IHWC92DA.PRN which were then imported into Quatro Pro. The spreadsheets produced IHWC91DB.WQ1 and IHWC92DA.WQ1 contained the initial quick plots for the quality control process following which, the final cleaned files became RHWC91DB.WQ1 and RHWC92DA.WQ1. These files of daily data were broken down into "summer" and "winter" periods and named BHWC91SD.WQ1, AHWC91WD.WQ1, BHWC92WD.WQ1 and AHWC92SD.WQ1.

Calculated Data

The hourly data found in the cleaned files RHWC91HB.WQ1 AND RHWC92HA.WQ1 were printed to .PRN files from the spreadsheet files to RHWC91HB.PRN and RHWC92HA.PRN in order to be processed by SPLIT. The .PAR files used were HWC91BC.PAR and HWC92AC.PAR. The .PRN files produced by this SPLIT run were HWC91BC.PRN and HWC92AC.PRN. which were imported into the spreadsheets IHWC91BC.WQ1 and IHWC92AC.WQ1 for quality control graphing purposes. The resulting spreadsheet files were also organized in the "summer" and "winter" periods and were named BHWC91SC.WQ1, AHWC91WC.WQ1, BHWC92WC.WQ1 and AHWC92SC.WQ1.

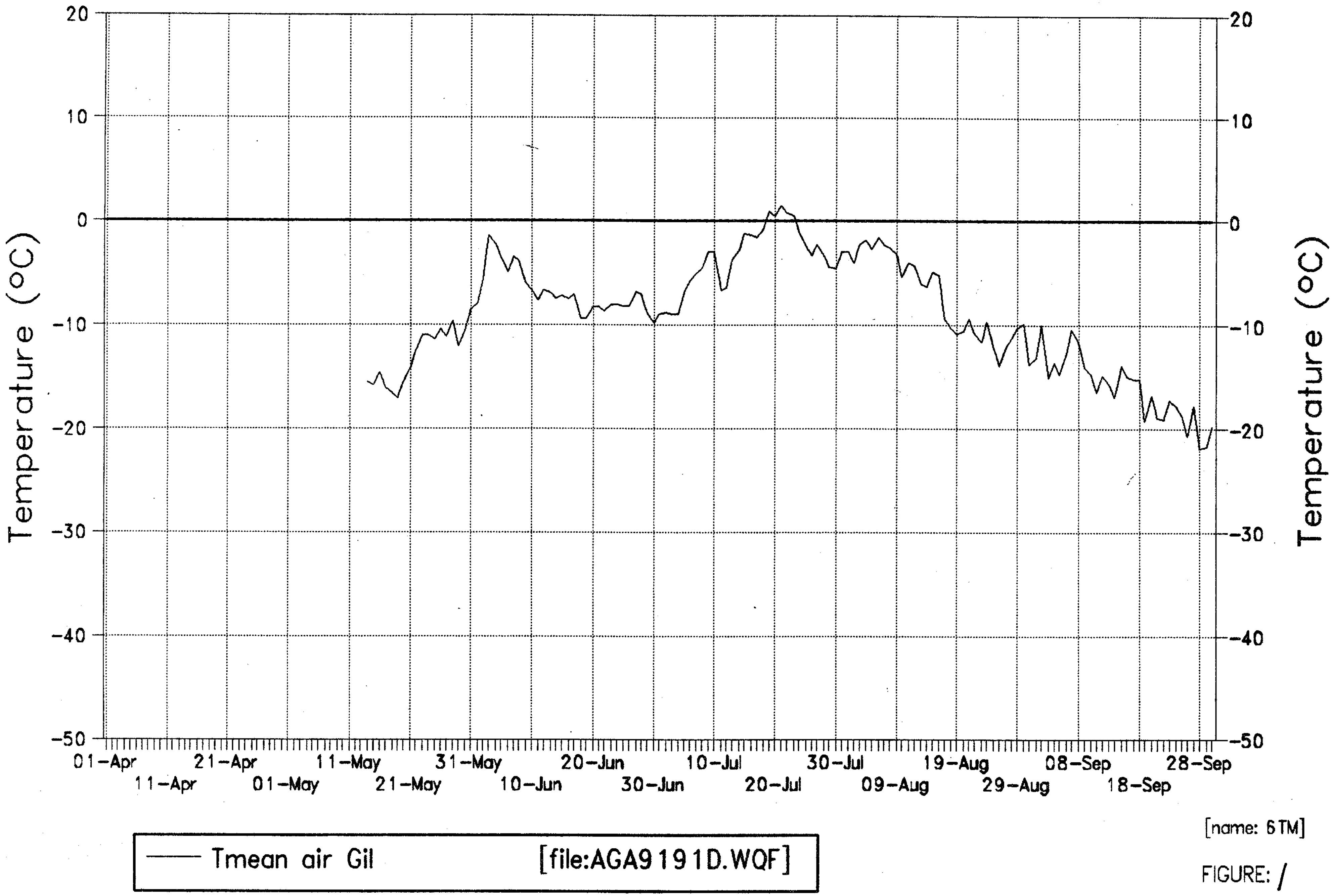
TABLE 1.1

DAILY PLOTS: Summer 1991 (April 1991 - September 1991)					
name:	Figure no.		Season/ Month	Years	Figure Caption
A: Plots printed for spreadsheet AGA9191D.WQP					
6tm	AGA9191D.	1	Summer	1991	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 107F in Gill screen
6txn	AGA9191D.	2	Summer	1991	Daily maximum and minimum air temperature (°C) from 107F in Gill screen
4txn	AGA9191D.	3	May - August	1991	Daily maximum and minimum air temperature (°C) from 107F in Gill screen
6rhm	AGA9191D.	4	Summer	1991	Daily mean values of relative humidity (%) from Vasala in Gill screen
5txnm	AGA9191D.	5	Melt Season	1991	Daily maximum, minimum and mean air temperature (total incomming solar radiation (KJ/m ^{2}) from Eppley pyranometerC) from 107F in Gill screen
4rhtm	AGA9191D.	6	May - August	1991	Daily mean values of relative humidity (%) from Vasala in Stevenson Screen and air temperature (°C) from 107F probe in Gill screen
6wsvwd	AGA9191D.	7	Summer	1991	Daily mean scalar and vector wind speed (Km/hr) and mean vector direction (deg)
5trhmc	AGA9191D.	8	Melt Season	1991	Daily means of air temperature (°C) [comparison of 107F probe in Gill screen and Vasaila probe in unventilated Stevenson Screen] and relative humidity (%) from Vasala in Stevenson Screen
6kdmxn	AGA9191D.	9	Summer	1991	Daily total incomming solar radiation (KJ/m ^{2}) from Eppley pyranometer
6snac	AGA9191D.	10	Summer	1991	Daily cleaned snow depth (mm) with all questionable data removed
6wswdsd	AGA9191D.	11	Summer	1991	Daily difference between the mean calculated from (max + min)/2 and the daily mean of 60 sec sampled values as output from the logger program
B: Additional plots available in spreadsheet not printed for report					
x6trngc	AGA9191D.		Summer	1991	Daily temperature range (°C) calculated from Tmax - Tmin for 107F probe in Gill screen
x6dtmm	AGA9191D.		Summer	1991	Daily wind speed and the stsndard deviation of wind direction

DAILY PLOTS: Summer 1991 (April 1991 - September 1991)					
name:	Figure no.		Season/ Month	Years	Figure Caption
x6dtxn	AGA9191D.		Summer	1991	Daily difference between temperatures from Vasaila probe in Gill screen and Vasaila probe in Stevenson screen for maximum and minimum air temperatures
x6dtxng2	AGA9191D.		Summer	1991	Daily difference between temperatures from 107F probe in Gill screen and from Gill screen mounted at same height on same mast for maximun and minimum air temperatures
x6txnd	AGA9191D.		Summer	1991	Daily maximum and minimun values of air temperature from 107F probe in Gill screen and difference betweenmean air temperature from 107F probe in Gill screen and from Vasaila probe in unventilated Stevenson Screen
xjultxnd	AGA9191D.		June	1991	Daily maximum and minimun values of air temperature from 107F probe in Gill screen and difference betweenmean air temperature from 107F probe in Gill screen and from Vasaila probe in unventilated Stevenson Screen
note: the remaining monthly graphs for this spreadsheet are not yet completed					

AGA(A77): DAILY TEMPERATURE

1991 summer 1991

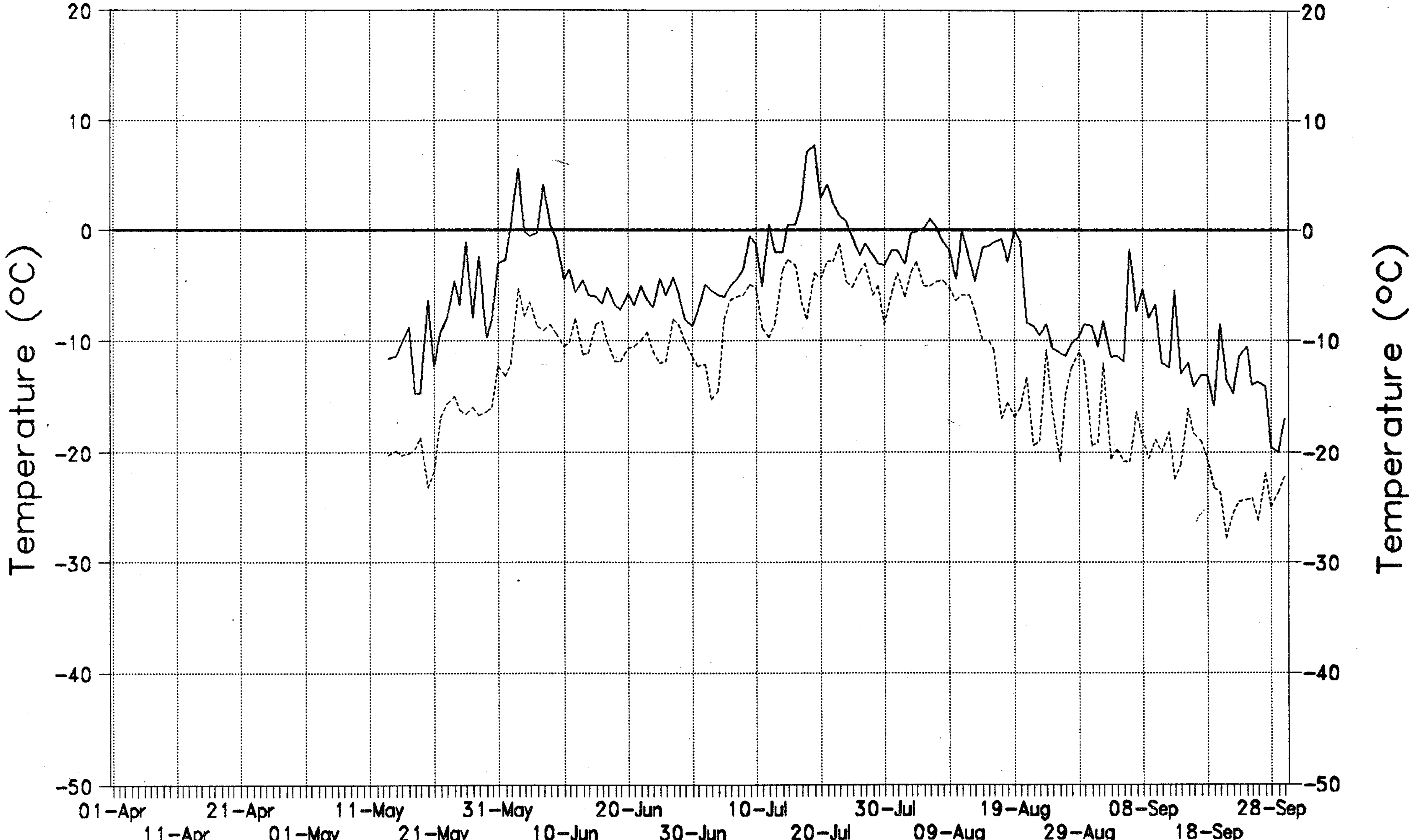


[name: 6TM]

FIGURE: /

AGA(A77): DAILY EXTREME TEMPERATURES

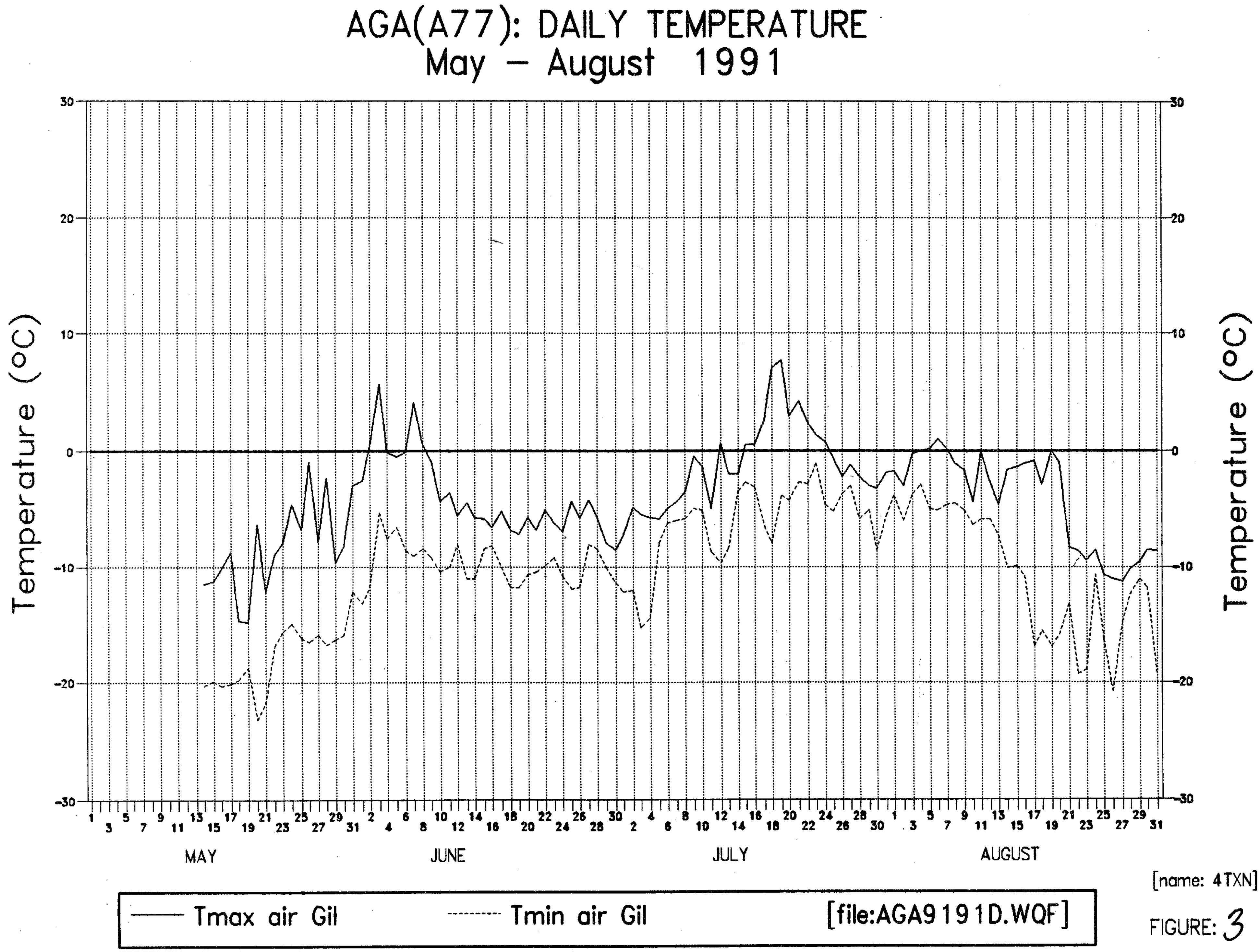
1991 summer 1991



[name: 6TXN]

Tmax air Gil ······· Tmin air Gil [file:AGA9191D.WQF]

FIGURE: 2



[name: 4TXN]

FIGURE: 3

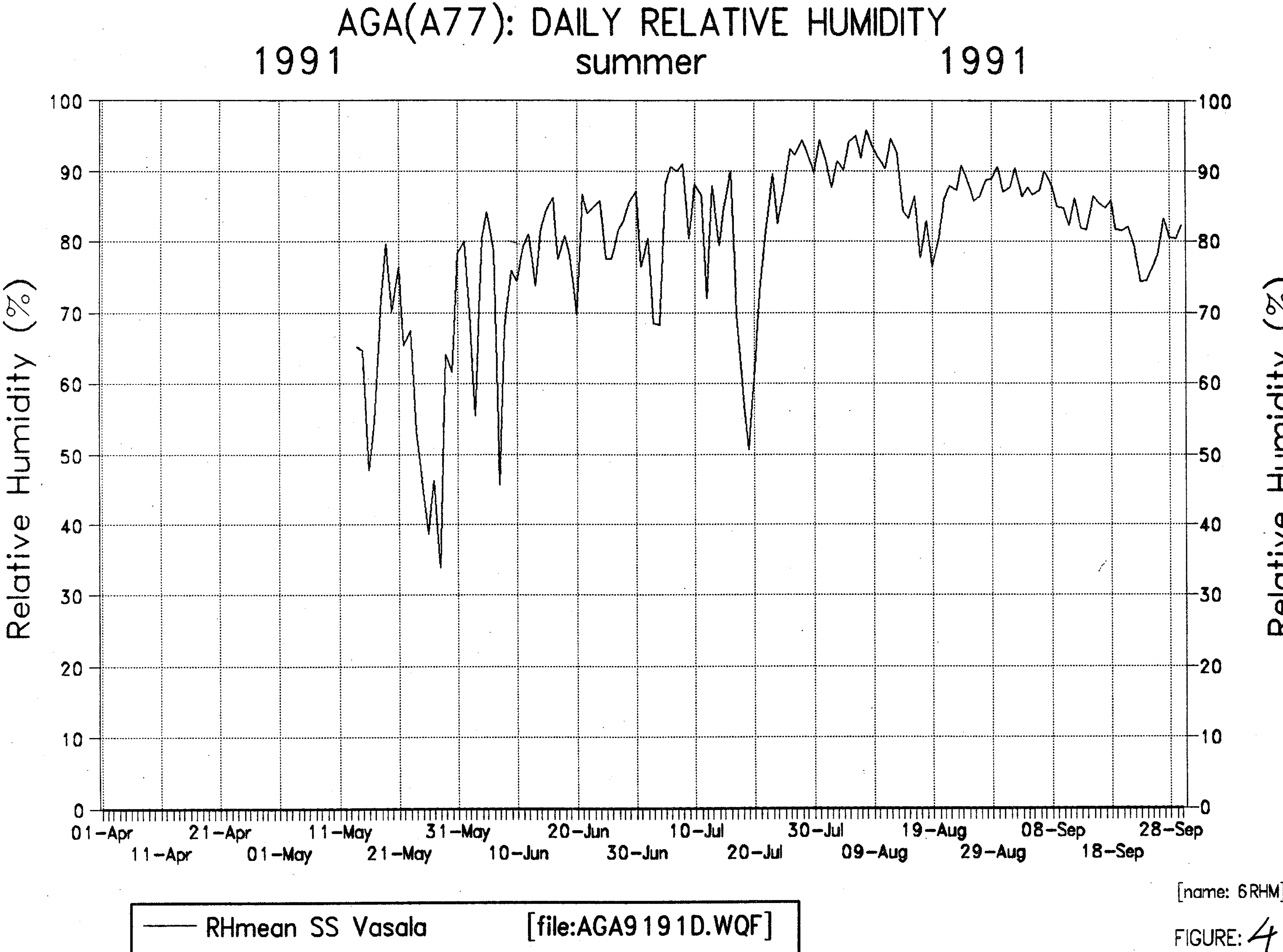
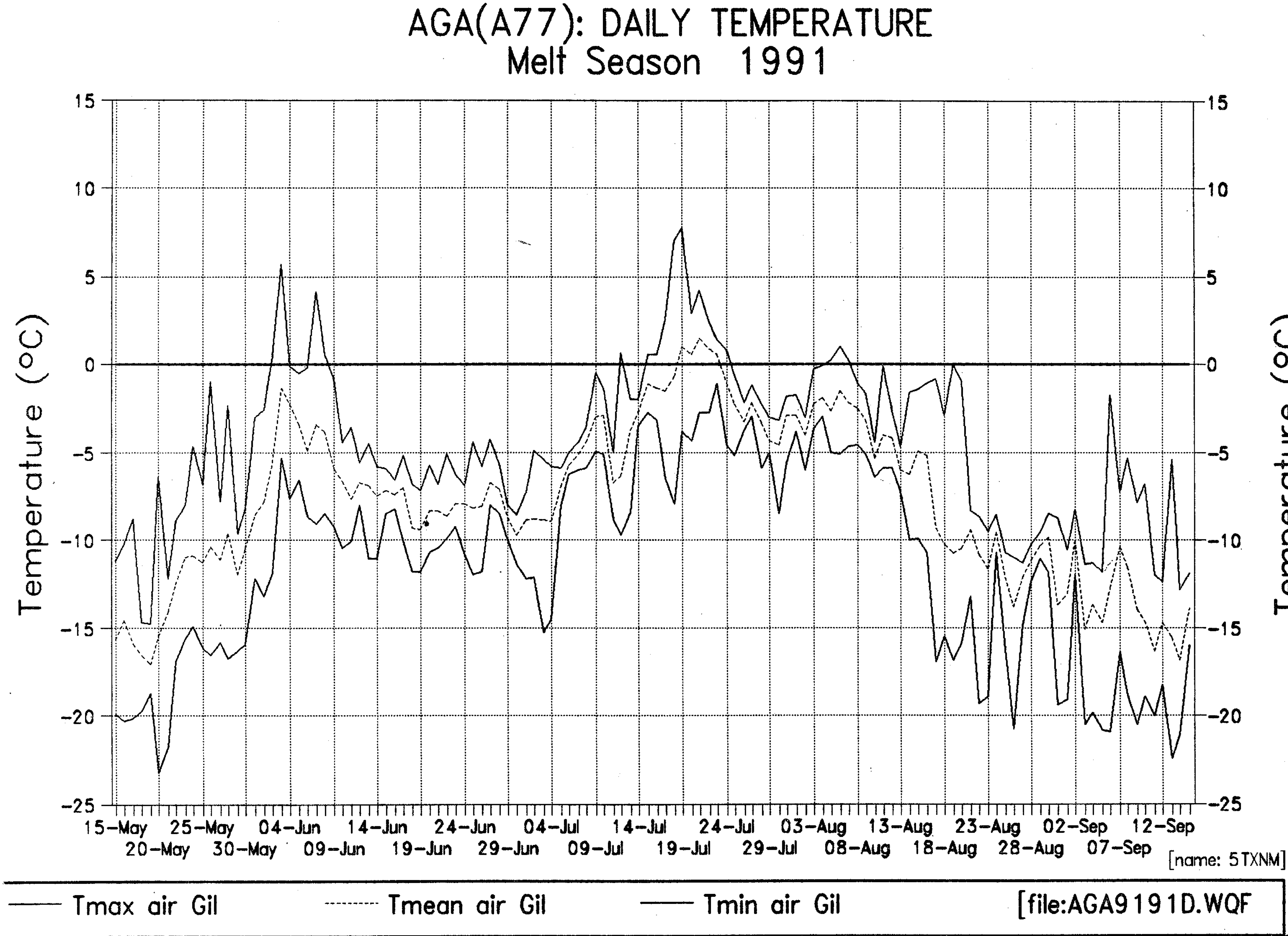
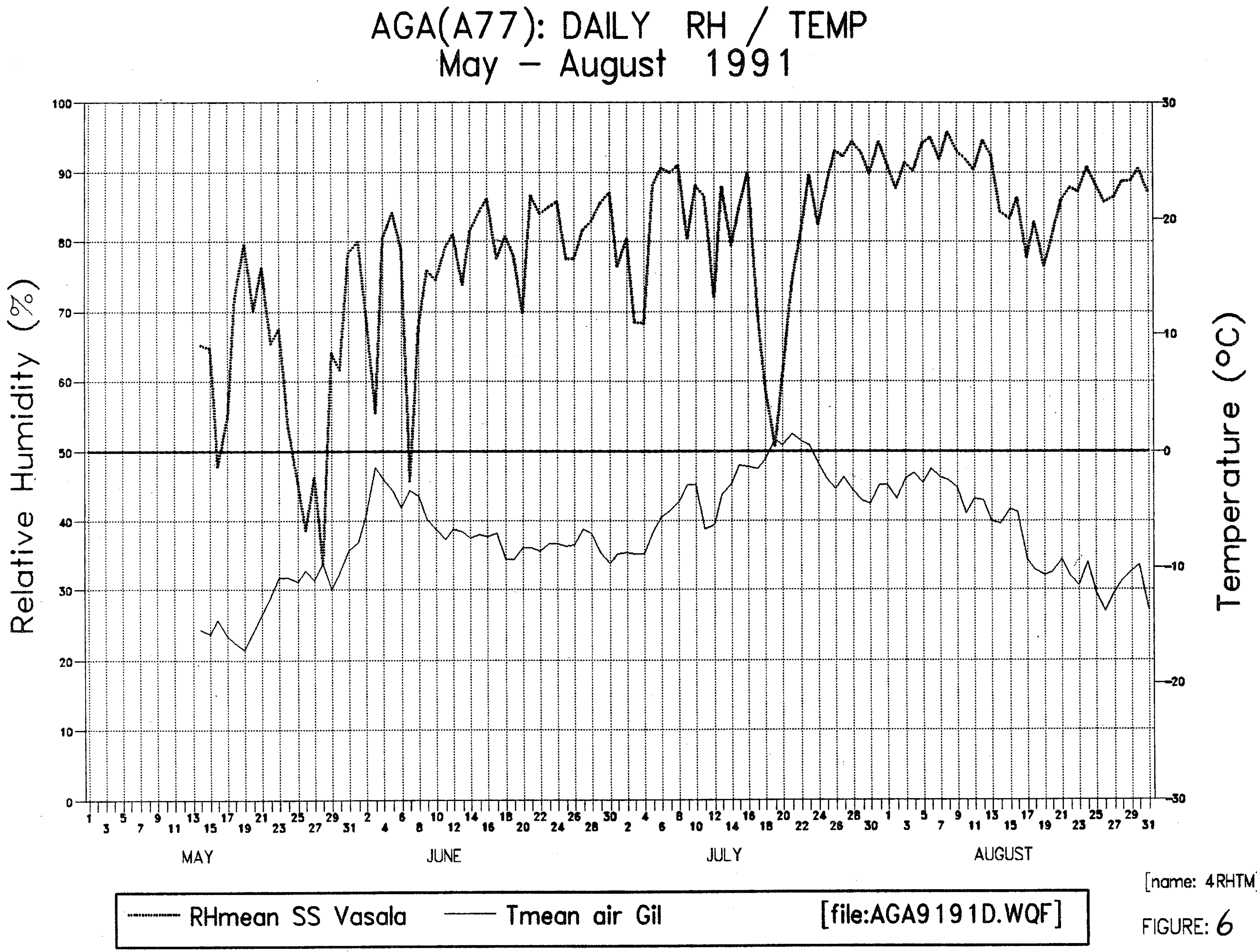

AGA(A77): DAILY RELATIVE HUMIDITY
1991 summer 1991
Relative Humidity (%)
100
90
80
70
60
50
40
30
20
10
0
01-Apr
11-Apr
21-Apr
01-May
11-May
21-May
31-May
10-Jun
20-Jun
30-Jun
10-Jul
20-Jul
30-Jul
09-Aug
19-Aug
29-Aug
08-Sep
18-Sep
28-Sep
RHmean SS Vasala
[file:AGA9191D.WQF]
[name: 6RHM]

FIGURE: 4



AGA(A77): DAILY TEMPERATURE
Melt Season 1991
Temperature (°C)
15
10
5
0
-5
-10
-15
-20
-25
15-May
20-May
25-May
30-May
04-Jun
09-Jun
14-Jun
19-Jun
24-Jun
29-Jun
04-Jul
09-Jul
14-Jul
19-Jul
24-Jul
29-Jul
03-Aug
08-Aug
13-Aug
18-Aug
23-Aug
28-Aug
02-Sep
07-Sep
12-Sep
[name: 5TXNM]
Tmax air Gil
Tmean air Gil
Tmin air Gil
[file:AGA9191D.WQF

FIGURE: 5



[name: 4RHTM]

FIGURE: 6

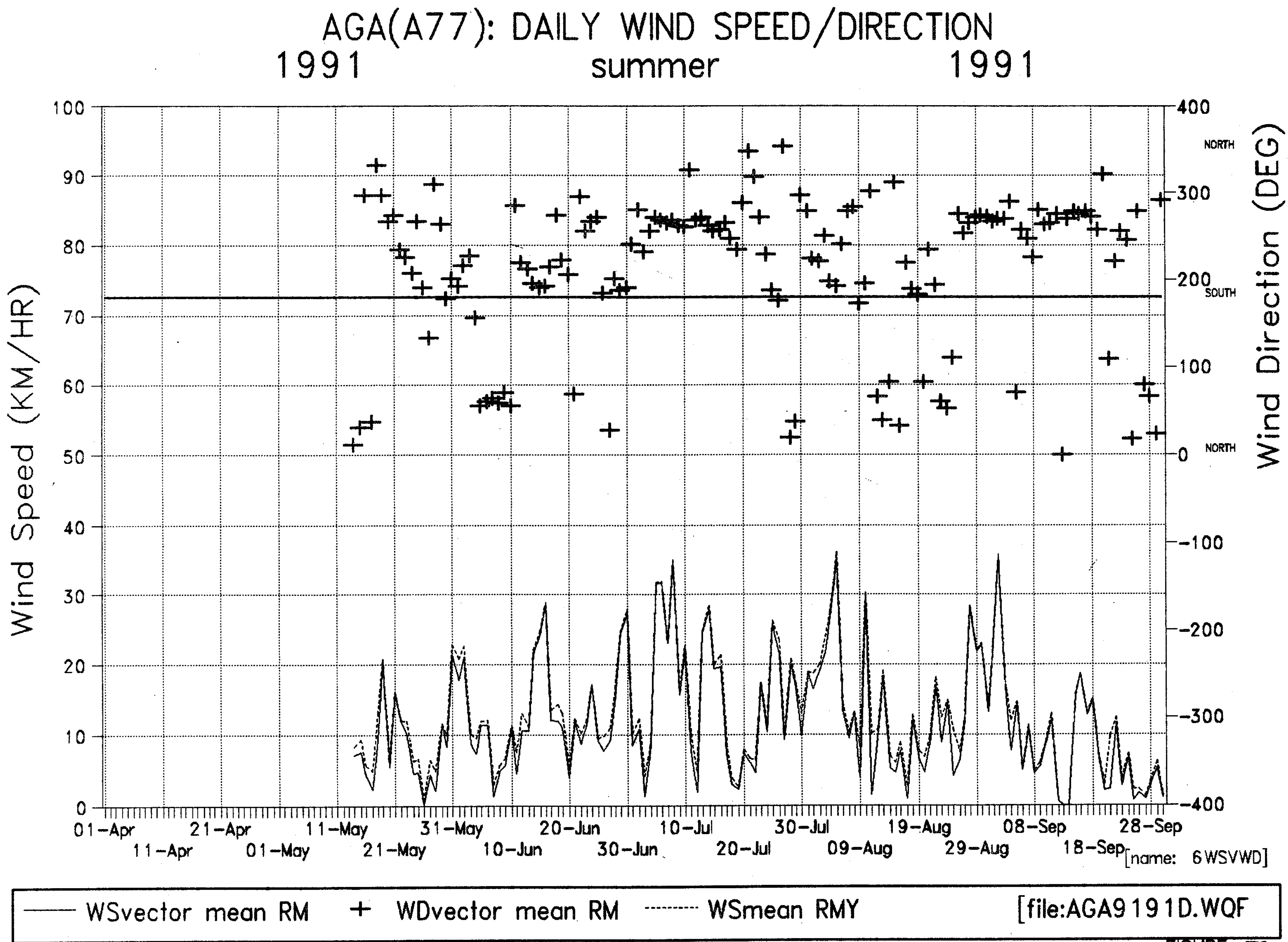

AGA(A77): DAILY WIND SPEED/DIRECTION
1991 summer 1991
Wind Speed (KM/HR)
Wind Direction (DEG)
NORTH
SOUTH
NORTH
100 90 80 70 60 50 40 30 20 10 0
400 300 200 100 0 -100 -200 -300 -400
01-Apr 11-Apr 21-Apr 01-May 11-May 21-May 31-May 10-Jun 20-Jun 30-Jun 10-Jul 20-Jul 30-Jul 09-Aug 19-Aug 29-Aug 08-Sep 18-Sep 28-Sep
[name: 6WSVWD]
WSvector mean RM
WDvector mean RM
WSmean RMY
[file:AGA9191D.WQF

FIGURE: 7

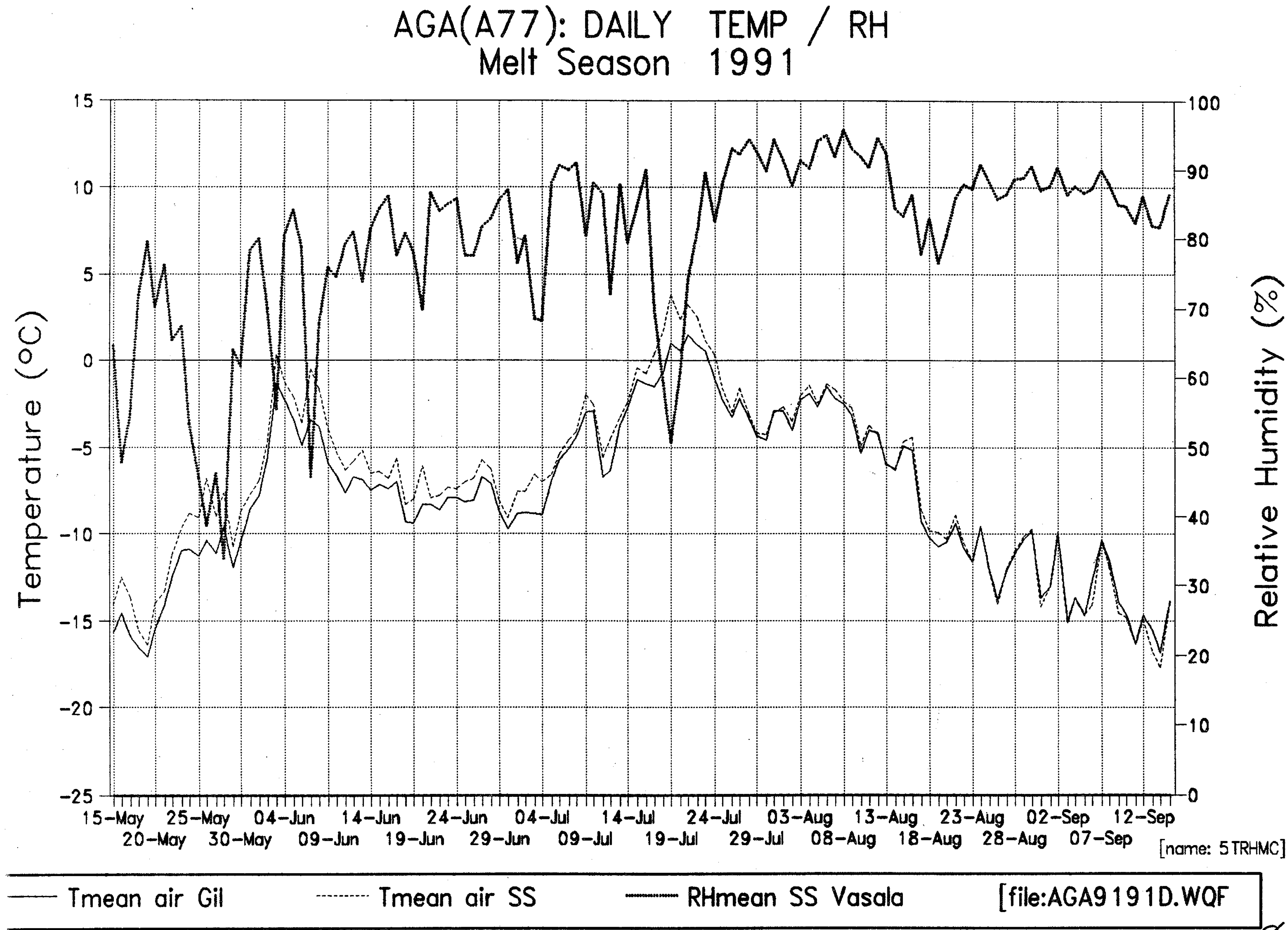

AGA(A77): DAILY TEMP / RH
Melt Season 1991
Temperature (°C)
Relative Humidity (%)
15
10
5
0
-5
-10
-15
-20
-25
100
90
80
70
60
50
40
30
20
10
0
15-May
20-May
25-May
30-May
04-Jun
09-Jun
14-Jun
19-Jun
24-Jun
29-Jun
04-Jul
09-Jul
14-Jul
19-Jul
24-Jul
29-Jul
03-Aug
08-Aug
13-Aug
18-Aug
23-Aug
28-Aug
02-Sep
07-Sep
12-Sep
[name: 5TRHMC]
Tmean air Gil
Tmean air SS
RHmean SS Vasala
[file:AGA9191D.WQF

FIGURE: 8

AGA(A77): DAILY SOLAR RADIATION

1991 summer 1991

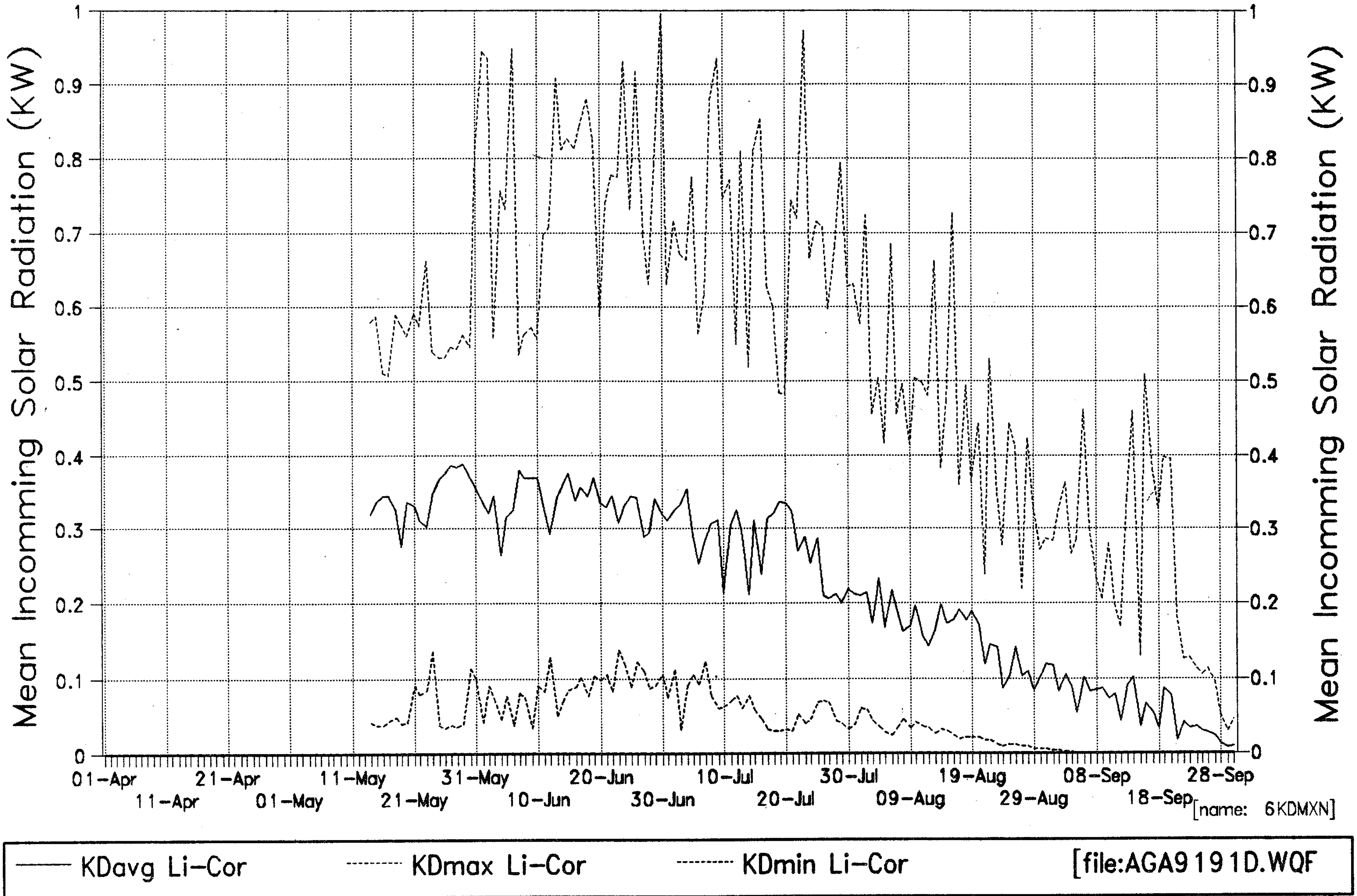
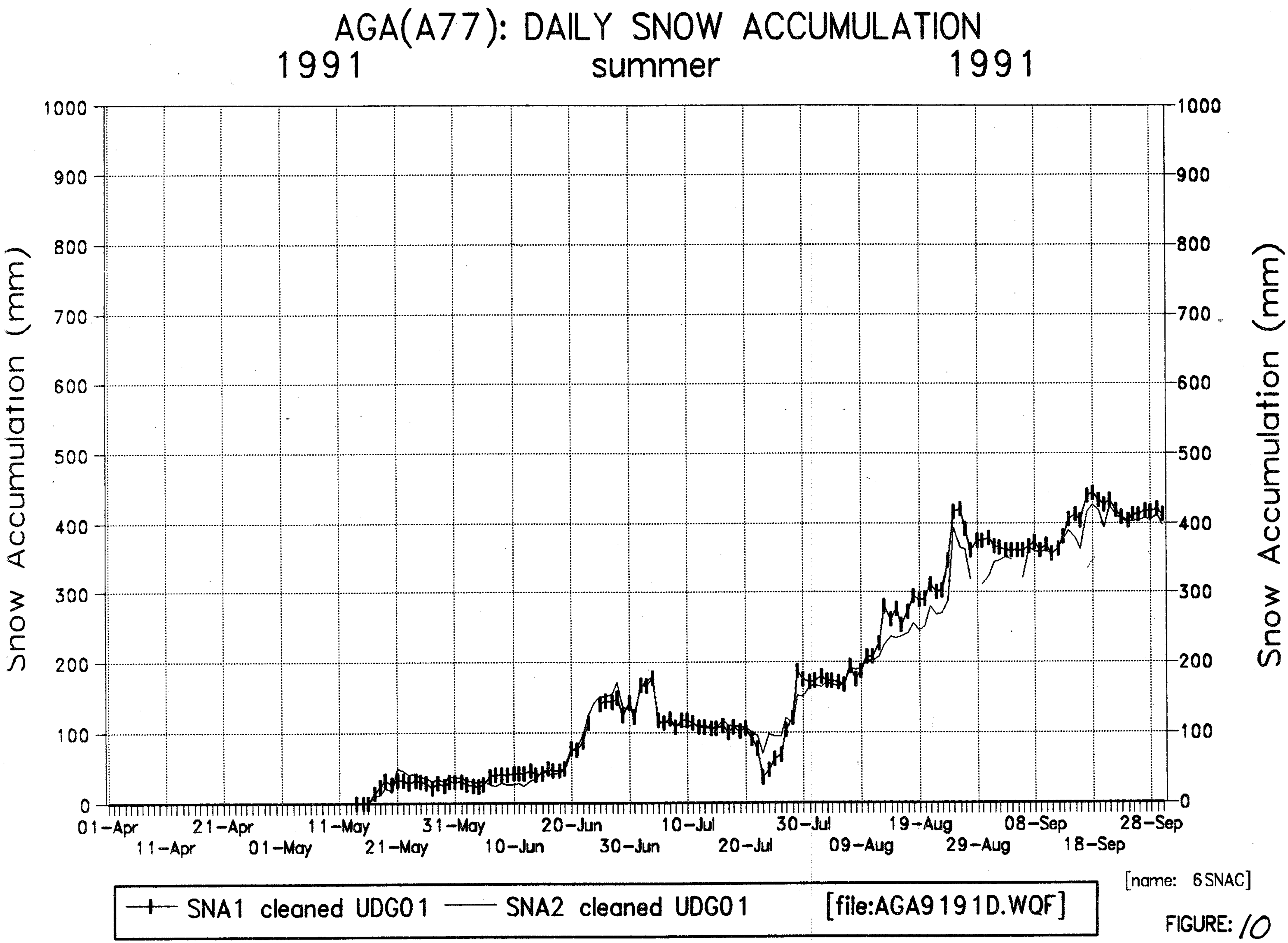


FIGURE: 9



[name: 6SNAC]

FIGURE: 10

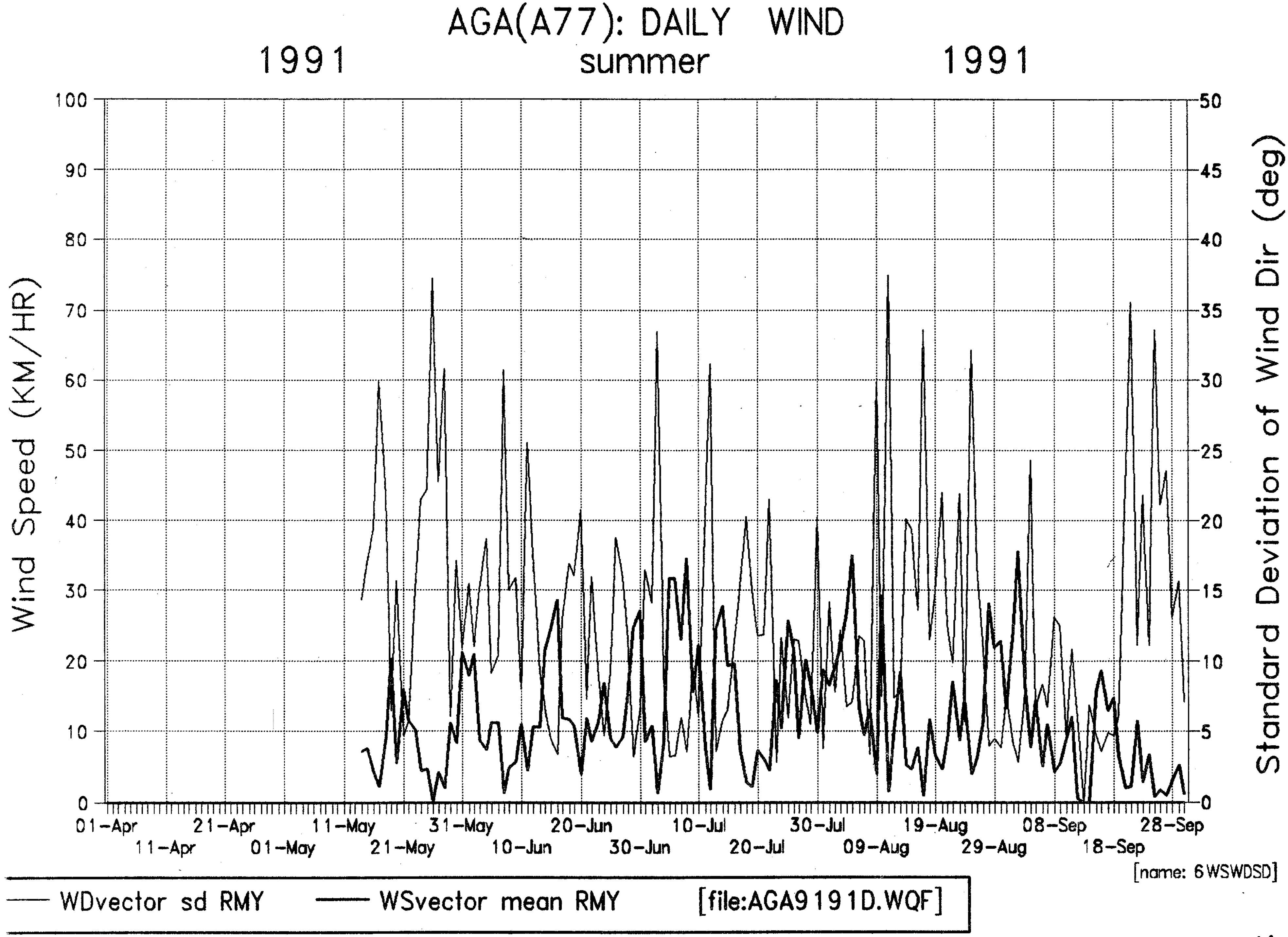
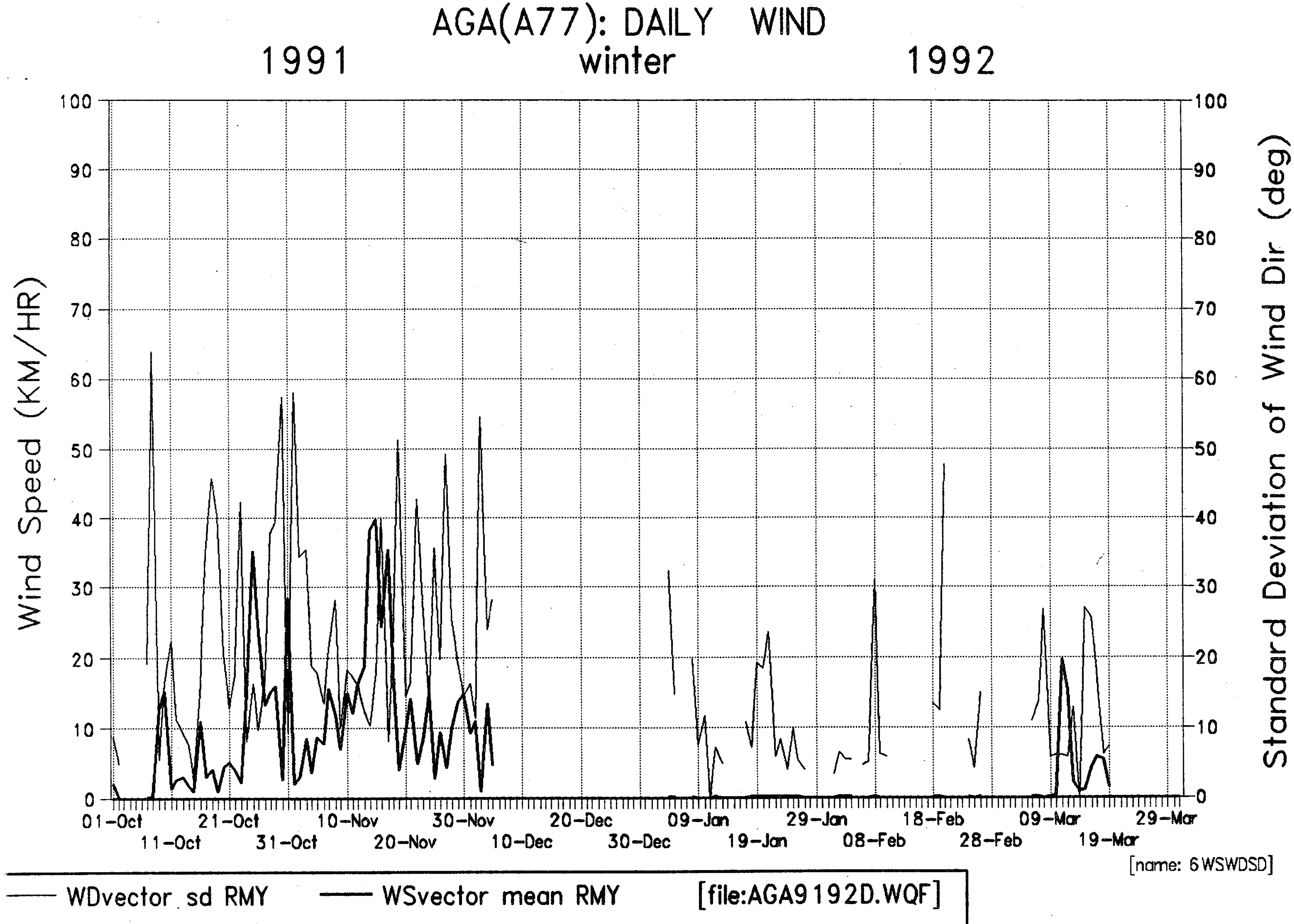

AGA(A77): DAILY WIND
1991
summer
1991
Wind Speed (KM/HR)
Standard Deviation of Wind Dir (deg)
0
10
20
30
40
50
60
70
80
90
100
0
5
10
15
20
25
30
35
40
45
50
01-Apr
11-Apr
21-Apr
01-May
11-May
21-May
31-May
10-Jun
20-Jun
30-Jun
10-Jul
20-Jul
30-Jul
09-Aug
19-Aug
29-Aug
08-Sep
18-Sep
28-Sep
[name: 6WSWDSD]
WDvector sd RMY
WSvector mean RMY
[file:AGA9191D.WQF]

FIGURE: 11

Table 1.2:

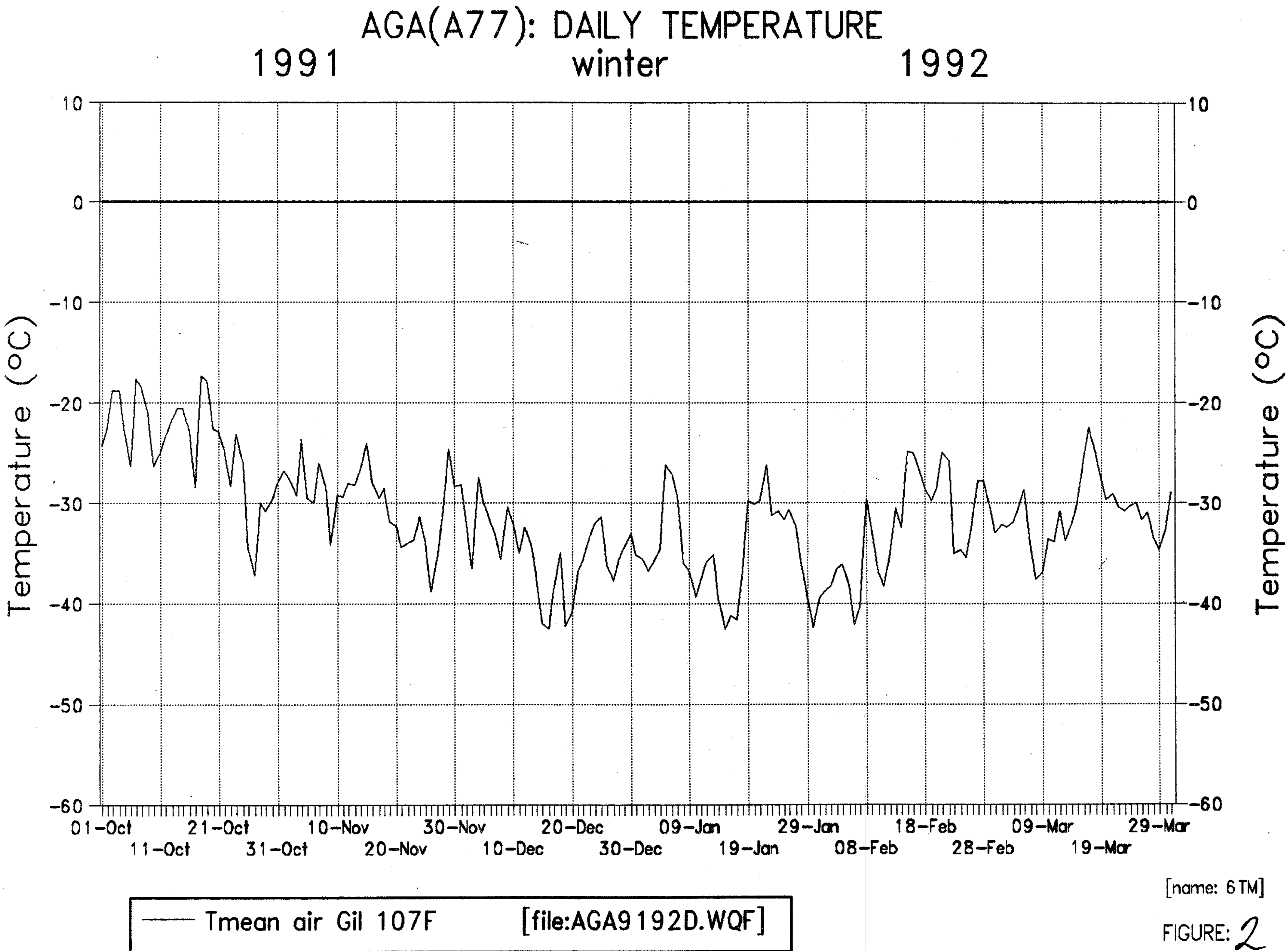
DAILY PLOTS: Winter 1991-92 (October 1991 - March 1992)					
name:	Figure no.		Season/ Month	Years	Figure Caption
A: Plots printed for spreadsheet AGA9192D.WQF					
6wswdsd	AGA9192D.	1	Winter	1991-92	Daily difference between the mean calculated from (max + min)/2 and the daily mean of 60 sec sampled values as output from the logger program
6tm	AGA9192D.	2	March	1991-92	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 107F in Gill screen
6txn	AGA9192D.	3	Winter	1991-92	Daily maximum and minimum air temperature (°C) from 107F in Gill screen
4txn	AGA9192D.	4	November - February	1991	Daily maximum and minimum air temperature (°C) from 107F in Gill screen
6rhm	AGA9192D.	5	Winter	1991-92	Daily mean values of relative humidity (%) from Vasala in Gill screen
5txnm	AGA9192D.	6	Dark Season	1991-92	Daily maximum, minimum and mean air temperature (total incomming solar radiation (KJ/m^2) from Eppley pyranometerC) from 107F in Gill screen
4rhtm	AGA9192D.	7	November - February	1991	Daily mean values of relative humidity (%) from Vasala in Stevenson Screen and air temperature (°C) from 107F probe in Gill scree n
6wsvwd	AGA9192D.	8	Winter	1991-92	Daily mean scalar and vector wind speed (Km/ hr) and mean vector direction (deg)
6snac	AGA9192D.	9	Winter	1991-92	Daily cleaned snow depth (mm) with all questionable data removed
B: Additional plots available in spreadsheet not printed for report					
5trhmc	AGA9192D.		Dark Seas on	1991-92	Daily means of air temperature (°C) [comparison of 107F probe in Gill screen and 107F probe in unventilated Stevenson Screen] and relative humidity (%) from Vasala in Steve nson Screen
6kdmxn	AGA9192D.		Winter	1991-92	Daily total incomming solar radiation (KJ/m^2) from Eppley pyranometer
octtxnc	AGA9192D.		April	1991	Daily comparison of maximum and minimun values of air temperature from 107F probe in Gill screen and 107F probe in unventilated Stevenson Screen

DAILY PLOTS: Winter 1991-92 (October 1991 - March 1992)					
name:	Figure no.		Season/ Month	Years	Figure Caption
novtxnc	AGA9192D.		November	1991	Daily comparison of maximum and minimun values of air temperature from 107F probe in Gill screen and 107F probe in unventilated Stevenson Screen
dectxnc	AGA9192D.		December	1991	Daily comparison of maximum and minimun values of air temperature from 107F probe in Gill screen and 107F probe in unventilated Stevenson Screen
jantxnc	AGA9192D.		January	1992	Daily comparison of maximum and minimun values of air temperature from 107F probe in Gill screen and 107F probe in unventilated Stevenson Screen
febtxnc	AGA9192D.		February	1992	Daily comparison of maximum and minimun values of air temperature from 107F probe in Gill screen and 107F probe in unventilated Stevenson Screen
martxnc	AGA9192D.		March	1992	Daily comparison of maximum and minimun values of air temperature from 107F probe in Gill screen and 107F probe in unventilated Stevenson Screen
note: the remaining monthly graphs for this spreadsheet are not yet completed					



AGA(A77): DAILY WIND
1991
winter
1992
Wind Speed (KM/HR)
Standard Deviation of Wind Dir (deg)
0
10
20
30
40
50
60
70
80
90
100
01-Oct
11-Oct
21-Oct
31-Oct
10-Nov
20-Nov
30-Nov
10-Dec
20-Dec
30-Dec
09-Jan
19-Jan
29-Jan
08-Feb
18-Feb
28-Feb
09-Mar
19-Mar
29-Mar
[name: 6WSWDSD]
WDvector sd RMY
WSvector mean RMY
[file:AGA9192D.WQF]

FIGURE: /



[name: 6TM]

FIGURE: 2

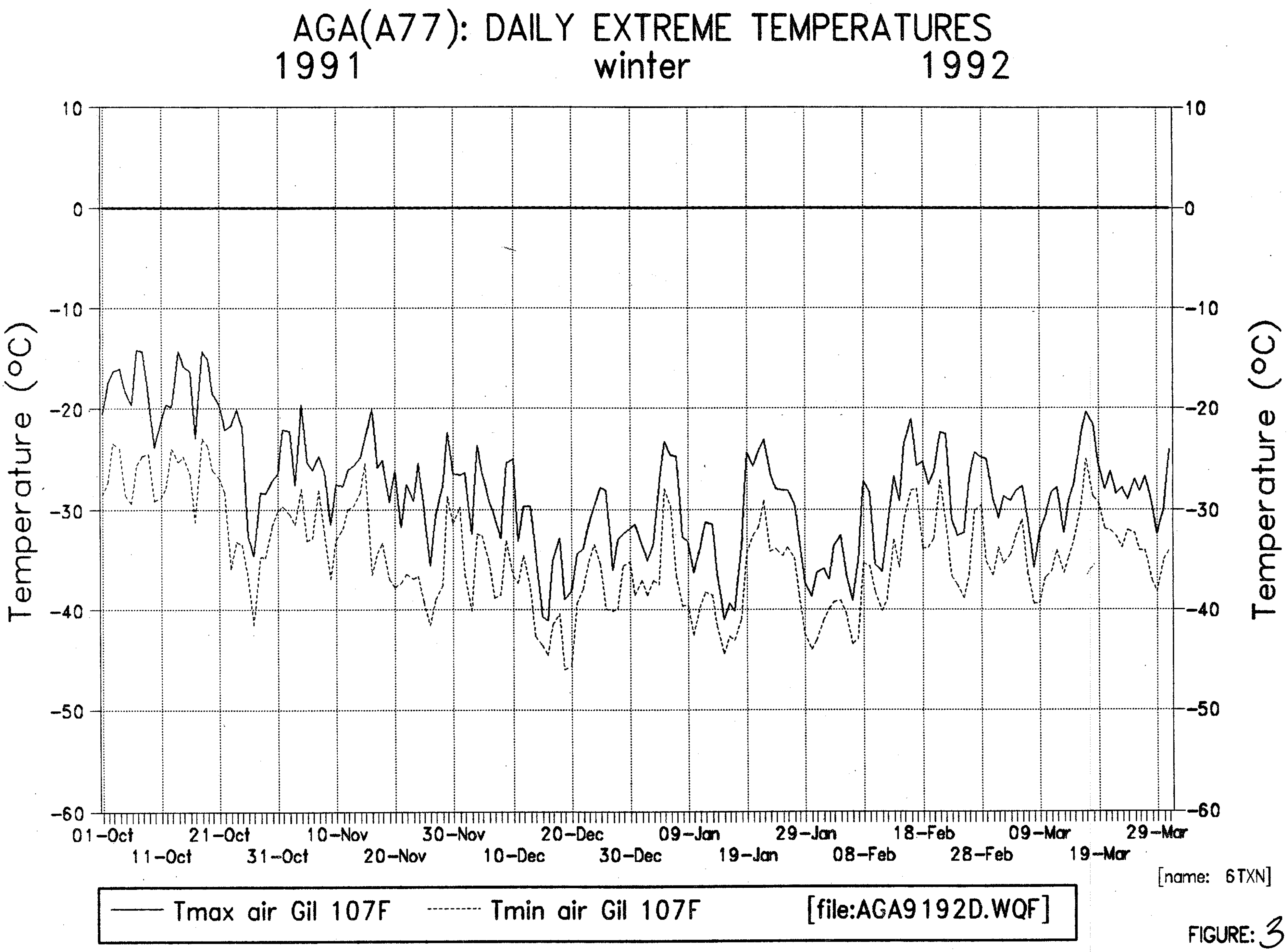
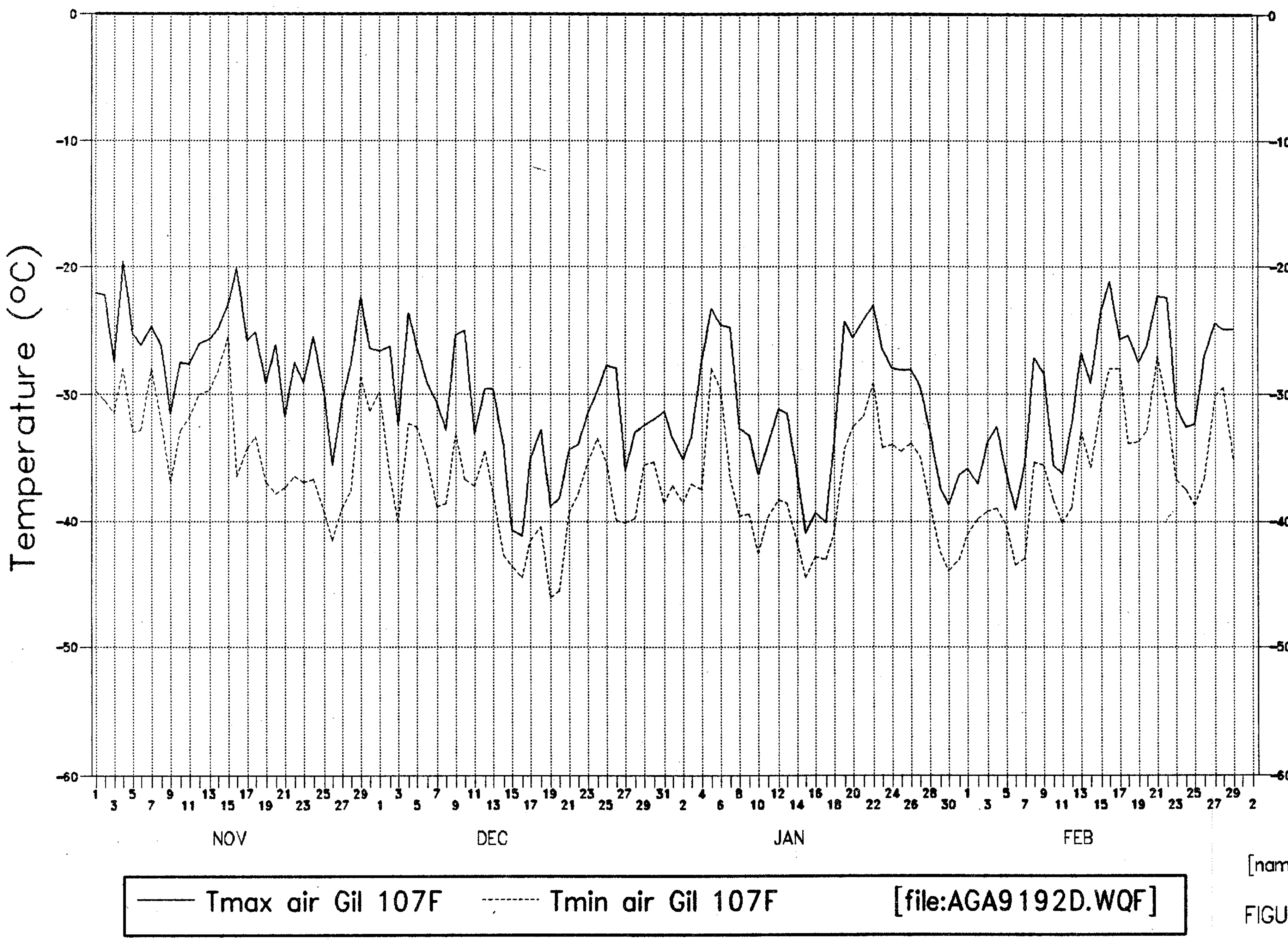

AGA(A77): DAILY EXTREME TEMPERATURES
1991 winter 1992
Temperature (oC)
10
0
-10
-20
-30
-40
-50
-60
01-Oct
11-Oct
21-Oct
31-Oct
10-Nov
20-Nov
30-Nov
10-Dec
20-Dec
30-Dec
09-Jan
19-Jan
29-Jan
08-Feb
18-Feb
28-Feb
09-Mar
19-Mar
29-Mar
[name: 6TXN]
Tmax air Gil 107F
Tmin air Gil 107F
[file:AGA9192D.WQF]

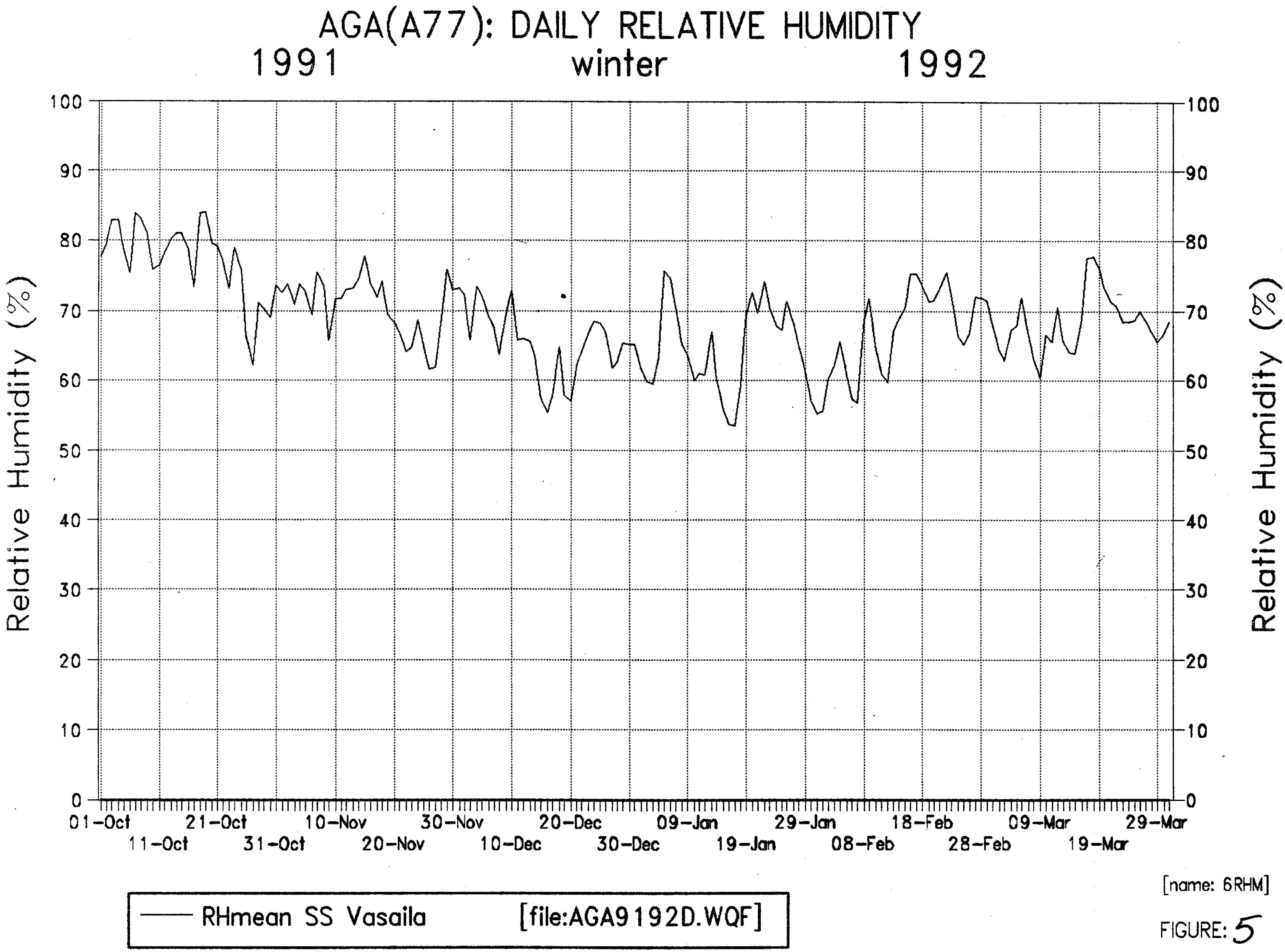
FIGURE: 3

AGA(A77): DAILY TEMPERATURE
November 1991 – February 1992



[name: 4TXN]

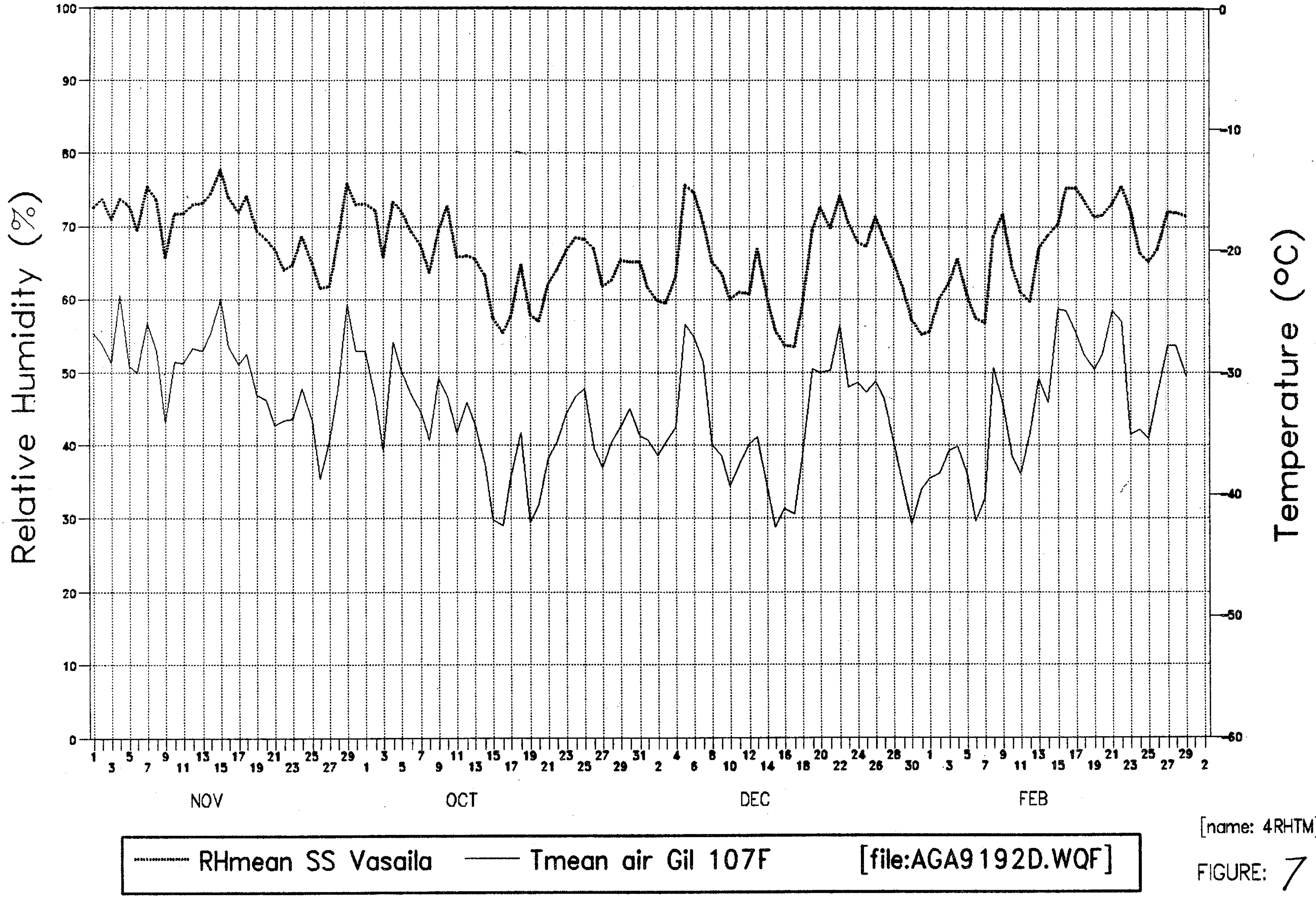
FIGURE: 4



[name: 6RHM]

FIGURE: 5

AGA(A77): DAILY RH / TEMP
November 1991 - February 1992



[name: 4RHTM]

FIGURE: 7

AGA(A77): DAILY WIND SPEED/DIRECTION
1991 winter 1992

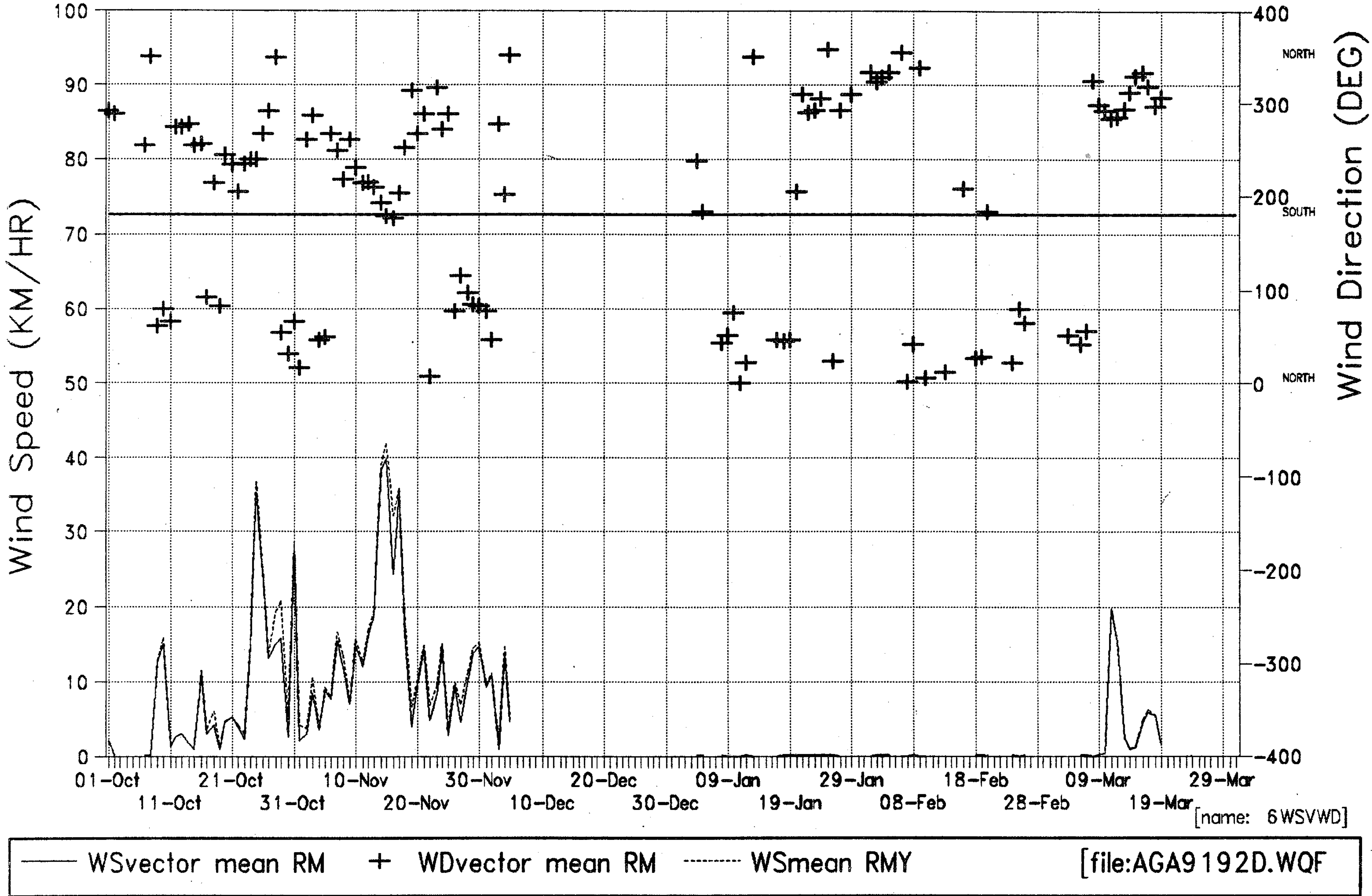


FIGURE: 8

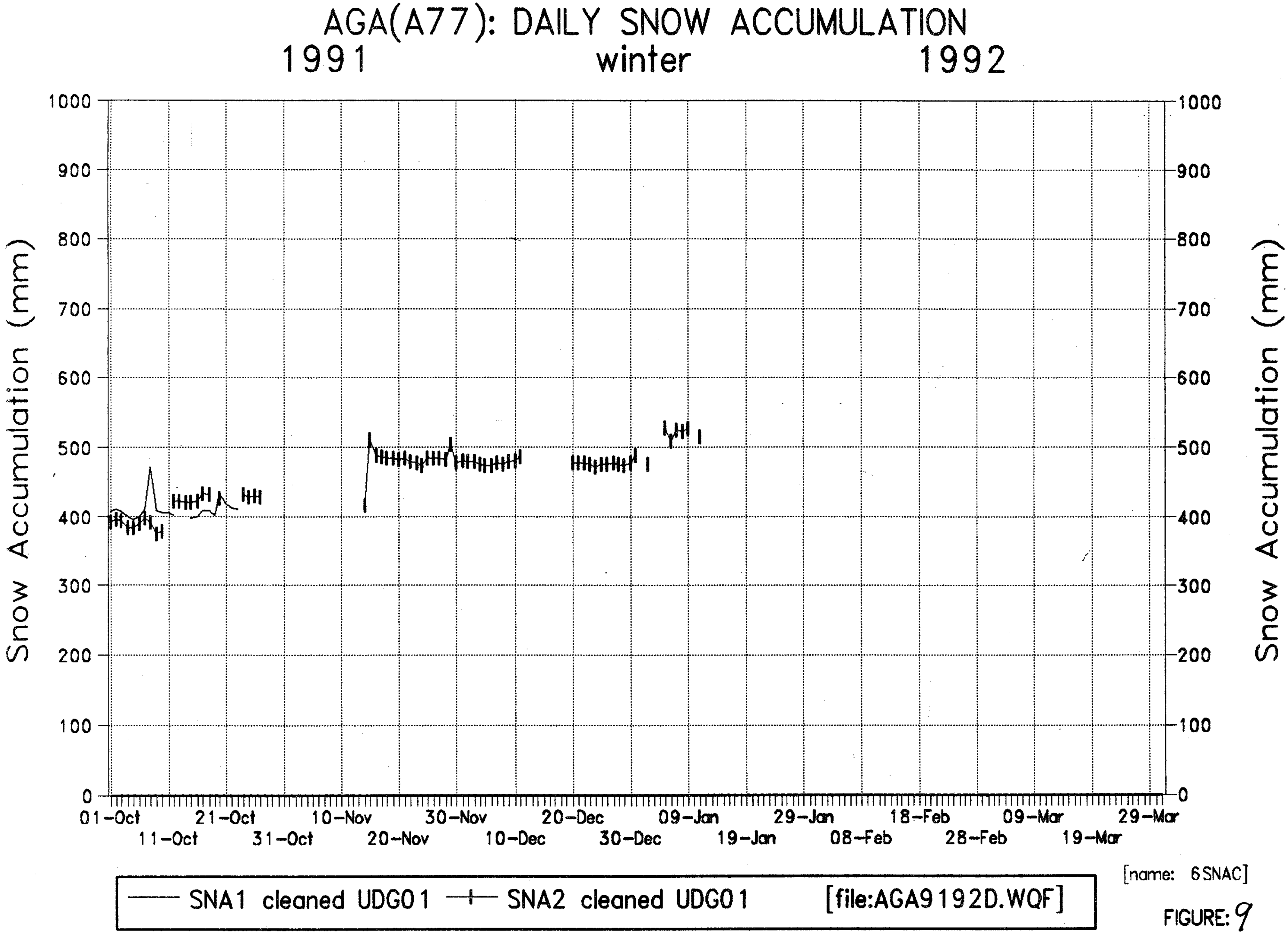
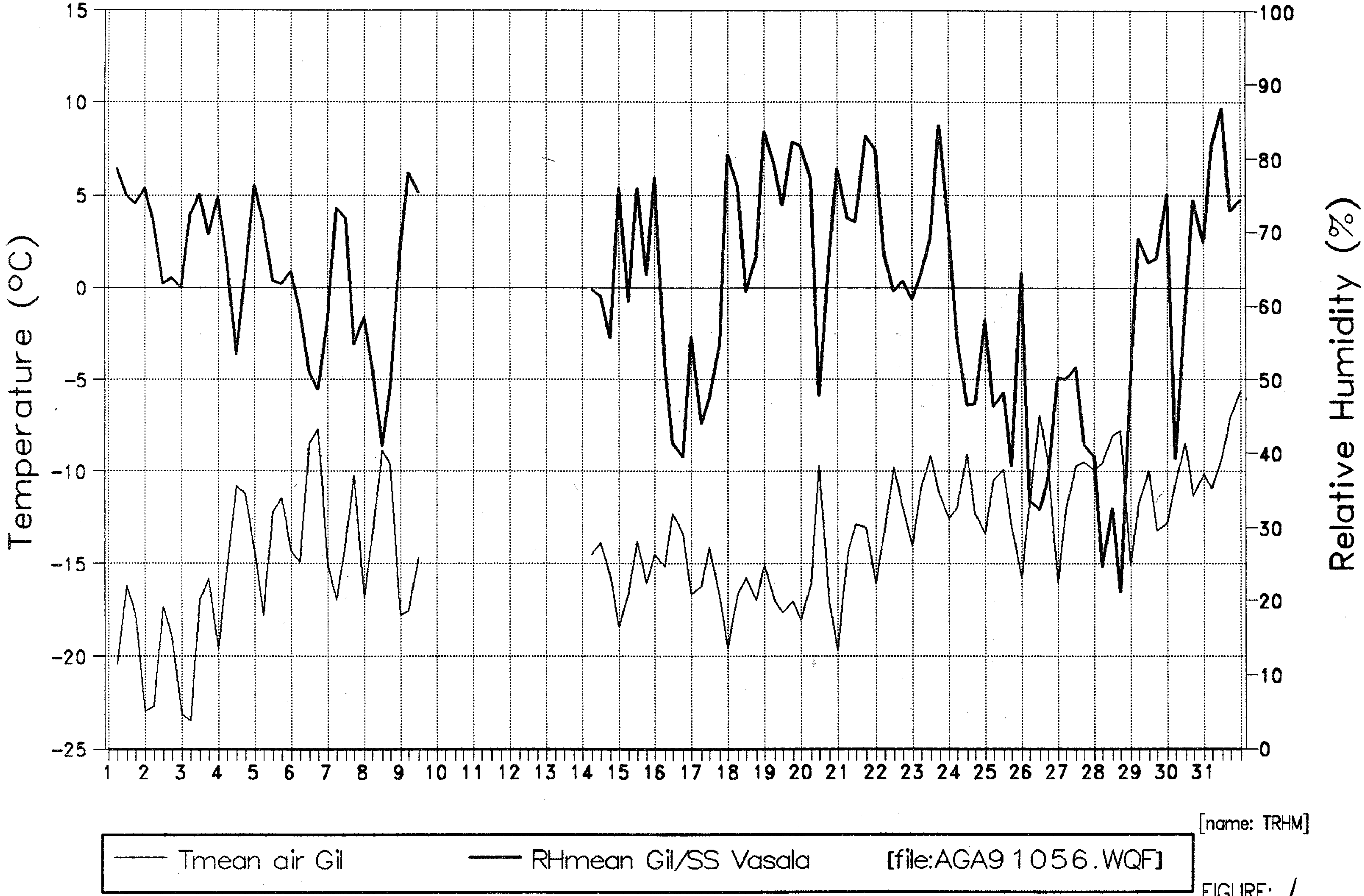

AGA(A77): DAILY SNOW ACCUMULATION
1991 winter 1992
Snow Accumulation (mm)
0
100
200
300
400
500
600
700
800
900
1000
01–Oct
11–Oct
21–Oct
31–Oct
10–Nov
20–Nov
30–Nov
10–Dec
20–Dec
30–Dec
09–Jan
19–Jan
29–Jan
08–Feb
18–Feb
28–Feb
09–Mar
19–Mar
29–Mar
SNA1 cleaned UDG01
SNA2 cleaned UDG01
[file:AGA9192D.WQF]
[name: 6SNAC]
FIGURE: 9

Table 1.3

SIX-HOURLY PLOTS: May 1991				
name:	Figure no,		Month Year	Figure Caption
A: Plots printed for spreadsheet AGA91056.WQF				
trhm	AGA91056.	1	May 1991	Six-hourly mean values of air temperature (°C) and relative humidity (%) from 207F probe in Gill screen
txn	AGA91056.	2	May 1991	Six-hourly mean values of maximum and minimun values of air temperature from 207F probe in Gill screen
rhxn	AGA91056.	3	May 1991	Six-hourly mean values of maximum and minimum relative humidity (%) 207F probe in Gill screen
snac12	AGA91056.	4	May 1991	Six-hourly sampled value of snow accumulation (spring zero reset) from two UDC01 sensors
wswdv	AGA91056.	5	May 1991	Six-hourly mean values of wind speed and vector mean values of wind speed and direction from RM Young anemometer
wdsd	AGA91056.	6	May 1991	Six-hourly vector wind direction and standard deviation of direc tion (deg)
wswdsd	AGA91056.	7	May 1991	Six-hourly mean vector wind speed (KM/HR) and the standard deviation of wind direction (deg)
B: Plots available in spreadsheet but not printed for report				
txnc	AGA91056.		May 1991	Comparison of six-hourly maximum and minimun values of air temperature from 207F probe in Gill screen and 107F probe in unventilated Stevenson Screen
dtxnm	AGA91056.		May 1991	Difference between temperatures from 207F probe in Gill scree n and from 107F probe in unventilated Stevenson Screen for mean, maximun and minimum and air temperatures

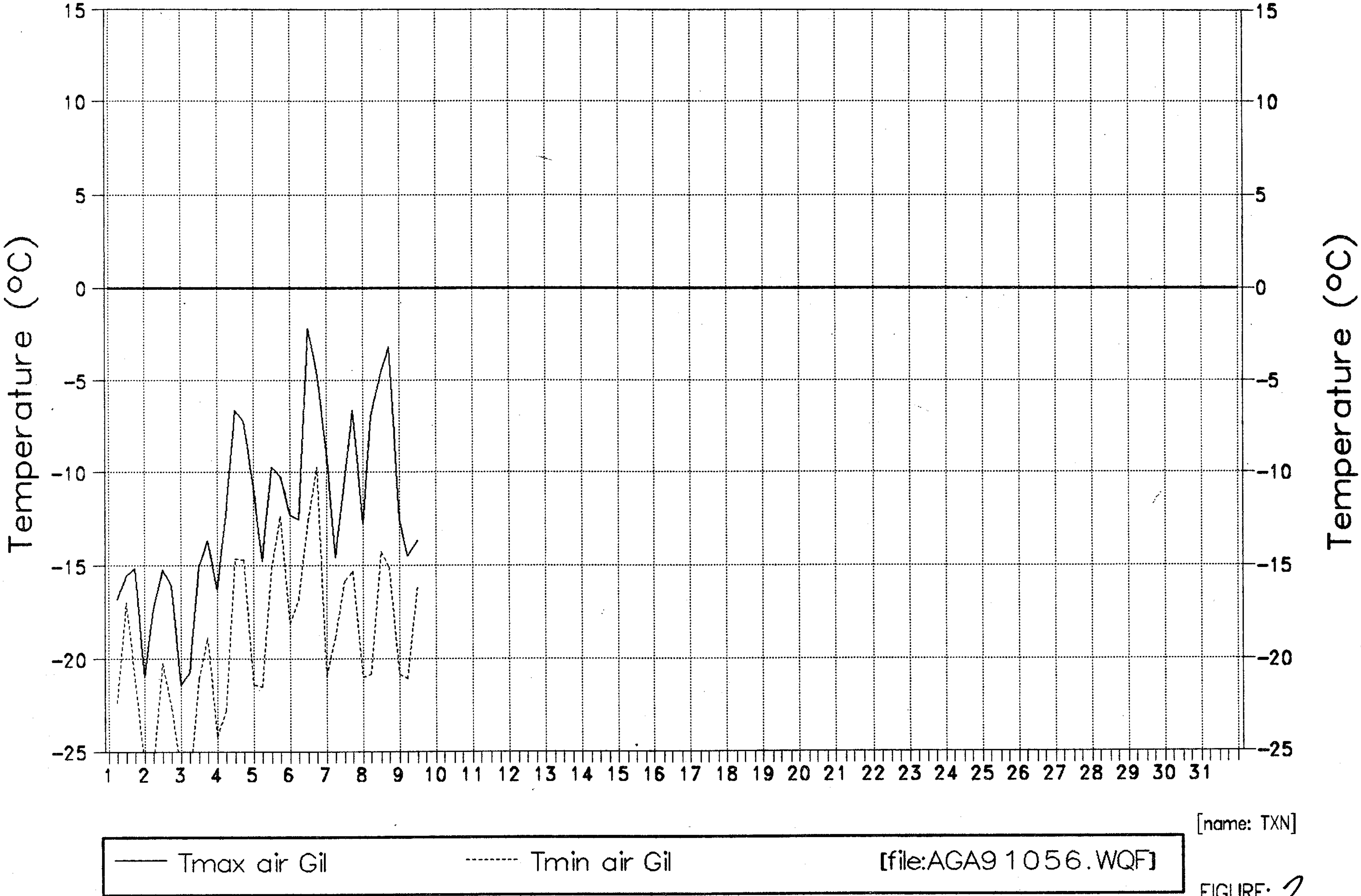
AGA(A77): SIX-HOURLY TEMP / RH
May 1991



[name: TRHM]

FIGURE: /

AGA(A77): SIX-HOURLY EXTREME TEMPERATURES
May 1991



[name: TXN]

FIGURE: 2

AGA(A77): SIX-HOURLY RELATIVE HUMIDITY
May 1991

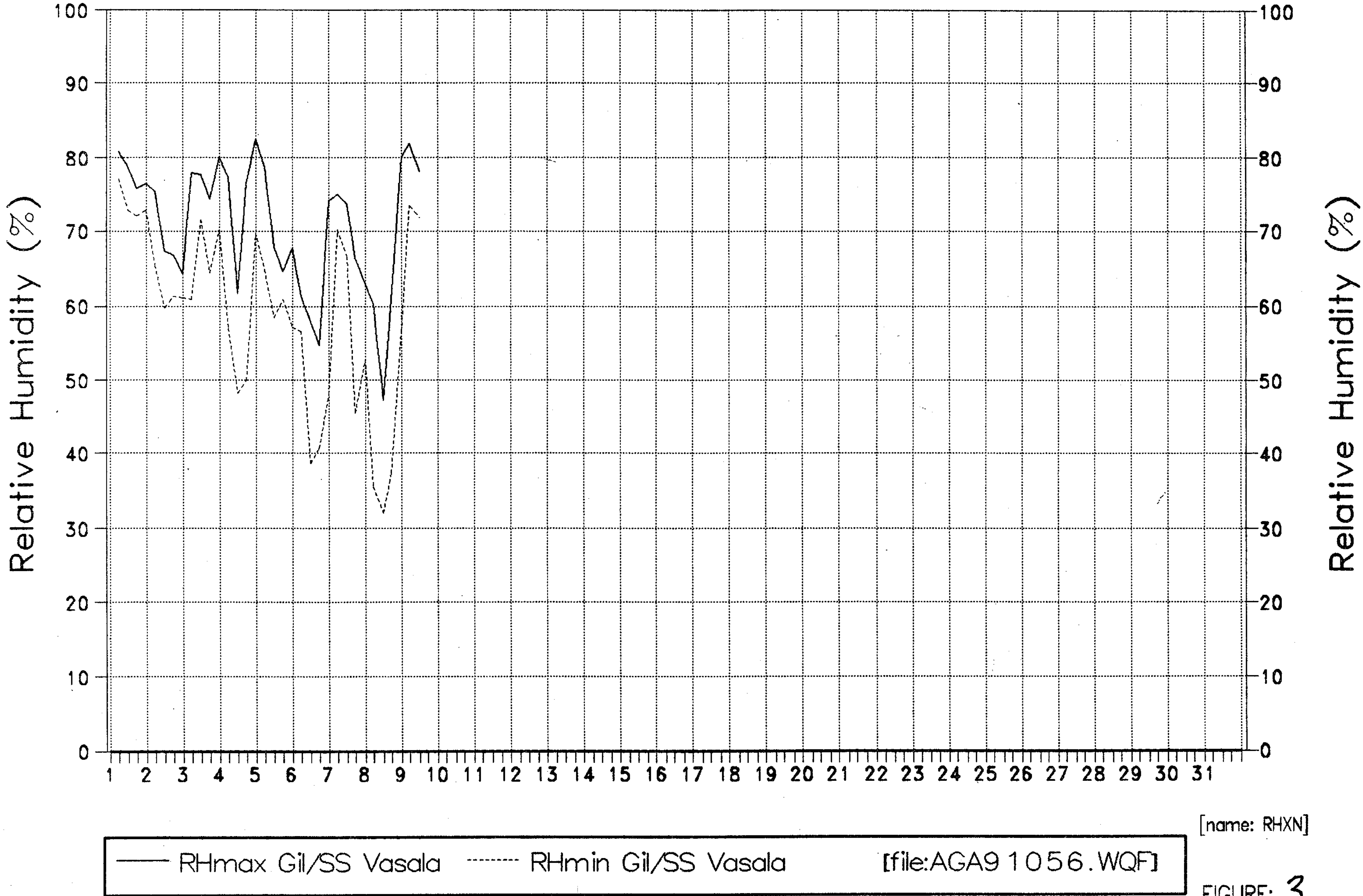
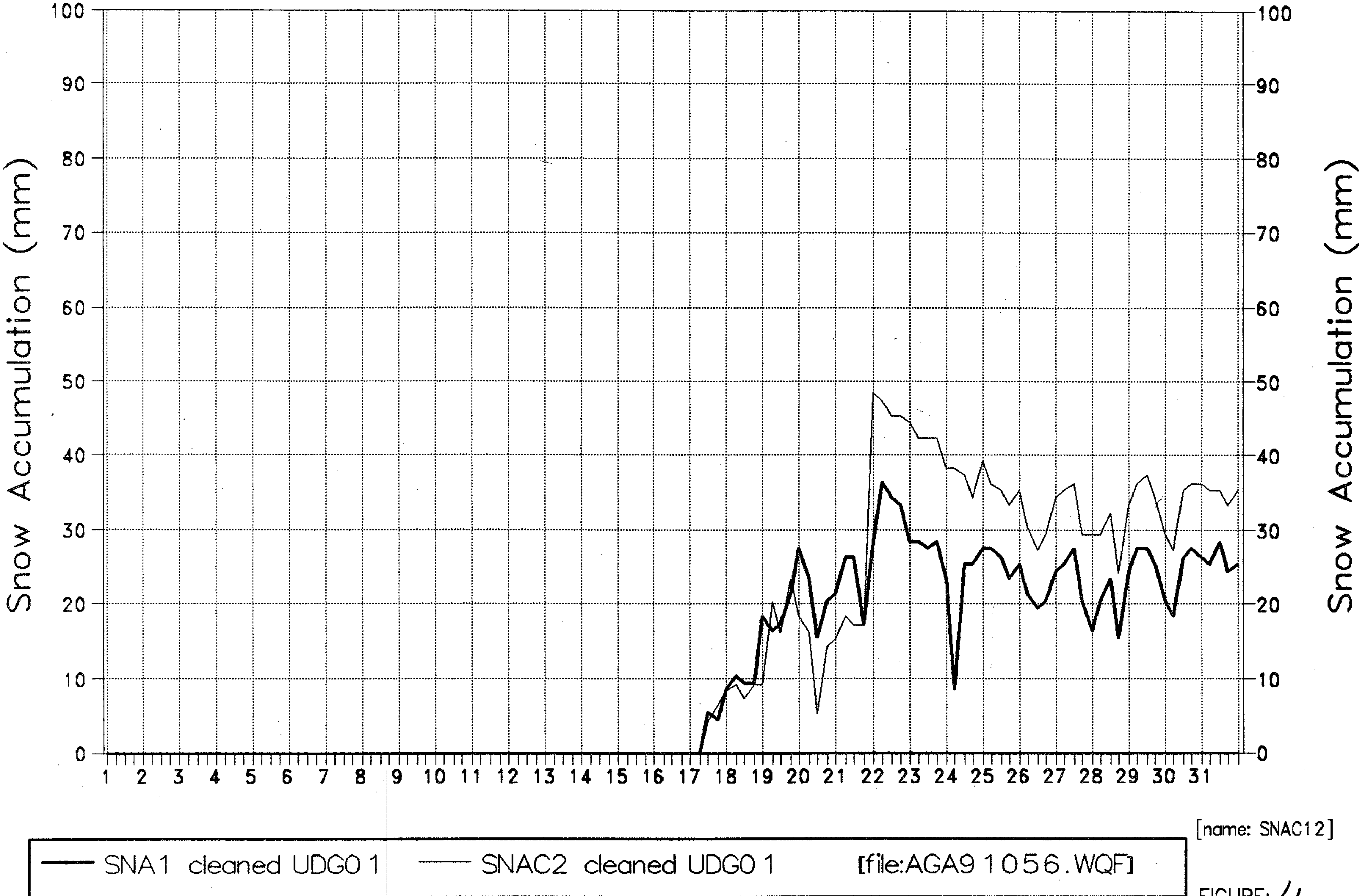


FIGURE: 3

AGA(A77): SIX-HOURLY SNOW ACCUMULATION
May 1991



[name: SNAC12]

FIGURE: 4

AGA(A77): SIX-HOURLY WIND
May 1991

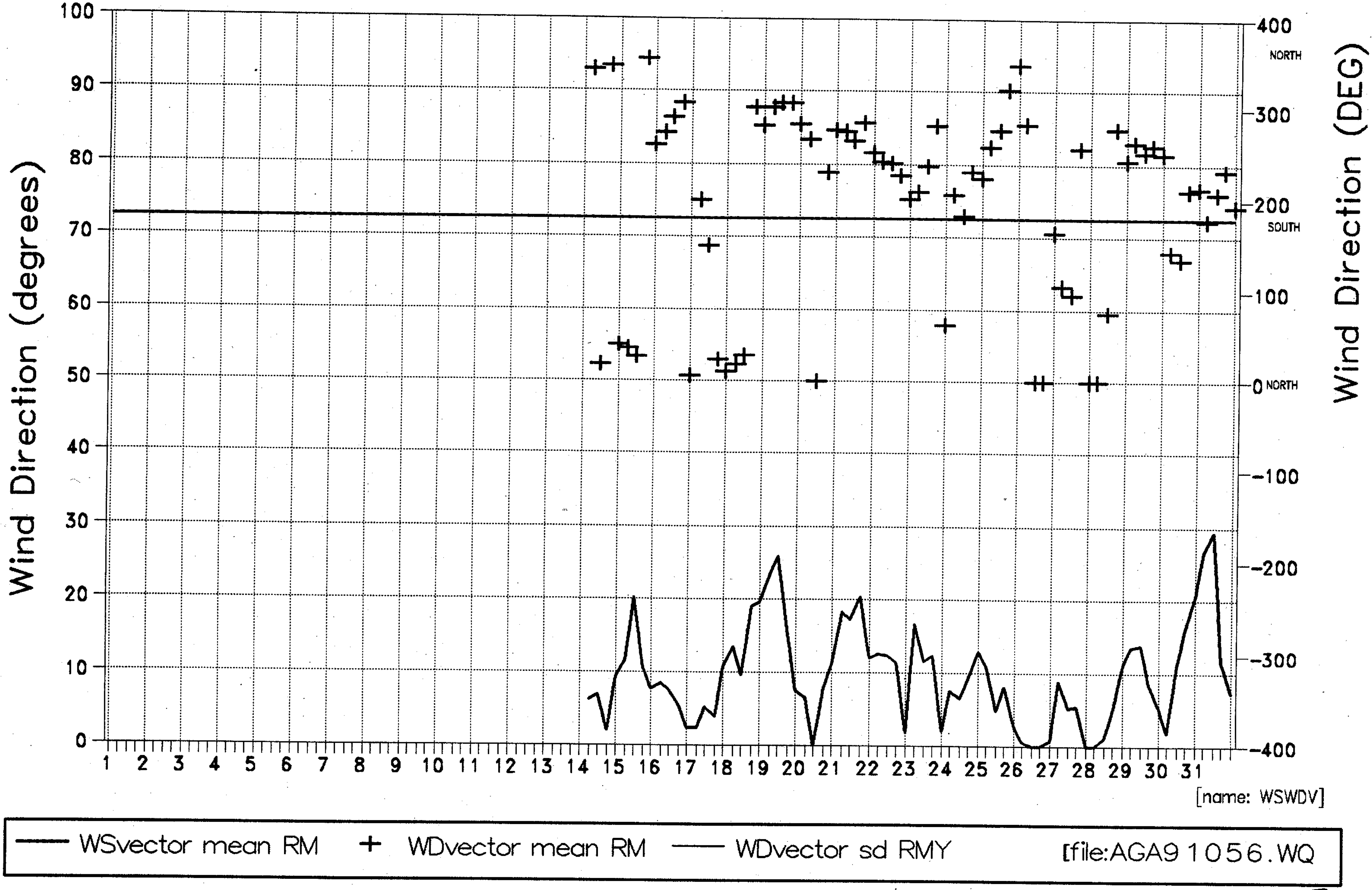
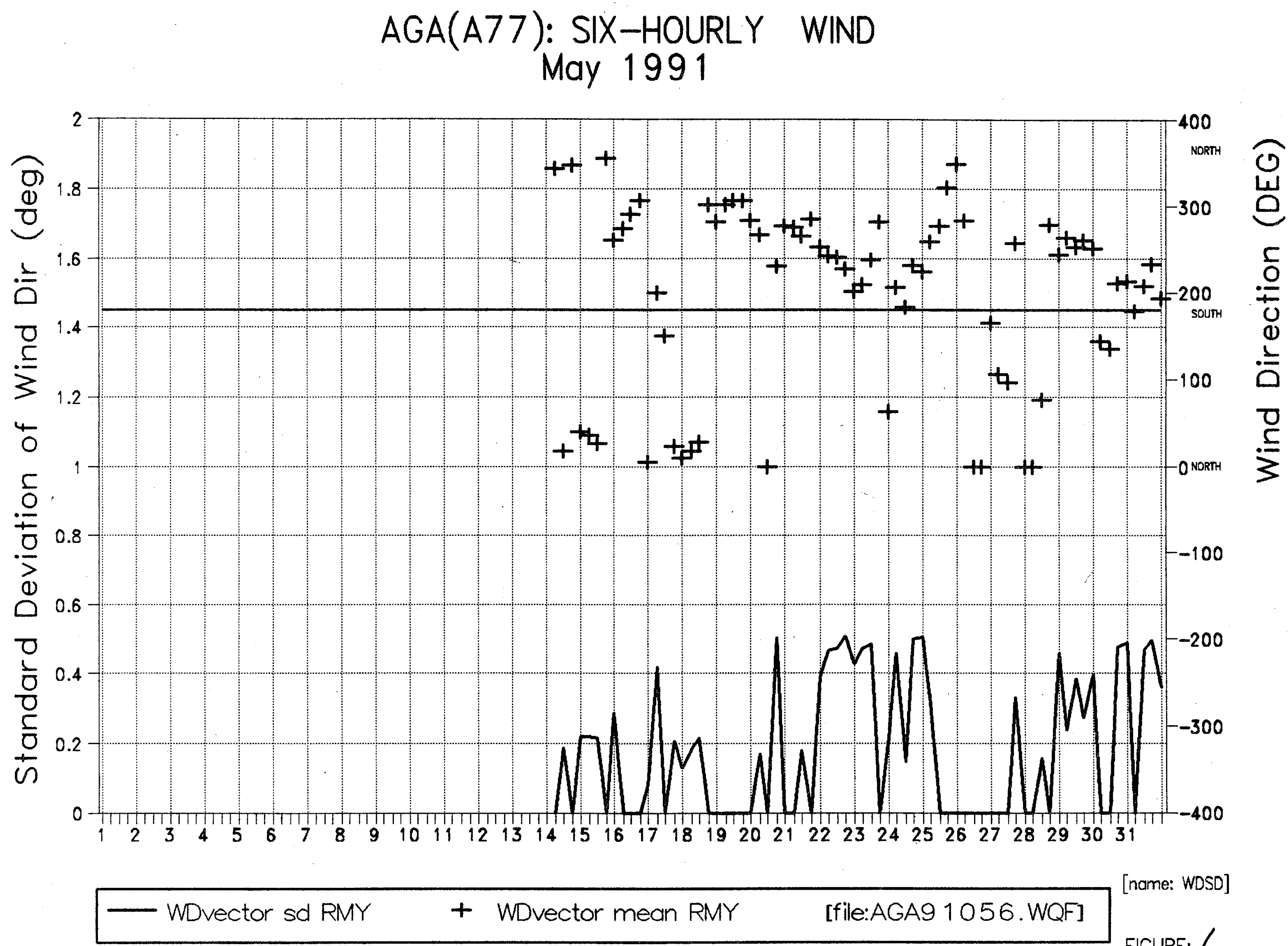


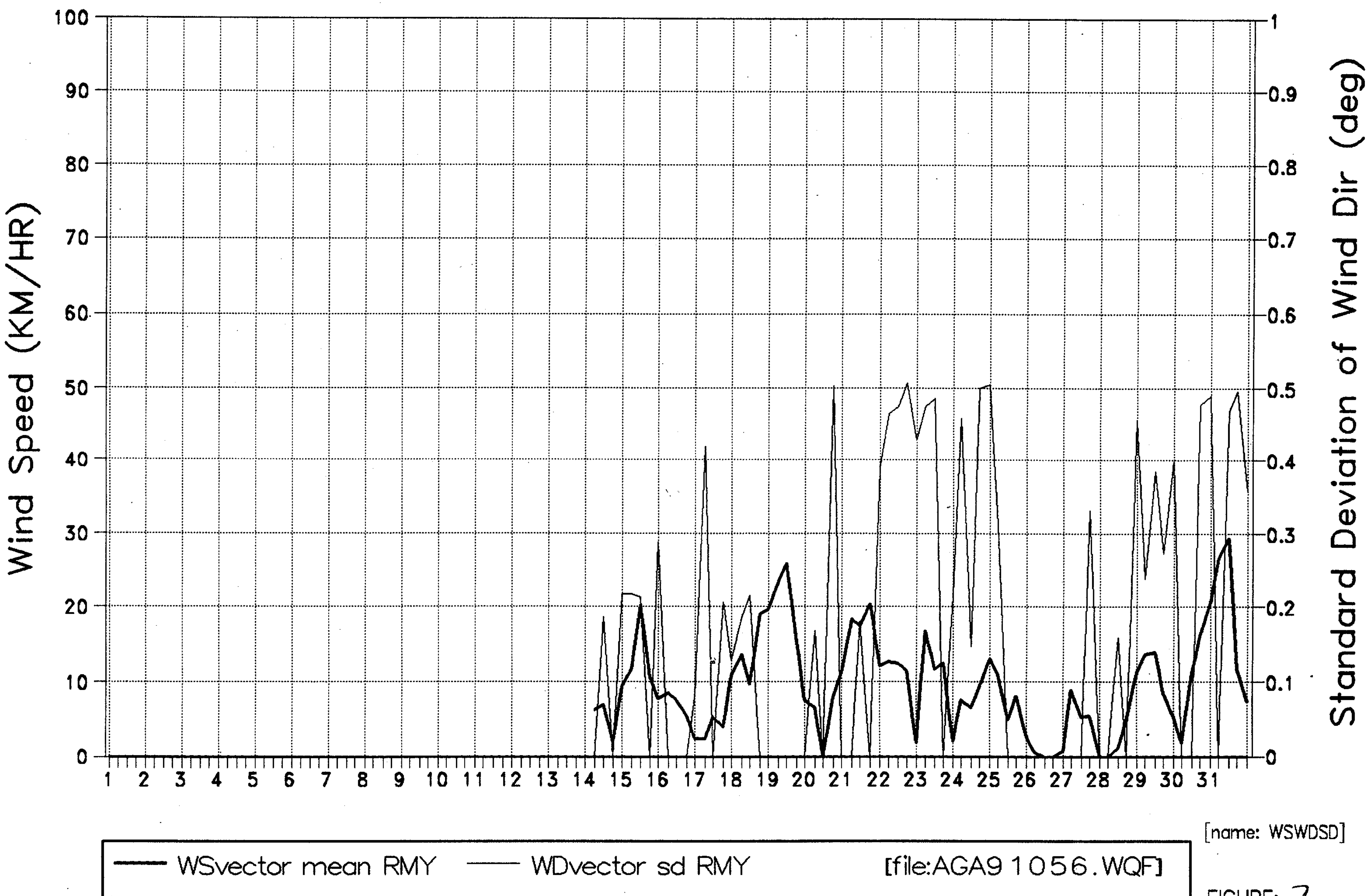
FIGURE: 5



AGA(A77): SIX-HOURLY WIND
May 1991
Standard Deviation of Wind Dir (deg)
Wind Direction (DEG)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
400
NORTH
300
200
SOUTH
100
0 NORTH
−100
−200
−300
−400
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
WDvector sd RMY
+ WDvector mean RMY
[file:AGA91056.WQF]
[name: WDSD]

FIGURE: 6

AGA(A77): SIX-HOURLY WIND
May 1991



[name: WSWDSD]

FIGURE: 7

Table 1.4

SIX-HOURLY PLOTS: March 1992				
name:	Figure no.		Month Year	Figure Caption
A: Plots printed for spreadsheet AGA92036.WQF				
trhm	AGA92036.	1	March 1992	Six-hourly mean values of air temperature (°C) and relative humidity (%) from 207F probe in Gill screen
wswdv	AGA92036.	2	March 1992	Six-hourly mean values of wind speed and vector mean values of wind speed and direction from RM Young anemometer
wdsd	AGA92036.	3	March 1992	Six-hourly vector wind direction and standard deviation of direction (deg)
wswdsd	AGA92036.	4	March 1992	Six-hourly mean vector wind speed (KM/HR) and the standard deviation of wind direction (deg)
xtmc	AGA92036.	5	March 1992	Comparison of six-hourly mean temperatures from 207F probe in main Gill screen, Stevenson screen and second Gill screen (°C)
B: Plots available in spreadsheet but not printed for report				
C: Plots having insignificant amounts of data				
txn	AGA92036.		March 1992	Six-hourly mean values of maximum and minimun values of air temperature from 207F probe in Gill screen
rhxn	AGA92036.		March 1992	Six-hourly mean values of maximum and minimum relative humidity (%) 207F probe in Gill screen
snac12	AGA92036.		March 1992	Six-hourly sampled value of snow accumulation (spring zero reset) from two UDC01 sensors
txnc	AGA92036.		March 1992	Comparison of six-hourly maximum and minimun values of air temperature from 207F probe in Gill screen and 107F probe in unventilated Stevenson Screen
xkd	AGA92036.		March 1992	Six-hourly mean values of incomming solar radiation (KW/m^2) from Li-Cor pyranometer

AGA(A77): SIX-HOURLY TEMP / RH
March 1992

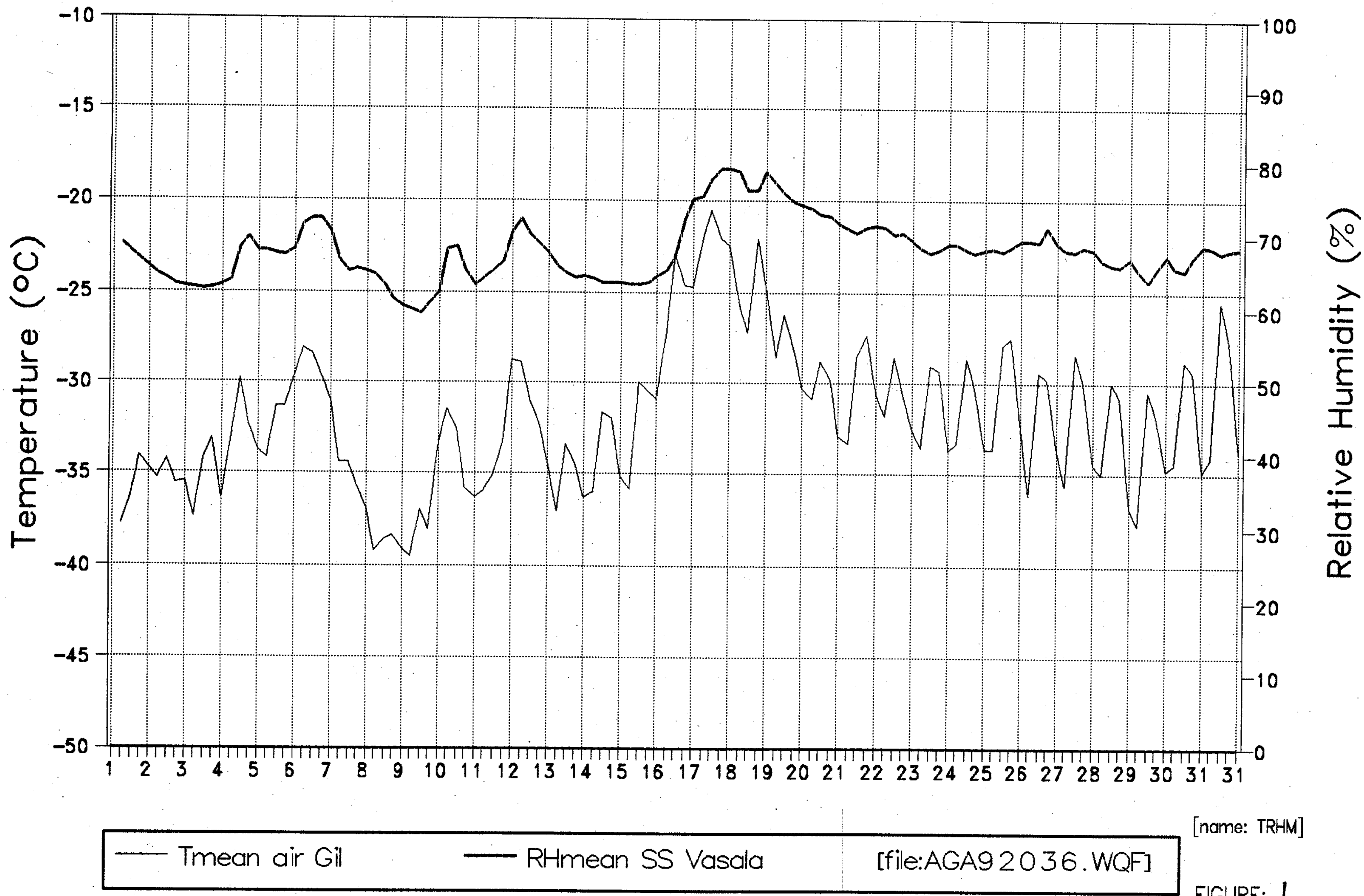


FIGURE: 1

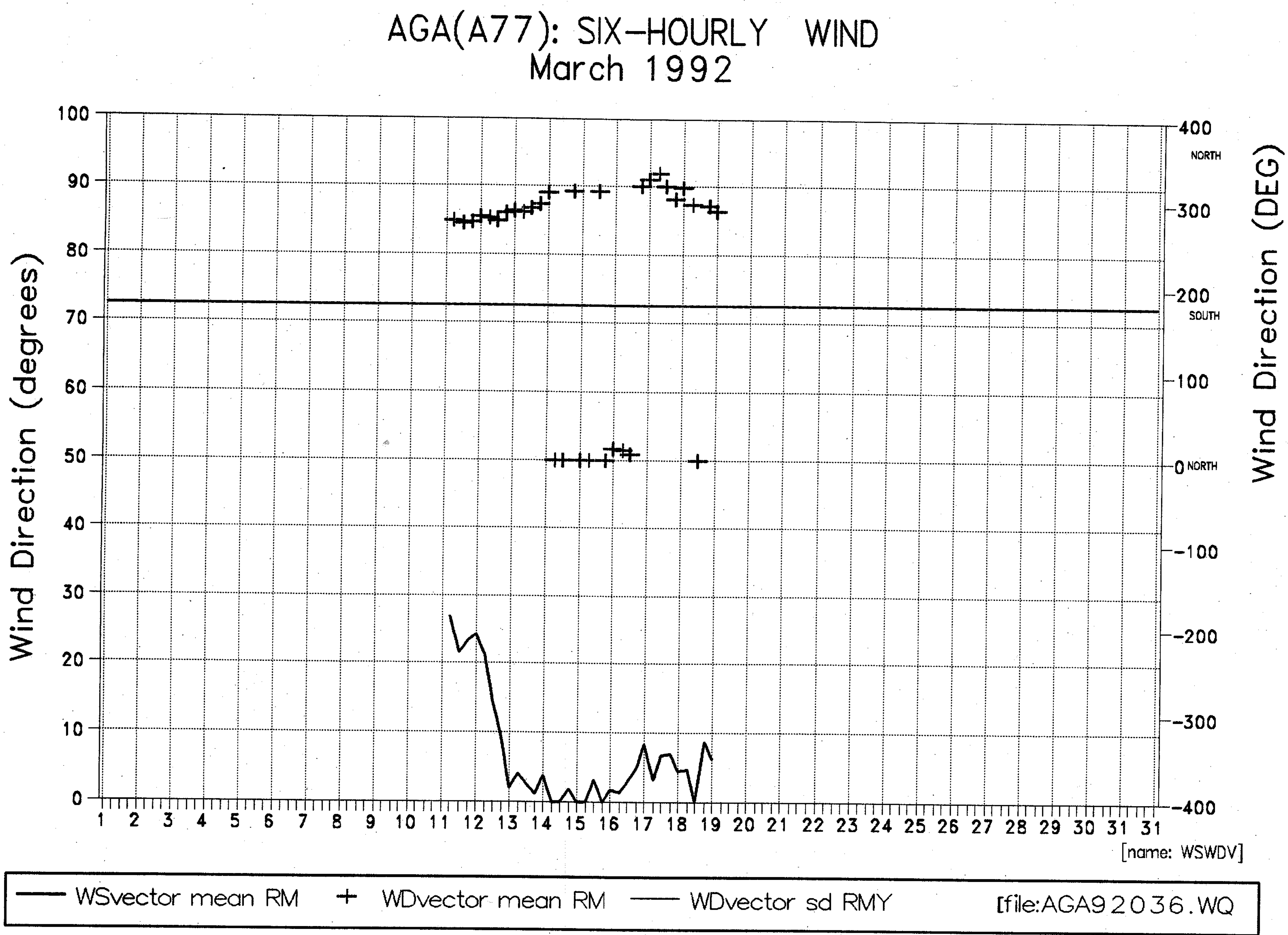

AGA(A77): SIX-HOURLY WIND
March 1992
Wind Direction (degrees)
Wind Direction (DEG)
NORTH
SOUTH
0 NORTH
[name: WSWDV]
WSvector mean RM
WDvector mean RM
WDvector sd RMY
[file:AGA92036.WQ

FIGURE: 2

AGA(A77): SIX-HOURLY WIND
March 1992

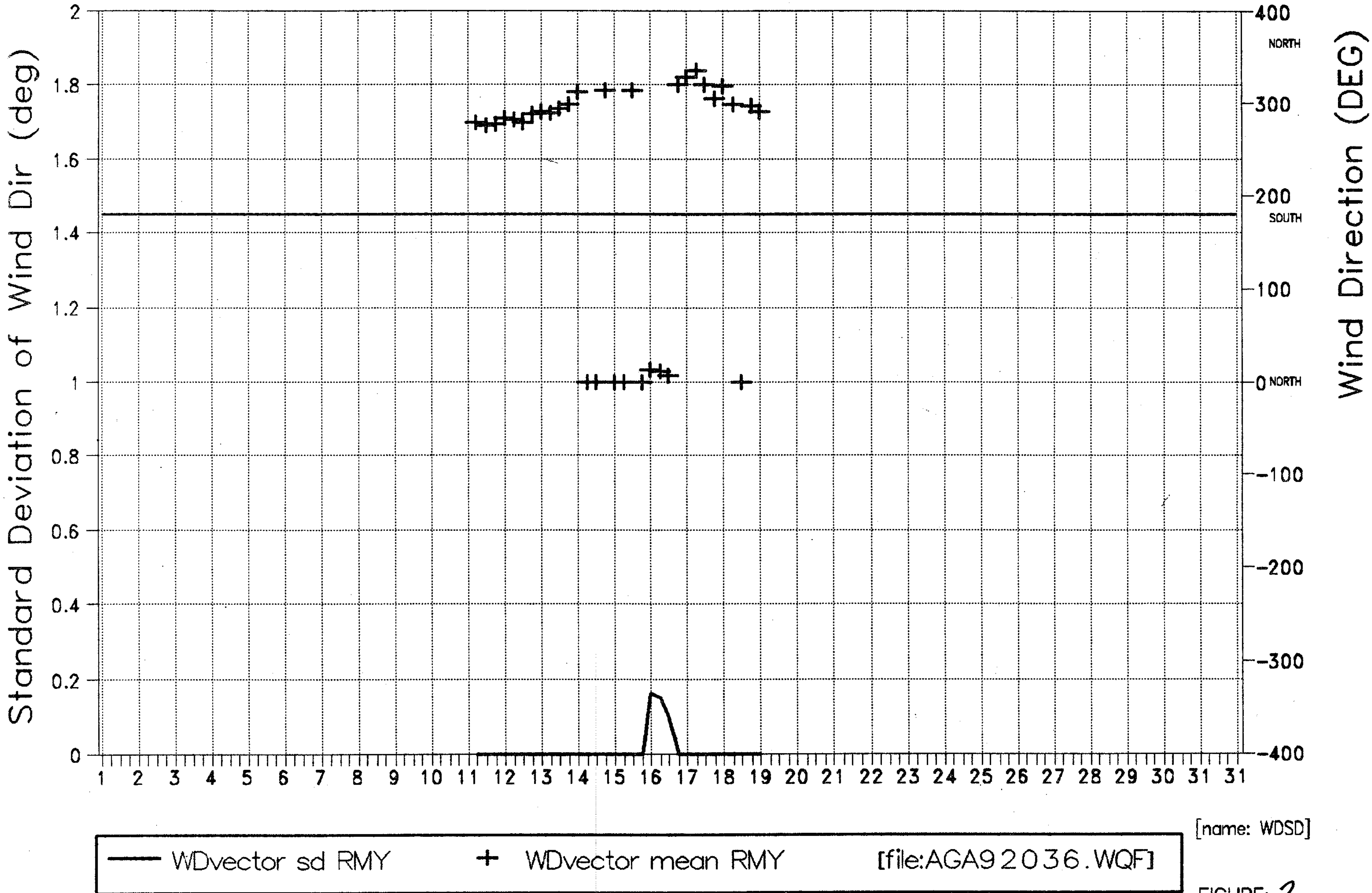


FIGURE: 3

AGA(A77): SIX-HOURLY WIND
March 1992

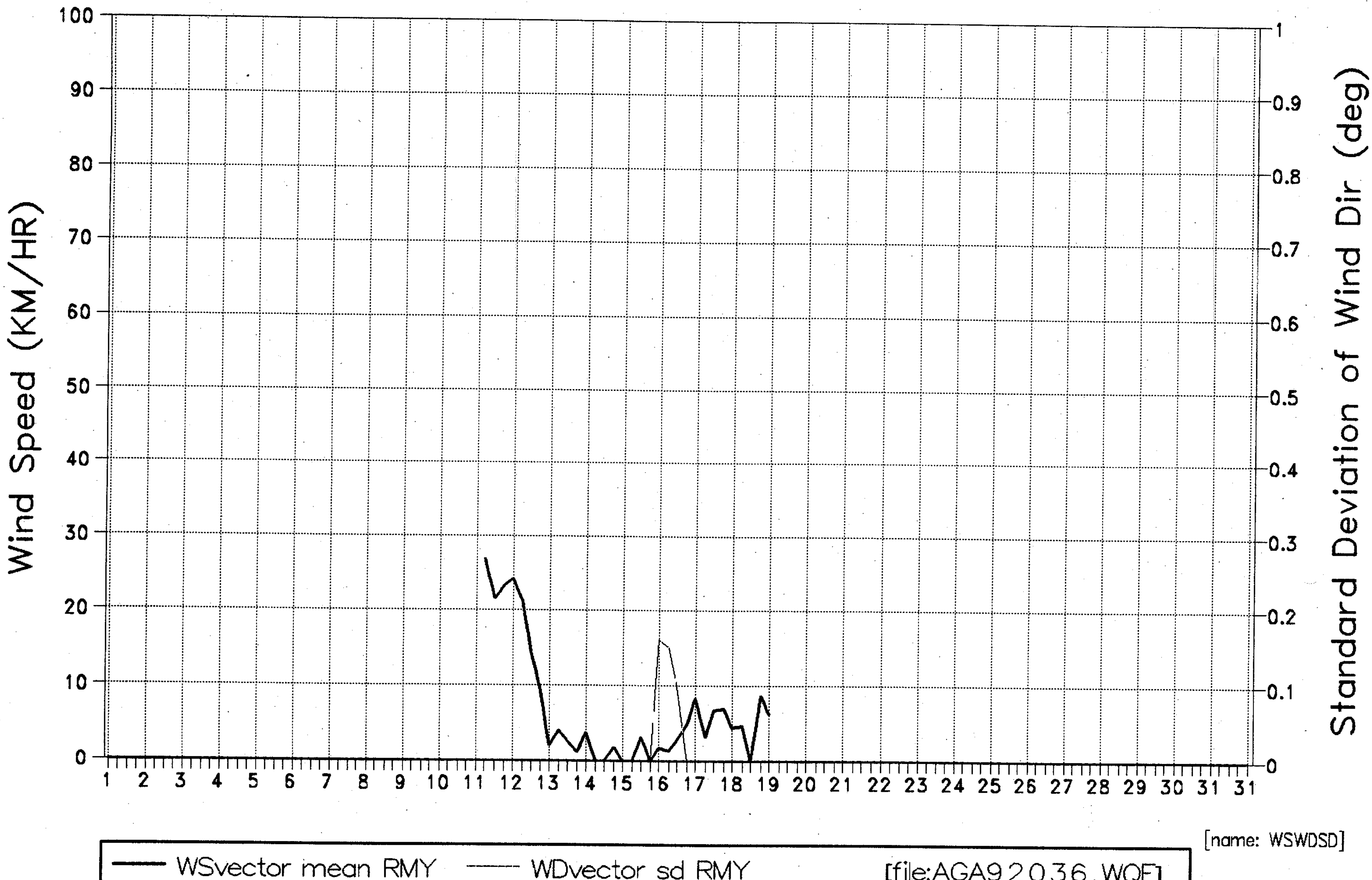
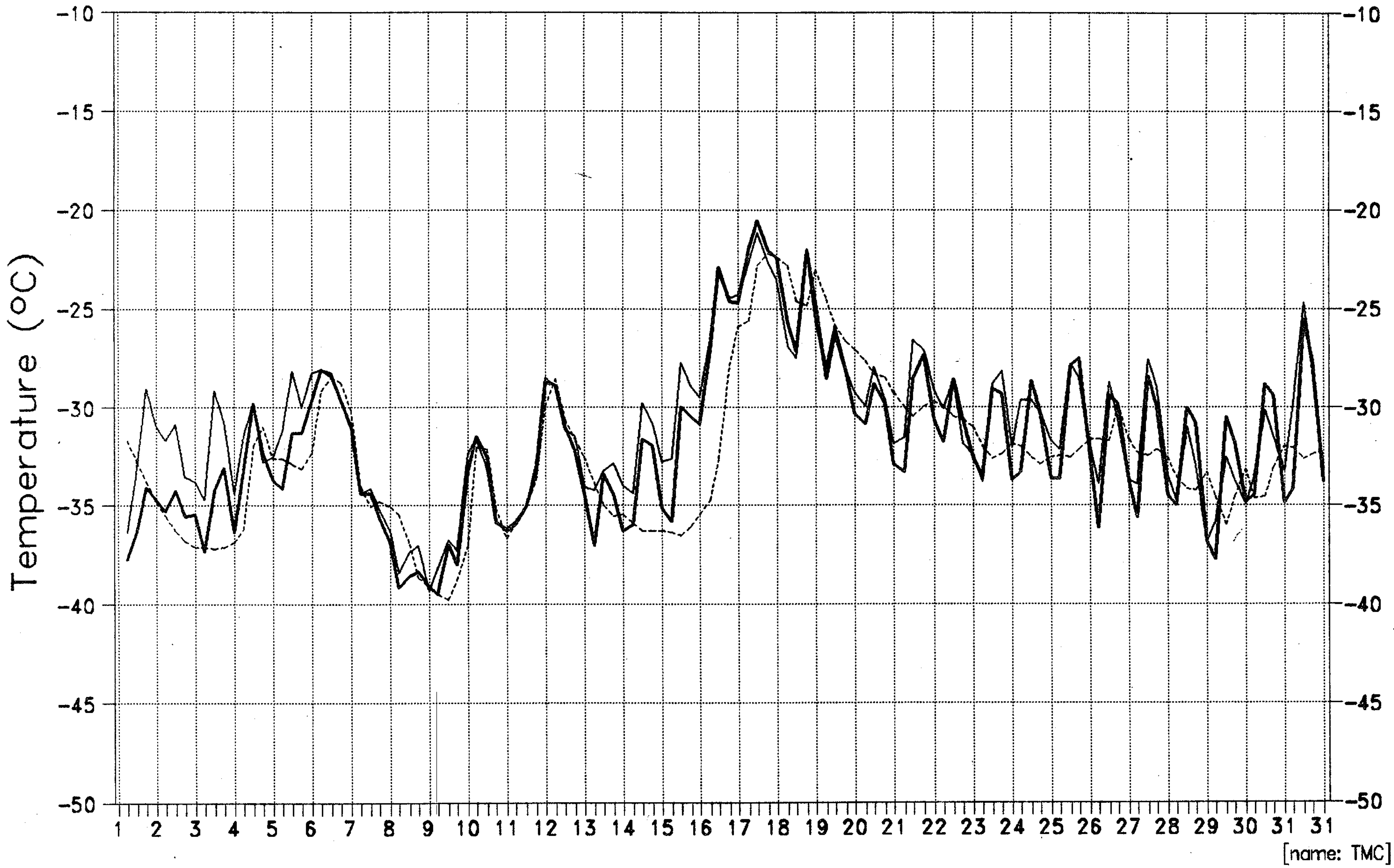


FIGURE: 4

AGA(A77): SIX-HOURLY TEMPERATURE
March 1992



Tmean air SS Vasail — Tmean Gil 107F — Tmean air Gil2 10 [file:AGA92036.WQ

FIGURE: 5

Table 2.1

DAILY PLOTS: Winter 1991-92 (October 1991 - March 1992)					
name:	Figure no.		Season/ Month	Years	Figure Caption
A: Plots printed for spreadsheet HWC9192D.WQF					
6tm	HWC9192D.	1	Winter	1991-92	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
6txn	HWC9192D.	2	Winter	1991-92	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
6wsxwd	HWC9192D.	3	Winter	1991-92	Daily maximum wind speed (Km/hr) and direction of that maximum speed (deg)
6rad	HWC9192D.	4	Winter	1991-92	Daily total incomming solar radiation (KJ/m^2) from Eppley pyranometer
6sndc	HWC9192D.	5	Winter	1991-92	Daily cleaned snow depth (mm) with all questionable data removed
5txnm	HWC9192D.	6	Dark Season	1991-92	Daily maximum, minimum and mean air temperature (°C) from 207F in Gill screen
B: Additional plots available in spreadsheet not printed for report					
6bat	HWC9192D.		Winter	1991-92	Daily battery power (volts)
4txn	HWC9192D.		November - February	1991-92	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
octtm	HWC9192D.		October	1991	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
octtxn	HWC9192D.		October	1991	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
octwsxwd	HWC9192D.		October	1991	Daily maximum wind speed (Km/hr) and direction of that maximum speed (deg)
octrad	HWC9192D.		October	1991	Daily total incomming solar radiation (KJ/m^2) from Eppley pyranometer
octsndc	HWC9192D.		October	1991	Daily cleaned snow depth (mm) with all quest ionable data removed
novtm	HWC9192D.		November	1991	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
novtxn	HWC9192D.		November	1991	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
novwsxwd	HWC9192D.		November	1991	Daily maximum wind speed (Km/hr) and direction of that maximum speed (deg)
novsndc	HWC9192D.		November	1991	Daily cleaned snow depth (mm) with all quest ionable data removed

DAILY PLOTS: Winter 1991-92 (October 1991 - March 1992)					
name:	Figure no.		Season/ Month	Years	Figure Caption
dectm	HWC9192D.		December	1991	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
dectxn	HWC9192D.		December	1991	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
decsndc	HWC9192D.		December	1991	Daily cleaned snow depth (mm) with all quest ionable data removed
jantm	HWC9192D.		January	1992	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
jantxn	HWC9192D.		January	1992	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
jansndc	HWC9192D.		January	1992	Daily cleaned snow depth (mm) with all quest ionable data removed
febtm	HWC9192D.		February	1992	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
febtxn	HWC9192D.		February	1992	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
febsndc	HWC9192D.		February	1992	Daily cleaned snow depth (mm) with all quest ionable data removed
martm	HWC9192D.		March	1992	Daily mean air temperature (°C) [(Tmax + Tmin)/2] from 207F in Gill screen
martxn	HWC9192D.		March	1992	Daily maximum and minimum air temperature (°C) from 207F in Gill screen
marrad	HWC9192D.		March	1992	Daily total incomming solar radiation (KJ/m^2) from Eppley pyranometer
marsndc	HWC9192D.		March	1992	Daily cleaned snow depth (mm) with all quest ionable data removed

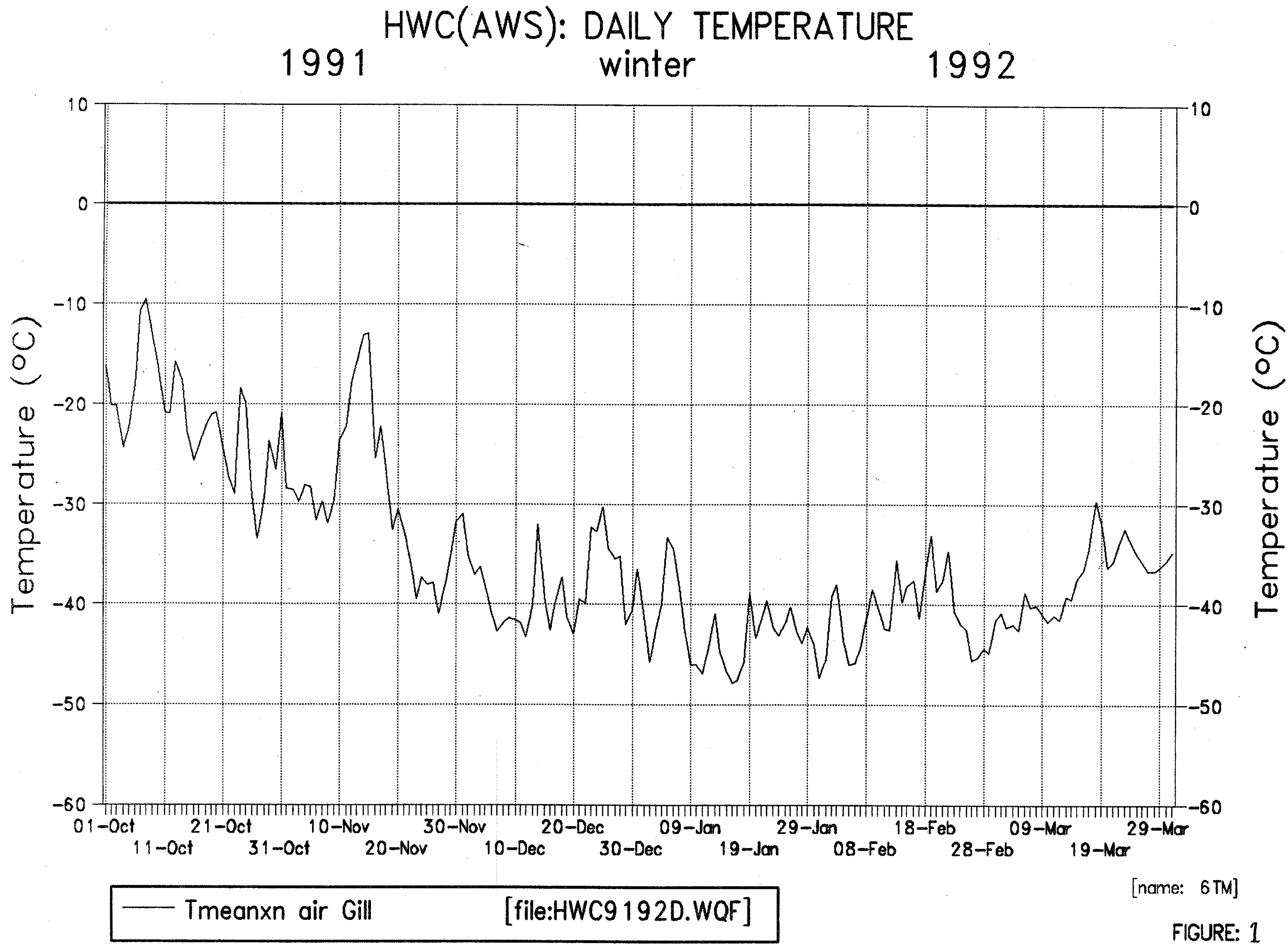
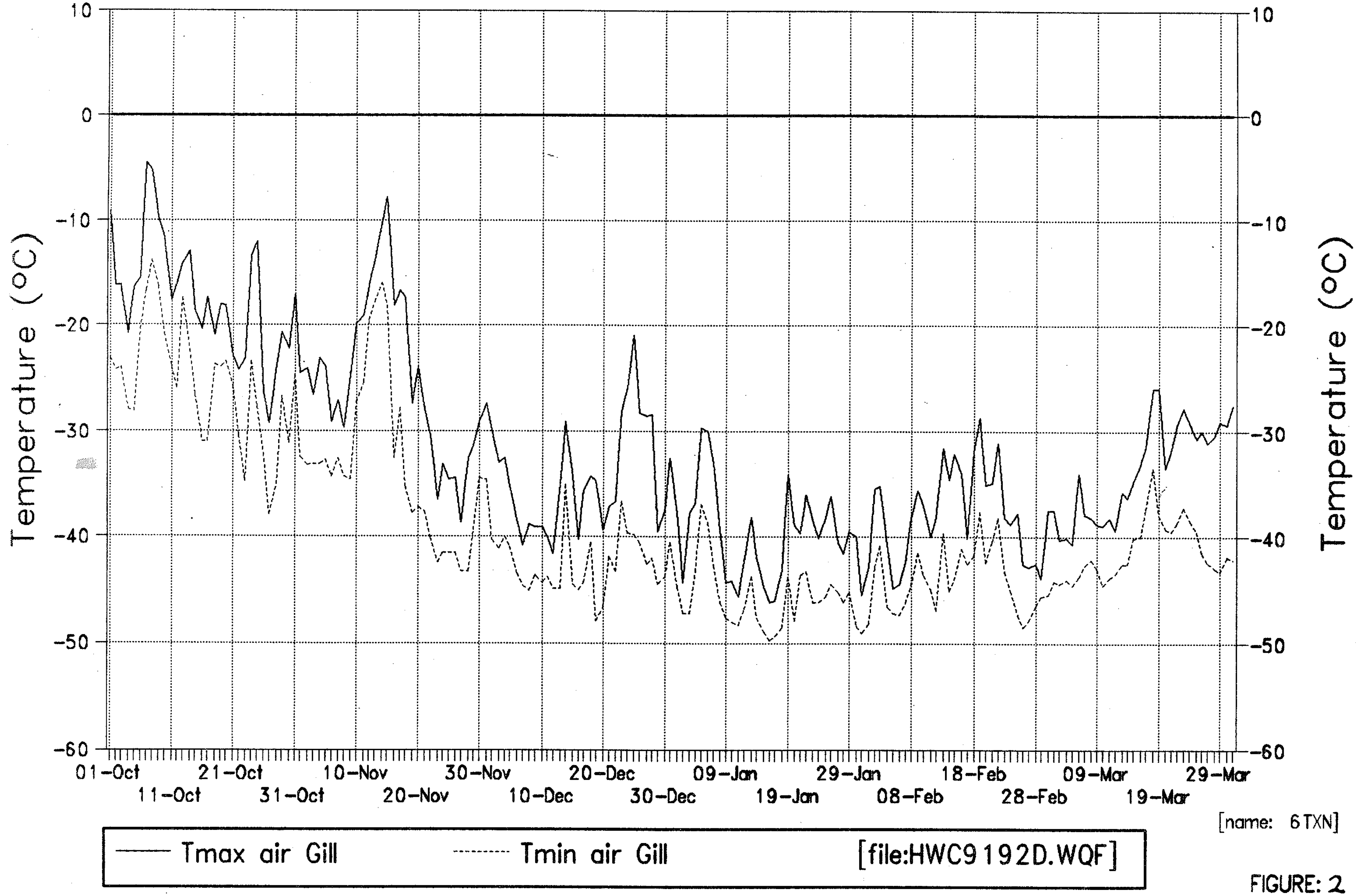

HWC(AWS): DAILY TEMPERATURE
1991
winter
1992
Temperature (oC)
10
0
-10
-20
-30
-40
-50
-60
01-Oct
11-Oct
21-Oct
31-Oct
10-Nov
20-Nov
30-Nov
10-Dec
20-Dec
30-Dec
09-Jan
19-Jan
29-Jan
08-Feb
18-Feb
28-Feb
09-Mar
19-Mar
29-Mar
Tmeanxn air Gill
[file:HWC9192D.WQF]
[name: 6TM]

FIGURE: 1

HWC(AWS): DAILY EXTREME TEMPERATURES
1991 winter 1992



[name: 6TXN]

FIGURE: 2

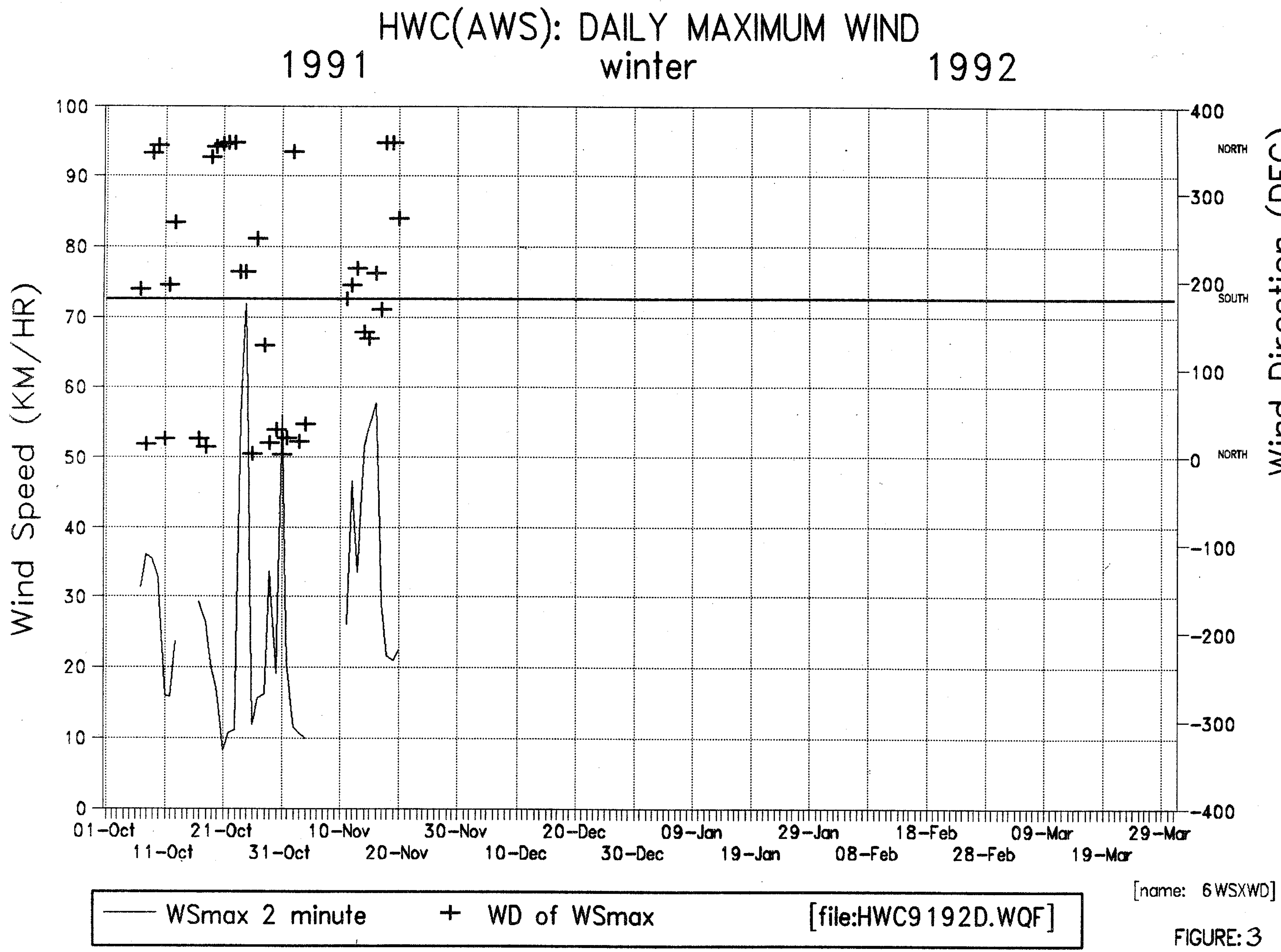
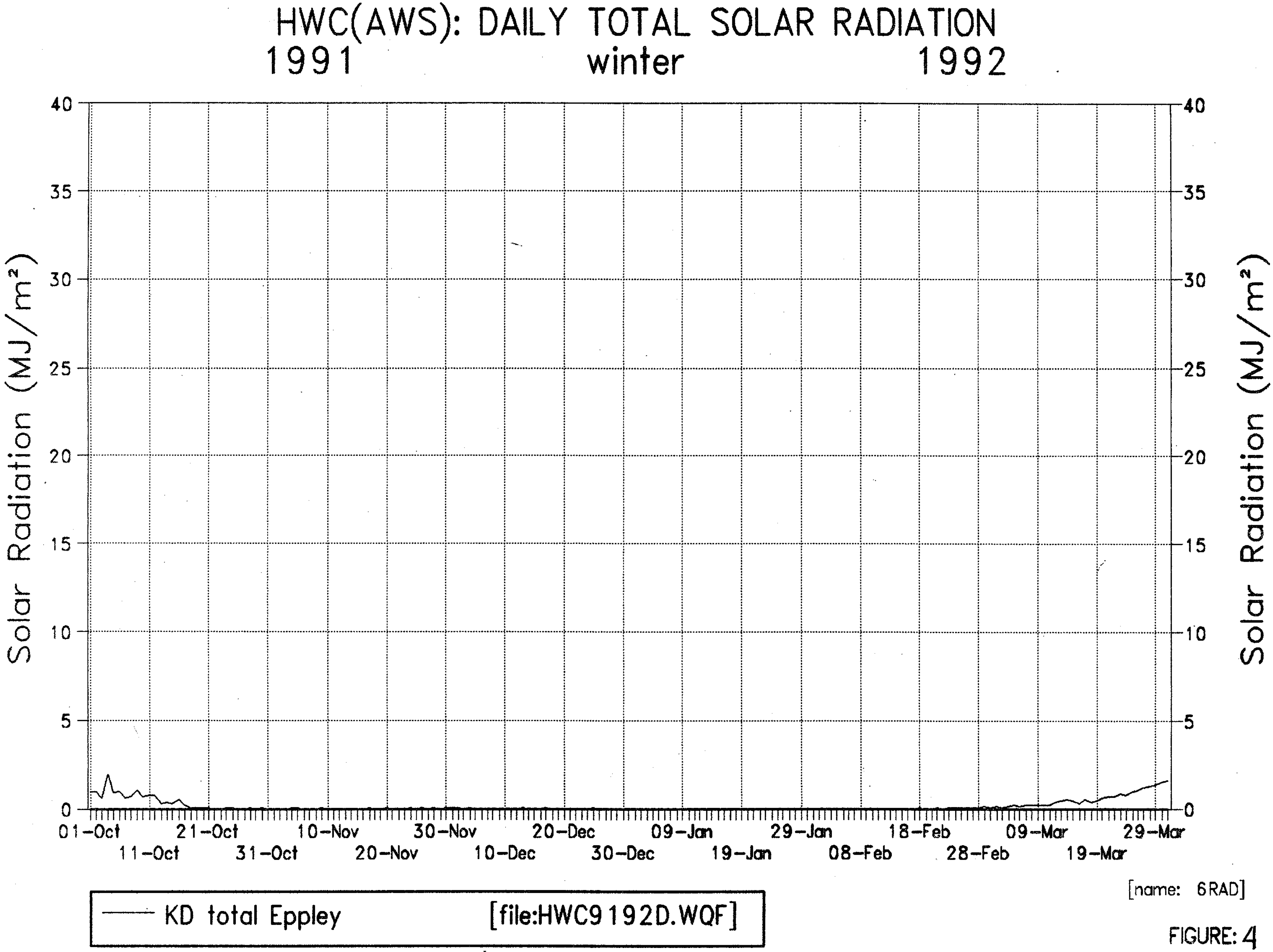
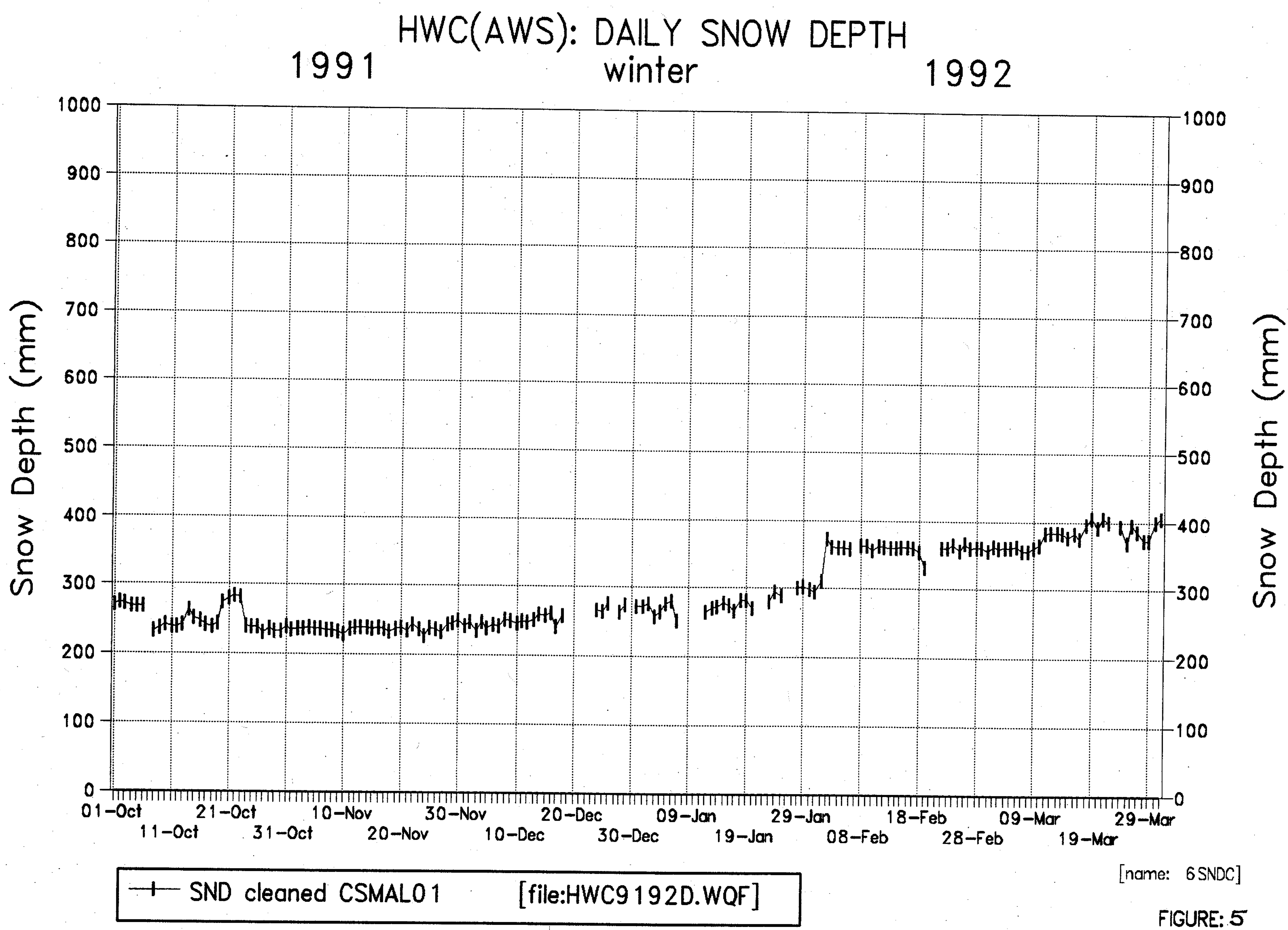

HWC(AWS): DAILY MAXIMUM WIND
1991
winter
1992
Wind Speed (KM/HR)
Wind Direction (DEG)
100
90
80
70
60
50
40
30
20
10
0
400
300
200
100
0
-100
-200
-300
-400
NORTH
SOUTH
NORTH
01-Oct
11-Oct
21-Oct
31-Oct
10-Nov
20-Nov
30-Nov
10-Dec
20-Dec
30-Dec
09-Jan
19-Jan
29-Jan
08-Feb
18-Feb
28-Feb
09-Mar
19-Mar
29-Mar
WSmax 2 minute
WD of WSmax
[file:HWC9192D.WQF]
[name: 6WSXWD]

FIGURE: 3


HWC(AWS): DAILY TOTAL SOLAR RADIATION
1991
winter
1992
Solar Radiation (MJ/m²)
40
35
30
25
20
15
10
5
0
01-Oct
11-Oct
21-Oct
31-Oct
10-Nov
20-Nov
30-Nov
10-Dec
20-Dec
30-Dec
09-Jan
19-Jan
29-Jan
08-Feb
18-Feb
28-Feb
09-Mar
19-Mar
29-Mar
KD total Eppley
[file:HWC9192D.WQF]
[name: 6RAD]
FIGURE: 4



[name: 6SNDC]

FIGURE: 5

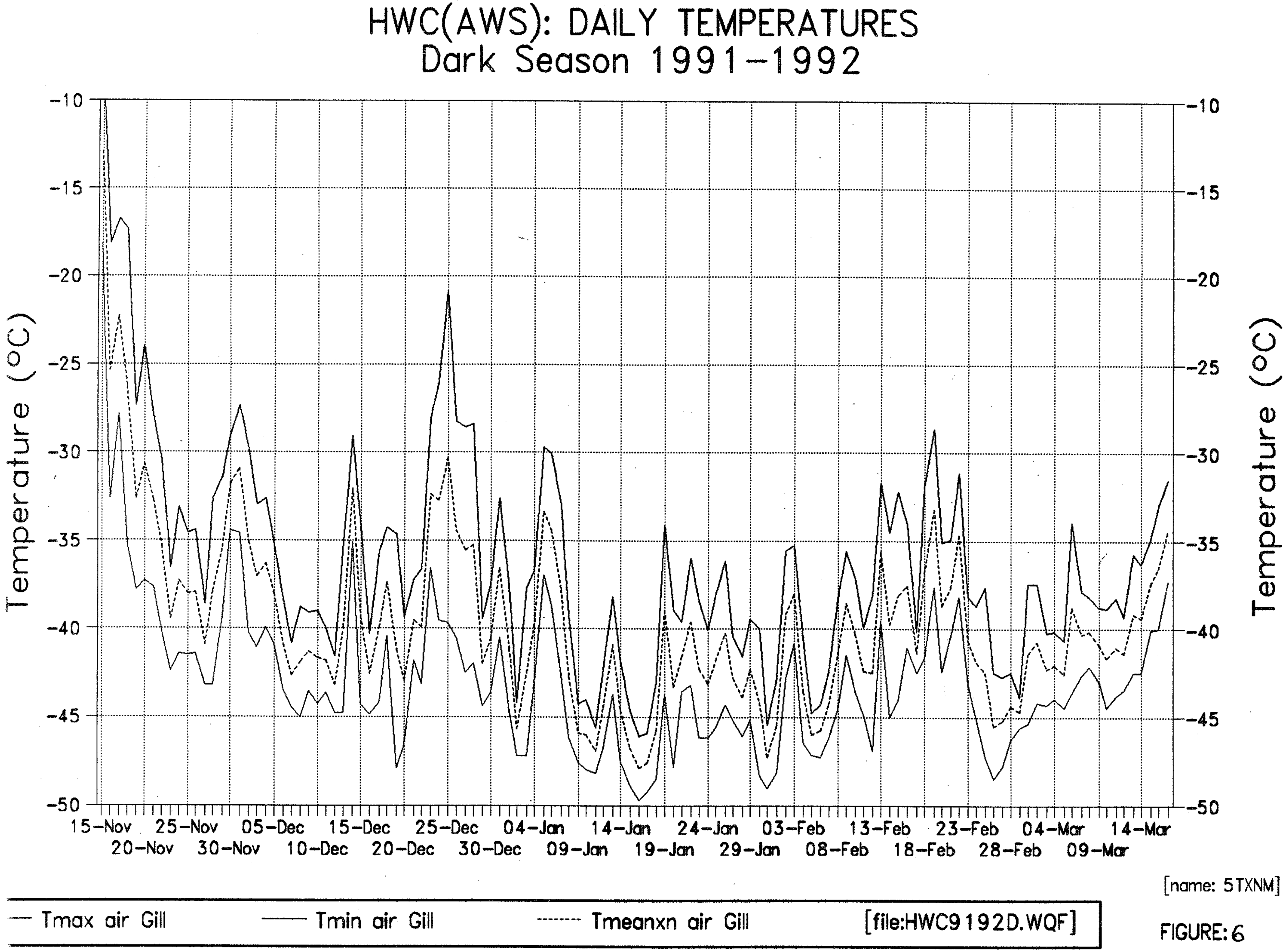
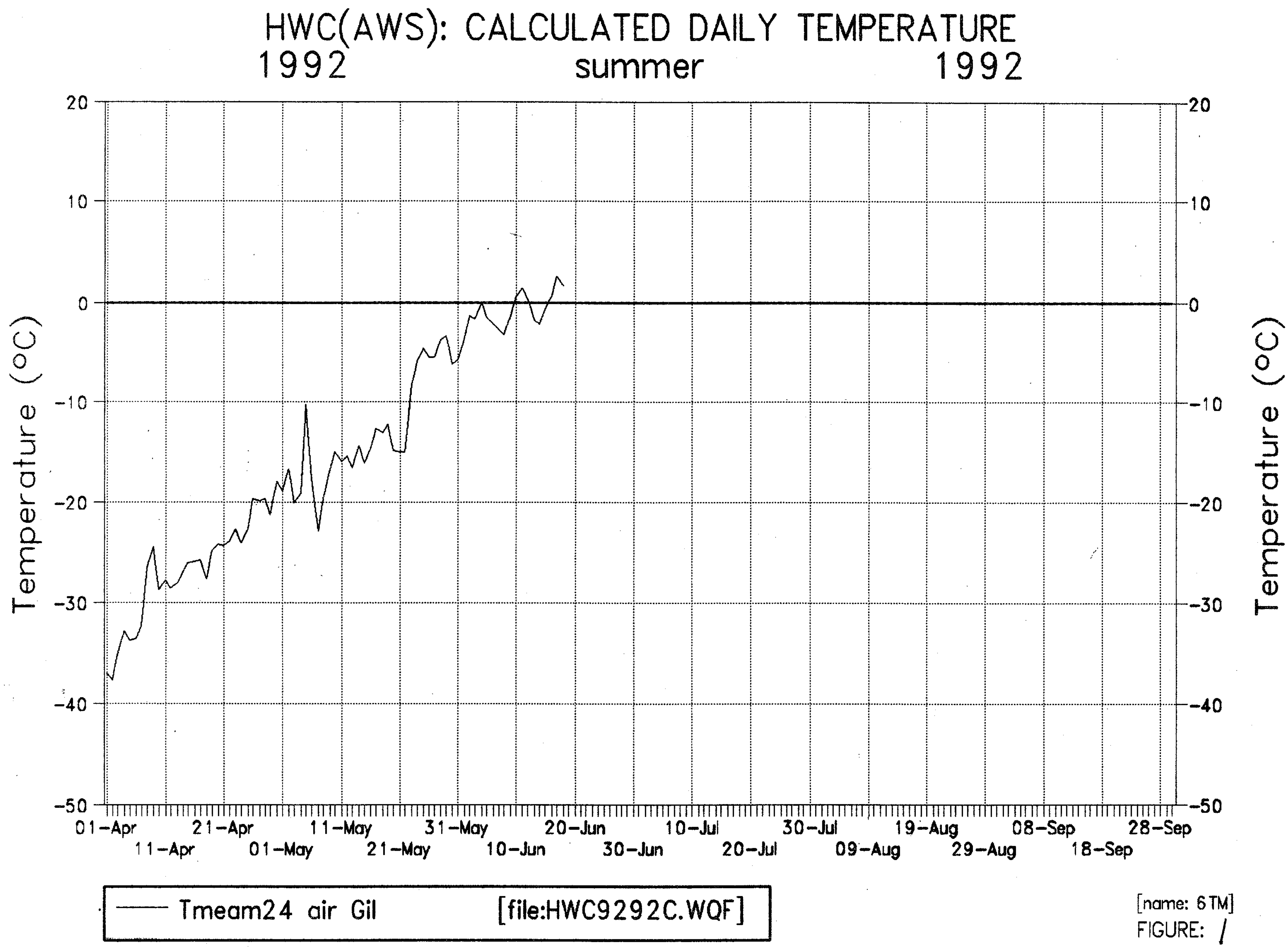

HWC(AWS): DAILY TEMPERATURES
Dark Season 1991–1992
Temperature (°C)
-10
-15
-20
-25
-30
-35
-40
-45
-50
15–Nov 20–Nov 25–Nov 30–Nov 05–Dec 10–Dec 15–Dec 20–Dec 25–Dec 30–Dec 04–Jan 09–Jan 14–Jan 19–Jan 24–Jan 29–Jan 03–Feb 08–Feb 13–Feb 18–Feb 23–Feb 28–Feb 04–Mar 09–Mar 14–Mar
[name: 5TXNM]
Tmax air Gill
Tmin air Gill
Tmeanxn air Gill
[file:HWC9192D.WQF]

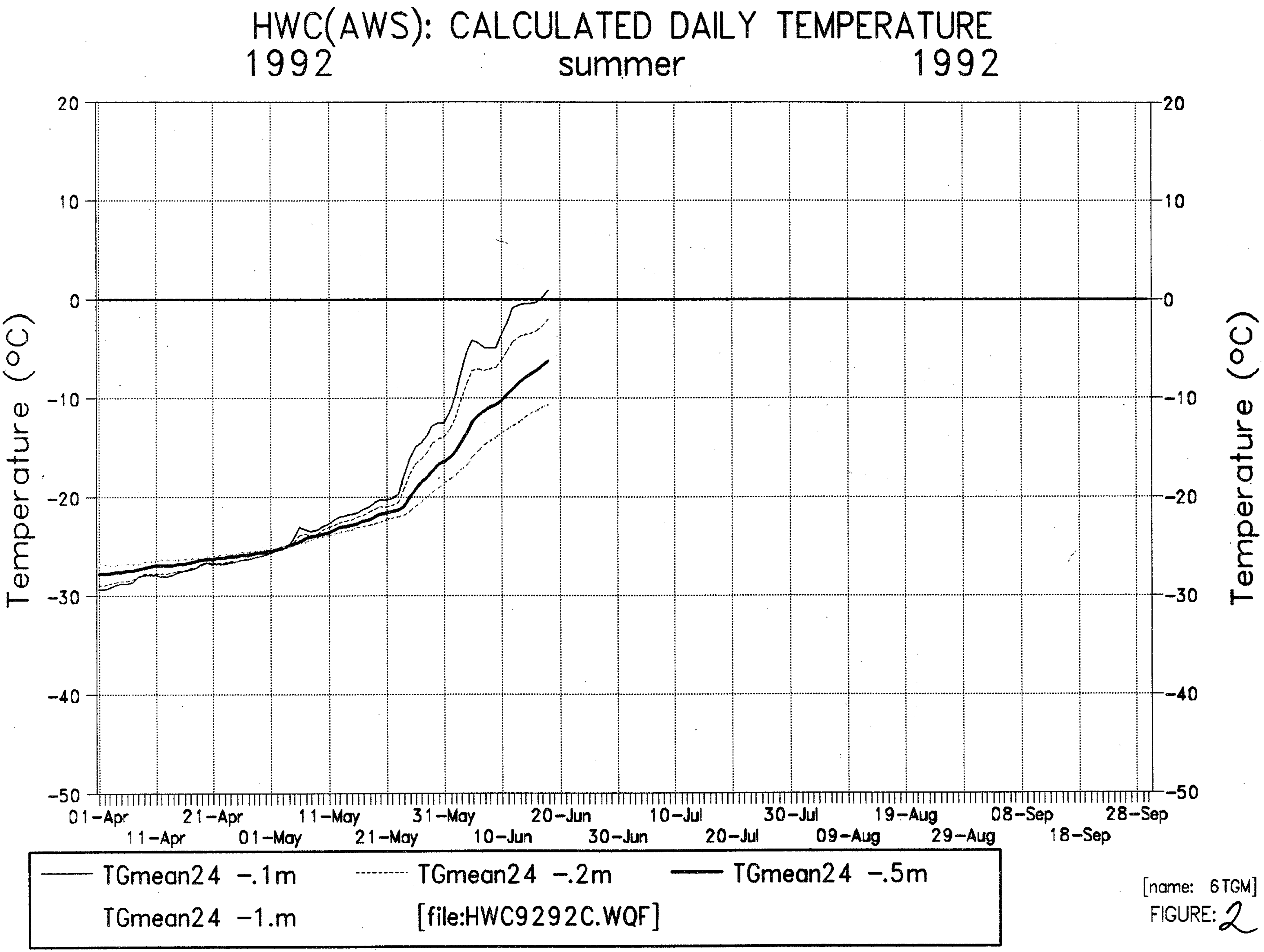
FIGURE: 6

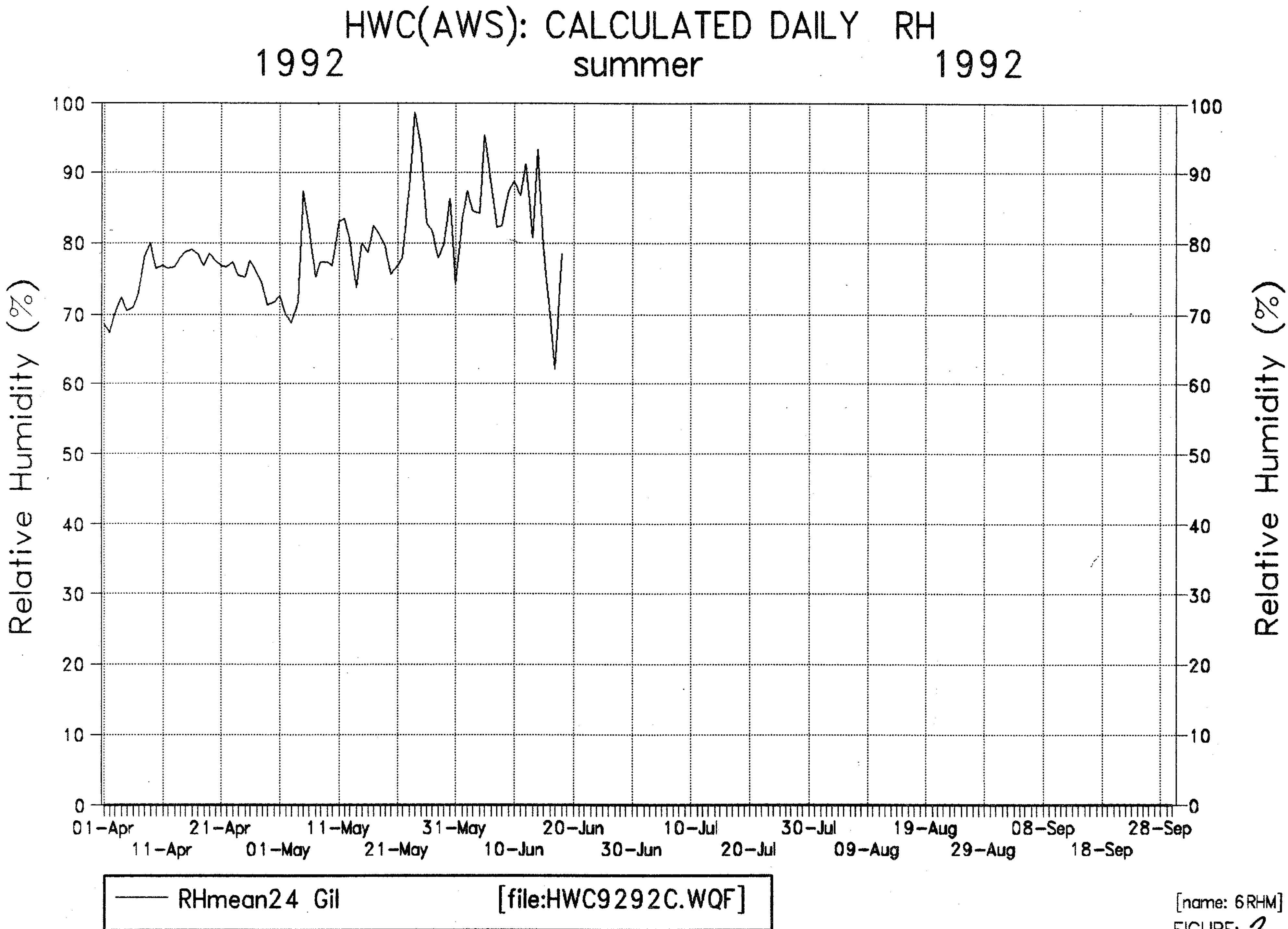
Table 2.3

CALCULATED PLOTS: Summer 1992 (April 1992 - September 1992)					
name:	Figure no.		Season/ Month	Years	Figure Caption
A: Plots printed for spreadsheet HWC9292C.WQF					
6tm	HWC9292C.	1	Summer	1992	Calculated daily mean of 24 hourly sampled values of air temperature (°C) from 207F probe in Gill screen
6tgm	HWC9292C.	2	Summer	1992	Calculated daily mean of 24 hourly sampled values of ground temperature (°C) at various depths from 207B thermisters
6rhm	HWC9292C.	3	Summer	1992	Calculated daily mean of 24 hourly sampled values of relative humidity (%) from 207C probe in Gill screen
6wsm	HWC9292C.	4	Summer	1992	Calculated daily mean of 24 hourly 2 minute vector mean values of wind speed (Km/hr) from Met-One anemometer
6tg-.1m	HWC9292C.	5	Summer	1992	Calculated daily mean of 24 hourly sampled values of air temperature and 10 cm ground temperature (°C)
6twsm	HWC9292C.	6	Summer	1992	Calculated daily mean of 24 hourly sampled values of air temperature (°C) from 207F probe in Gill screen and mean of 24 hourly 2 minute vector mean values of wind speed (Km/hr) from Met-One anemometer
5tagm	HWC9292C.	7	Melt Season	1992	Calculated daily mean of 24 hourly sampled values of air temperature and ground temperatures at various depths (°C)
aprtm	HWC9292C.	8	April	1992	Calculated daily mean of 24 hourly sampled values of air temperature (°C) from 207F probe in Gill screen
aprtgm	HWC9292C.	9	April	1992	Calculated daily mean of 24 hourly sampled values of ground temperature (°C) at various depths from 207B thermisters
maytm	HWC9292C.	10	May	1992	Calculated daily mean of 24 hourly sampled values of air temperature (°C) from 207F probe in Gill screen
maytgm	HWC9292C.	11	May	1992	Calculated daily mean of 24 hourly sampled values of ground temperature (°C) at various depths from 207B thermisters

CALCULATED PLOTS: Summer 1992 (April 1992 - September 1992)					
name:	Figure no.		Season/ Month	Years	Figure Caption
maywsm	HWC9292C.	12	May	1992	Calculated daily mean of 24 hourly 2 minute vector mean values of wind speed (Km/hr) from Met-One anemometer
juntgm	HWC9292C.	13	June	1992	Calculated daily mean of 24 hourly sampled values of ground temperature (°C) at various depths from 207B thermisters
B: Additional plots available in spreadsheet not printed for report					
5tm	HWC9292C.		Melt Season	1992	Calculated daily mean of 24 hourly sampled values of air temperature (°C) from 207F probe in Gill screen
4tm	HWC9292C.		May - August	1992	Calculated daily mean of 24 hourly sampled values of air temperature (°C) from 207F probe in Gill screen
juntm	HWC9292C.		June	1992	Calculated daily mean of 24 hourly sampled values of air temperature (°C) from 207F probe in Gill screen
note: Graph aprtm has tmeanxn from daily spreadsheet added. All other 'tm graphs have not been converted. All should have tmeanxn and Diff Tmeanxn - Tmean also included.					


HWC(AWS): CALCULATED DAILY TEMPERATURE
1992
summer
1992
Temperature (°C)
20
10
0
-10
-20
-30
-40
-50
01-Apr
11-Apr
21-Apr
01-May
11-May
21-May
31-May
10-Jun
20-Jun
30-Jun
10-Jul
20-Jul
30-Jul
09-Aug
19-Aug
29-Aug
08-Sep
18-Sep
28-Sep
Tmeam24 air Gil
[file:HWC9292C.WQF]
[name: 6TM]
FIGURE: /


HWC(AWS): CALCULATED DAILY TEMPERATURE
1992
summer
1992
Temperature (oC)
20
10
0
-10
-20
-30
-40
-50
01-Apr
11-Apr
21-Apr
01-May
11-May
21-May
31-May
10-Jun
20-Jun
30-Jun
10-Jul
20-Jul
30-Jul
09-Aug
19-Aug
29-Aug
08-Sep
18-Sep
28-Sep
TGmean24 -.1m
TGmean24 -.2m
TGmean24 -.5m
TGmean24 -1.m
[file:HWC9292C.WQF]
[name: 6TGM]
FIGURE: 2

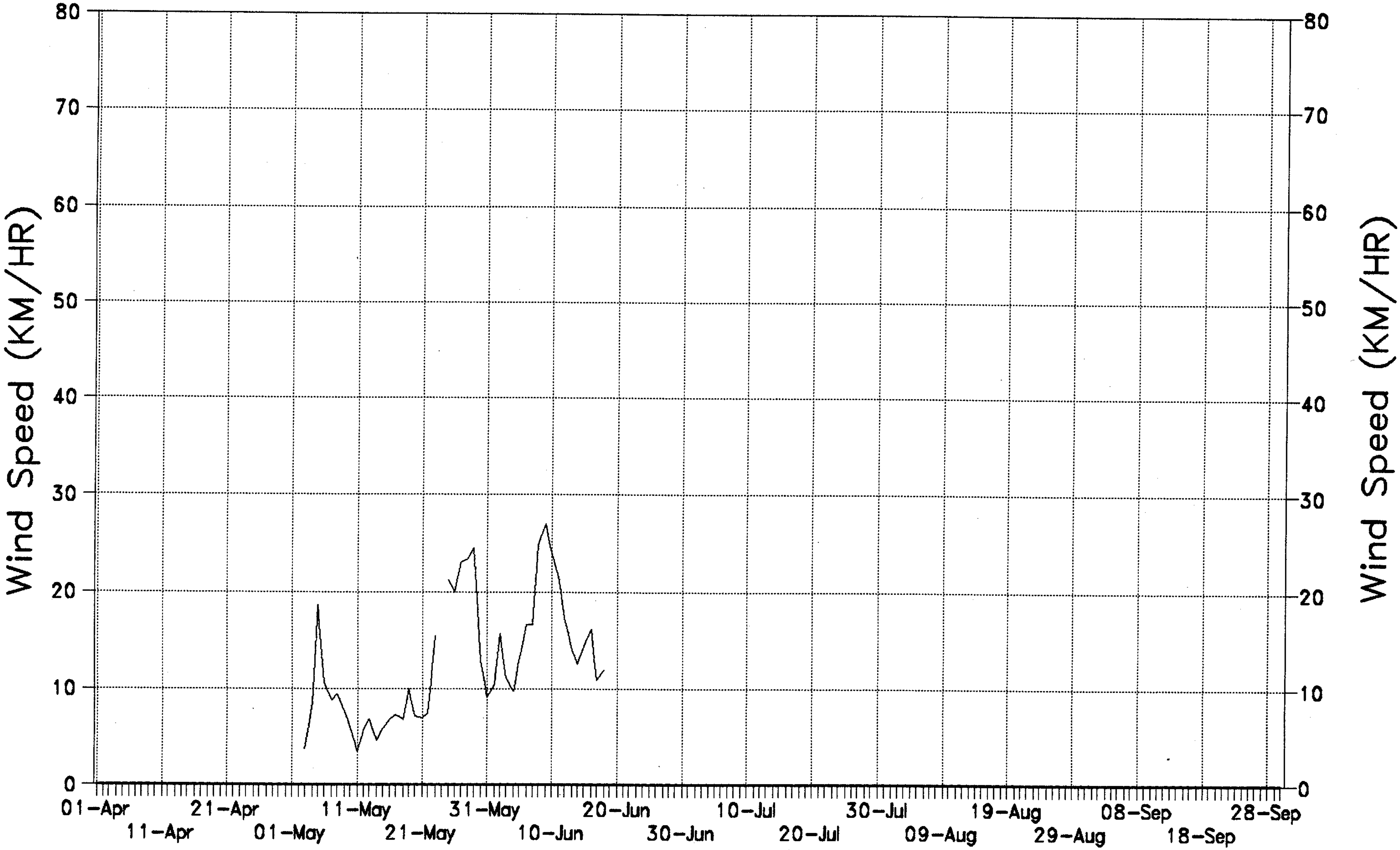


HWC(AWS): CALCULATED DAILY RH
1992 summer 1992
Relative Humidity (%)
100
90
80
70
60
50
40
30
20
10
0
01-Apr
11-Apr
21-Apr
01-May
11-May
21-May
31-May
10-Jun
20-Jun
30-Jun
10-Jul
20-Jul
30-Jul
09-Aug
19-Aug
29-Aug
08-Sep
18-Sep
28-Sep
RHmean24 Gil
[file:HWC9292C.WQF]
[name: 6RHM]

FIGURE: 3

HWC(AWS): CALCULATED DAILY WIND SPEED

1992 summer 1992

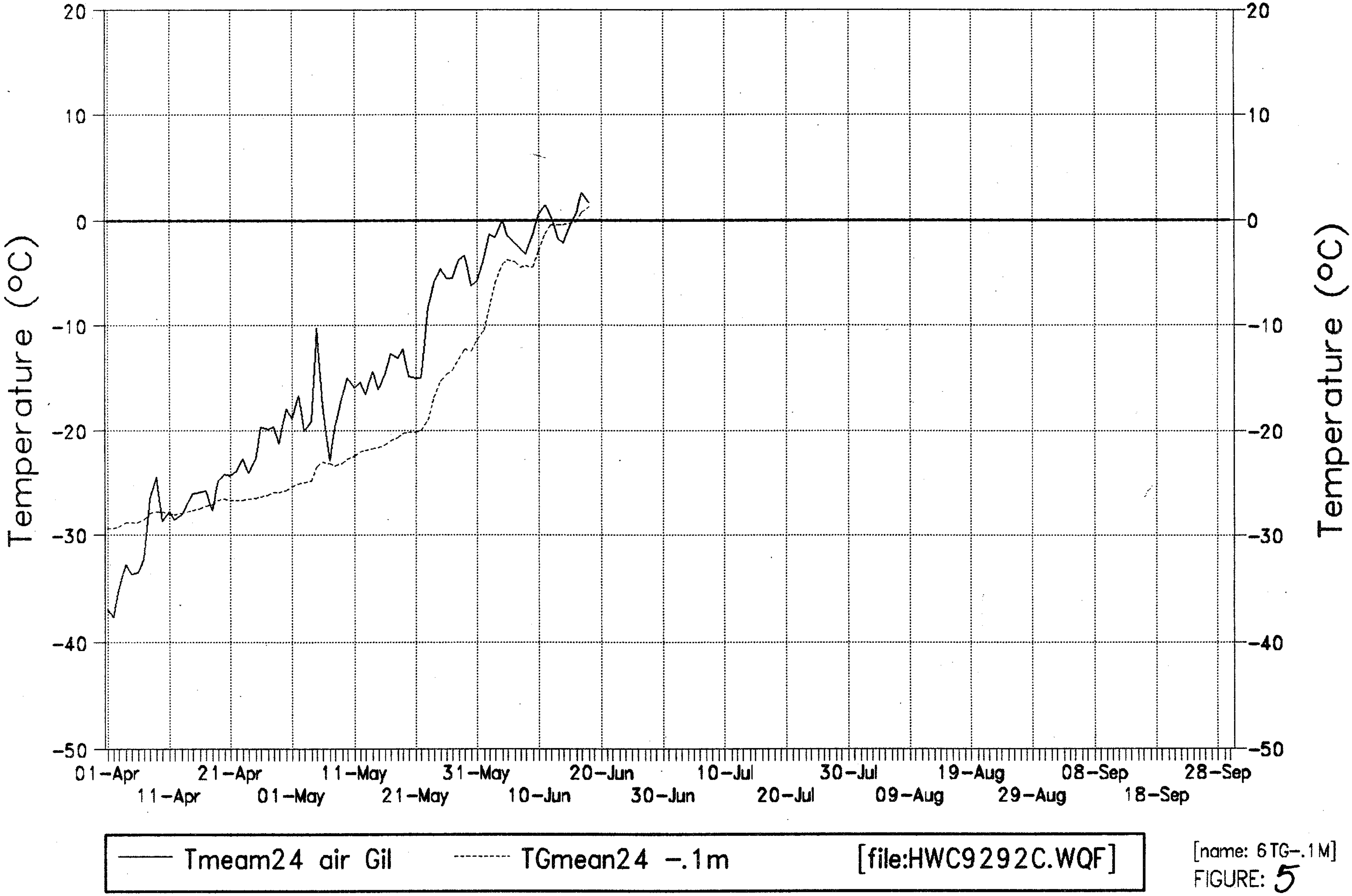


WSmean24 2 minute [file:HWC9292C.WQF]

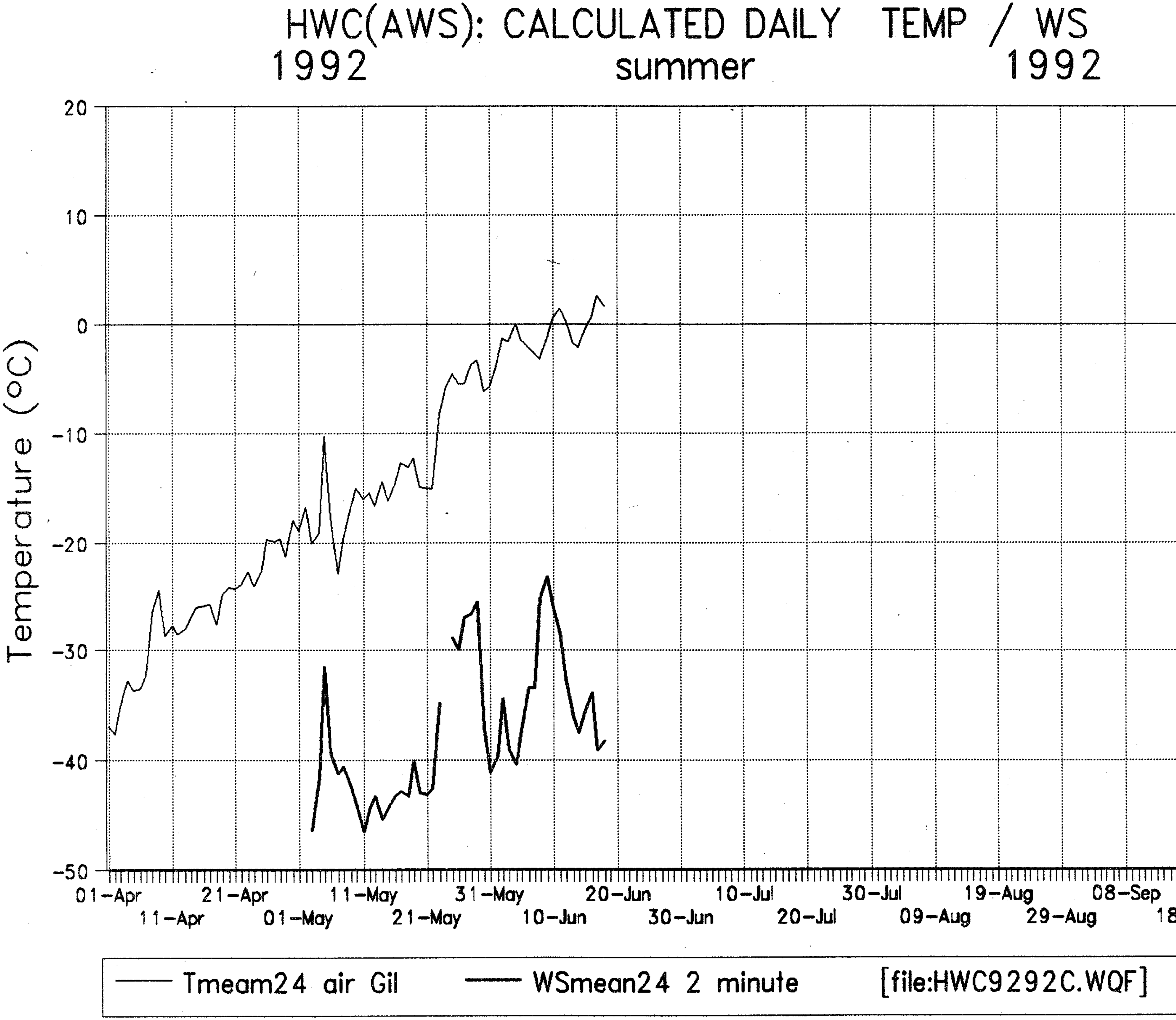
[name: 6 WSM]

FIGURE: 4

HWC(AWS): CALCULATED DAILY TEMPERATURE
1992 summer 1992



[name: 6TG-.1M]
FIGURE: 5



[name: 6TWSM]
FIGURE: 6

HWC(AWS): CALCULATED DAILY TEMPERATURE
Melt Season 1992

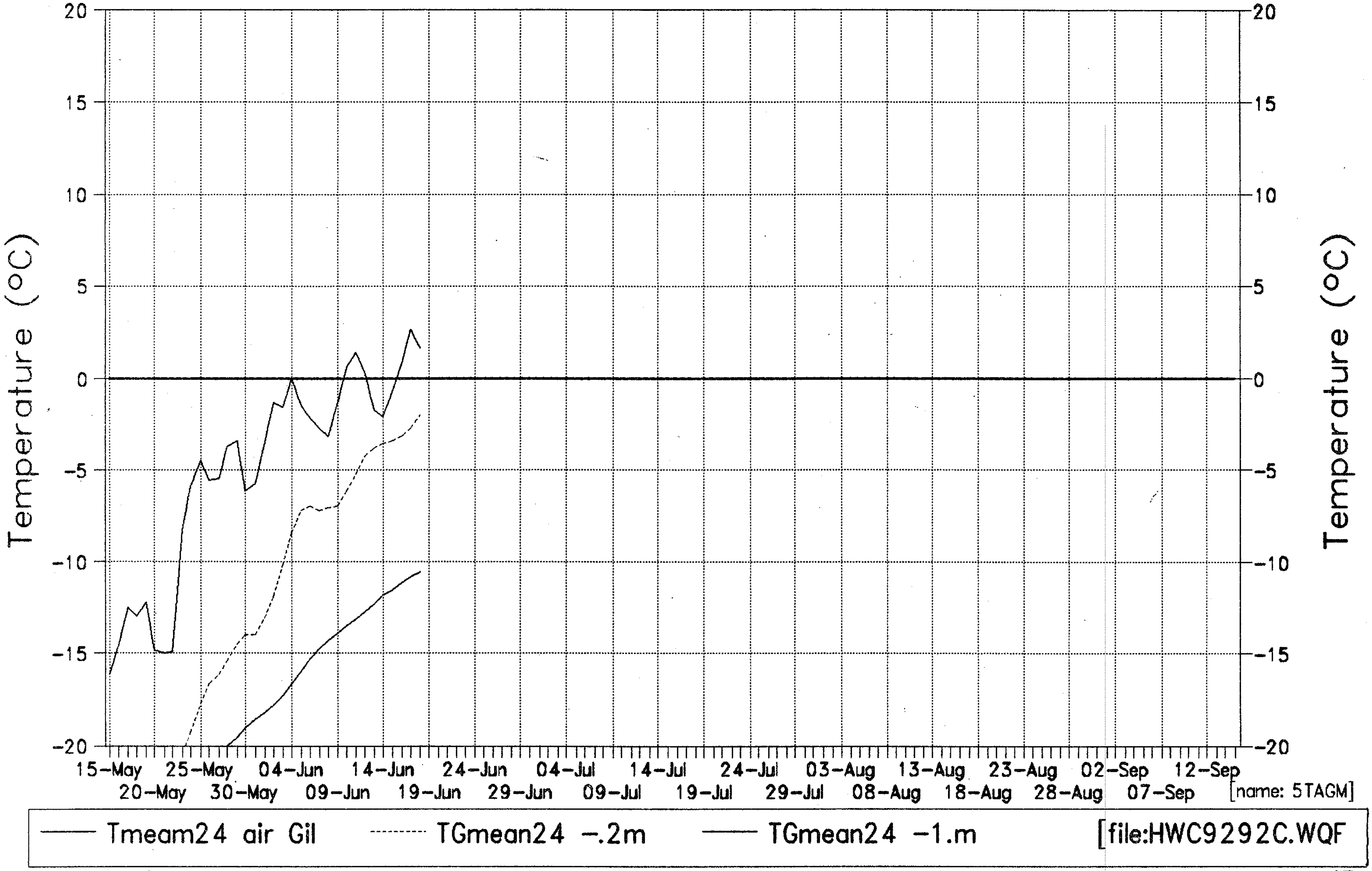
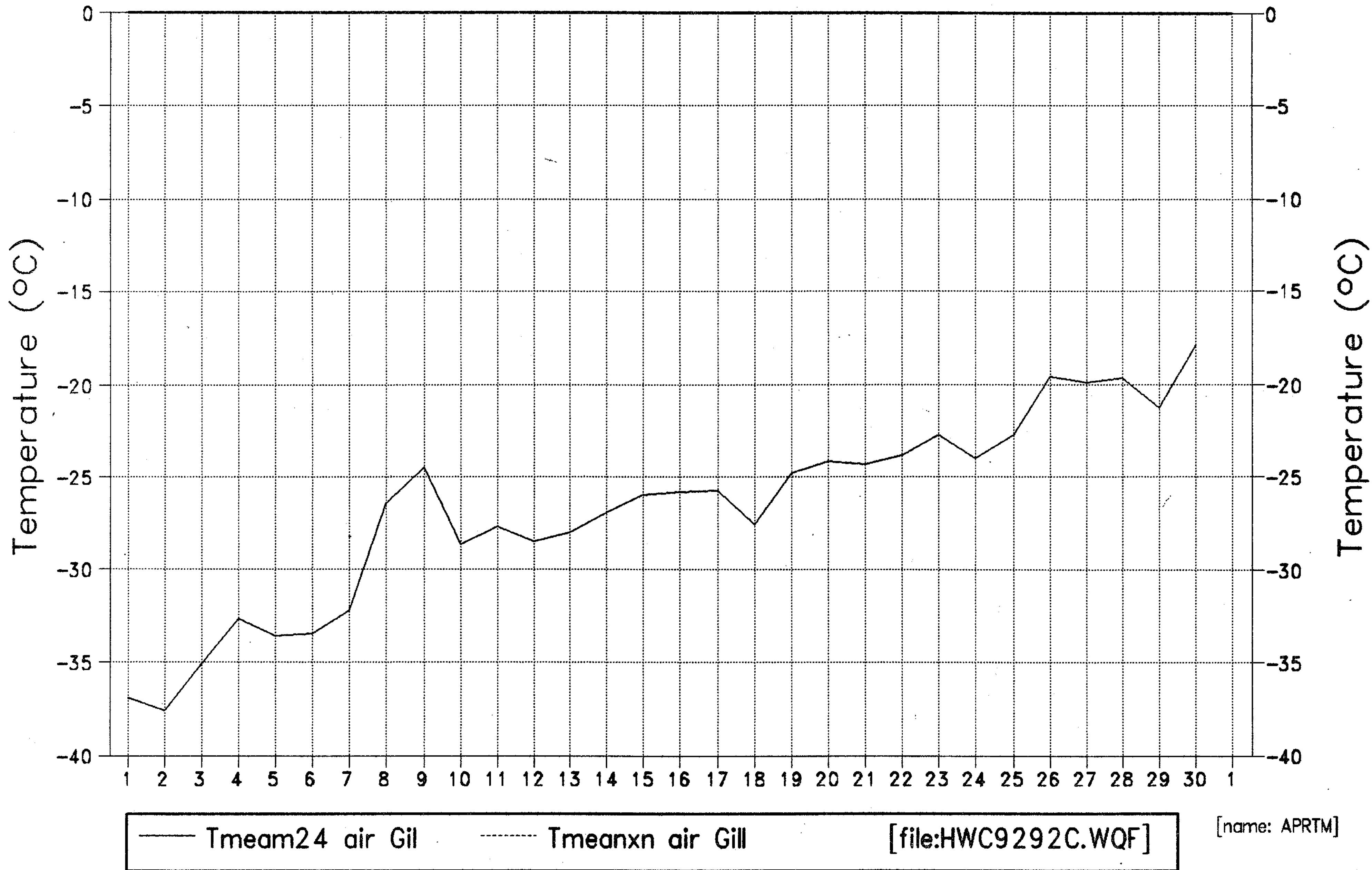


FIGURE: 7

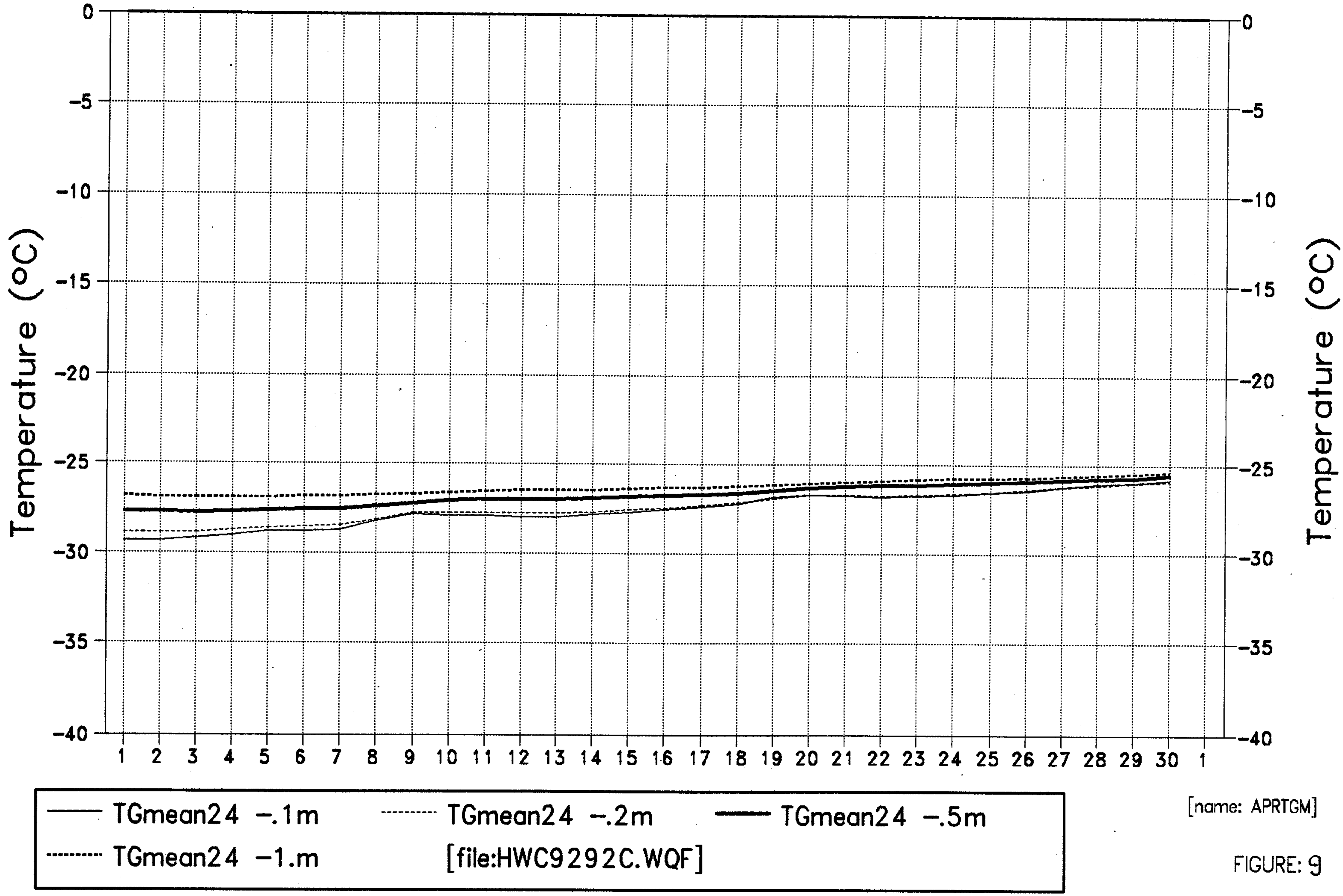
HWC(AWS): CALCULATED DAILY TEMPERATURE
April 1992



[name: APRTM]

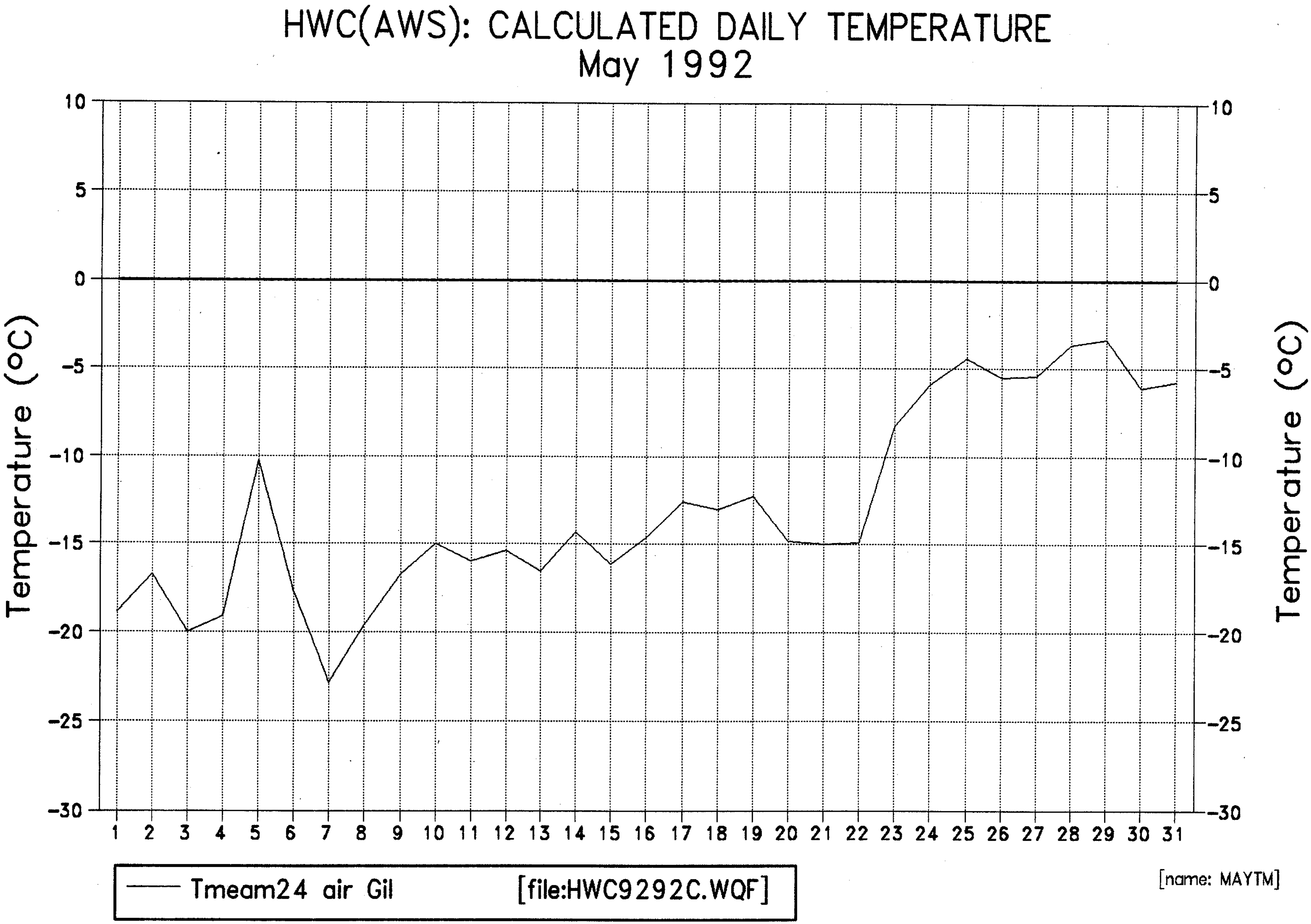
FIGURE: 8

HWC(AWS): CALCULATED DAILY TEMPERATURE
April 1992



[name: APRTGM]

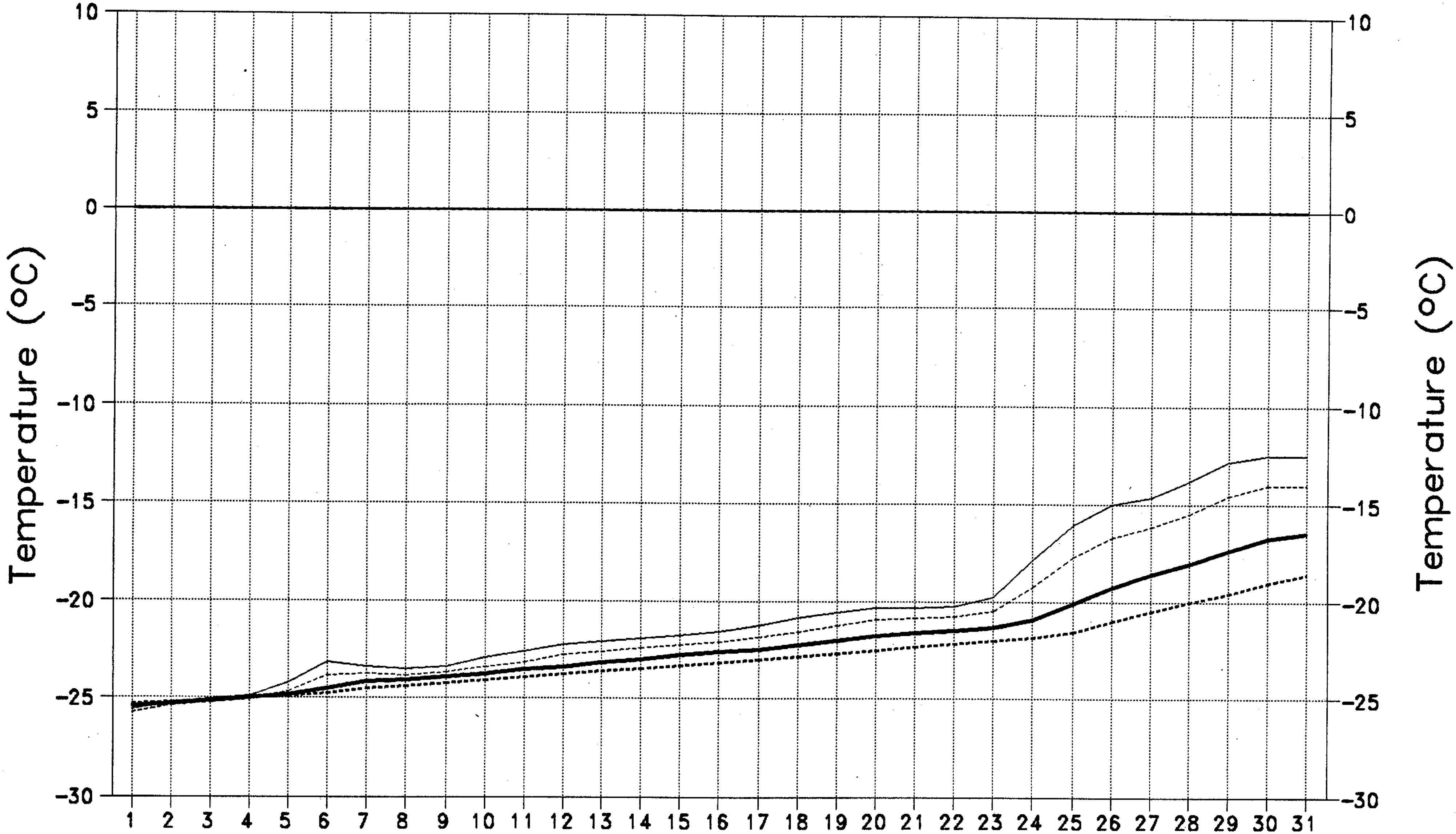
FIGURE: 9



[name: MAYTM]

FIGURE: 1D

HWC(AWS): CALCULATED DAILY TEMPERATURE
May 1992

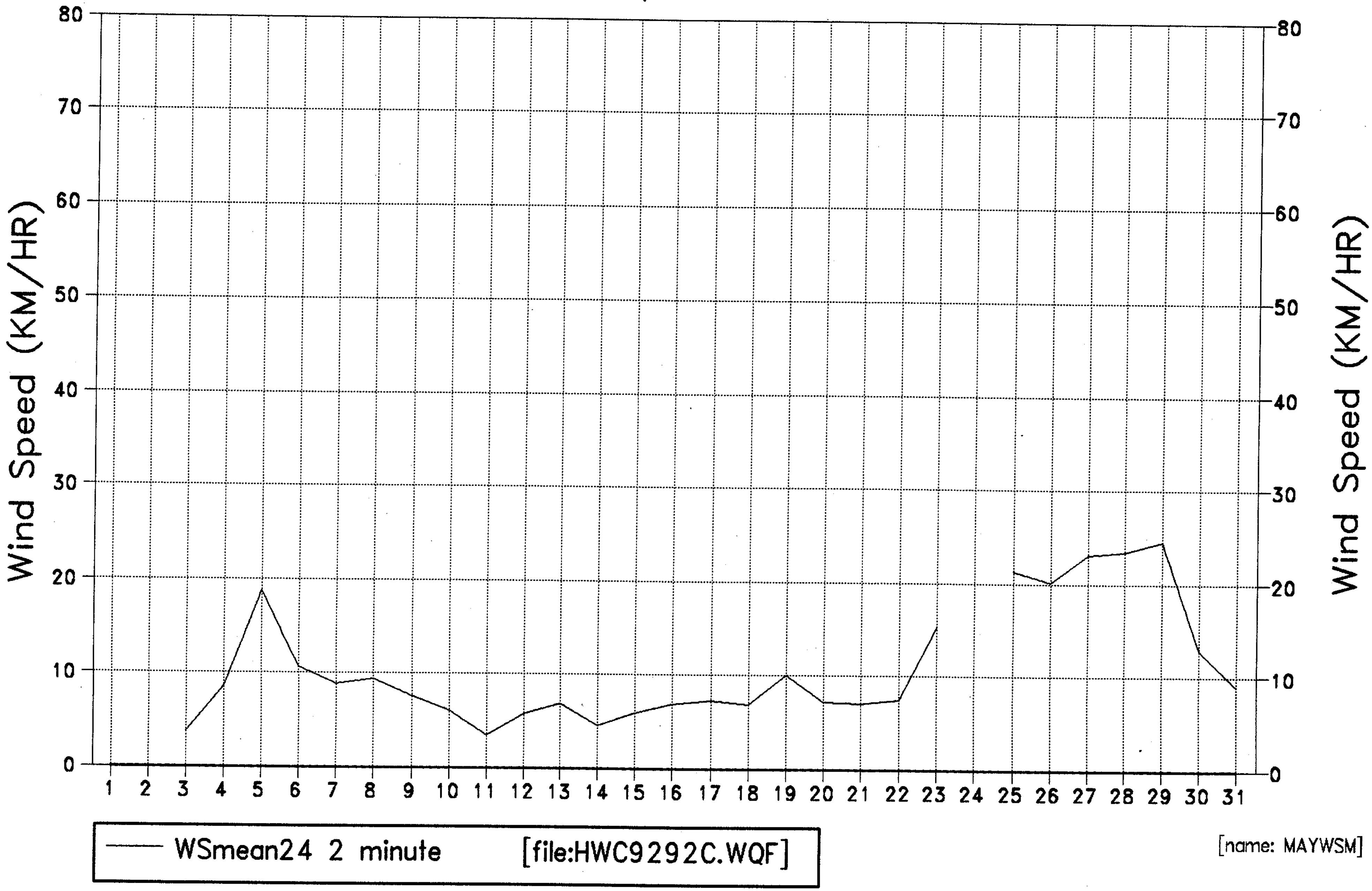


TGmean24 -.1m
TGmean24 -.2m
TGmean24 -.5m
TGmean24 -1.m
[file:HWC9292C.WQF]

[name: MAYTGM]

FIGURE: 11

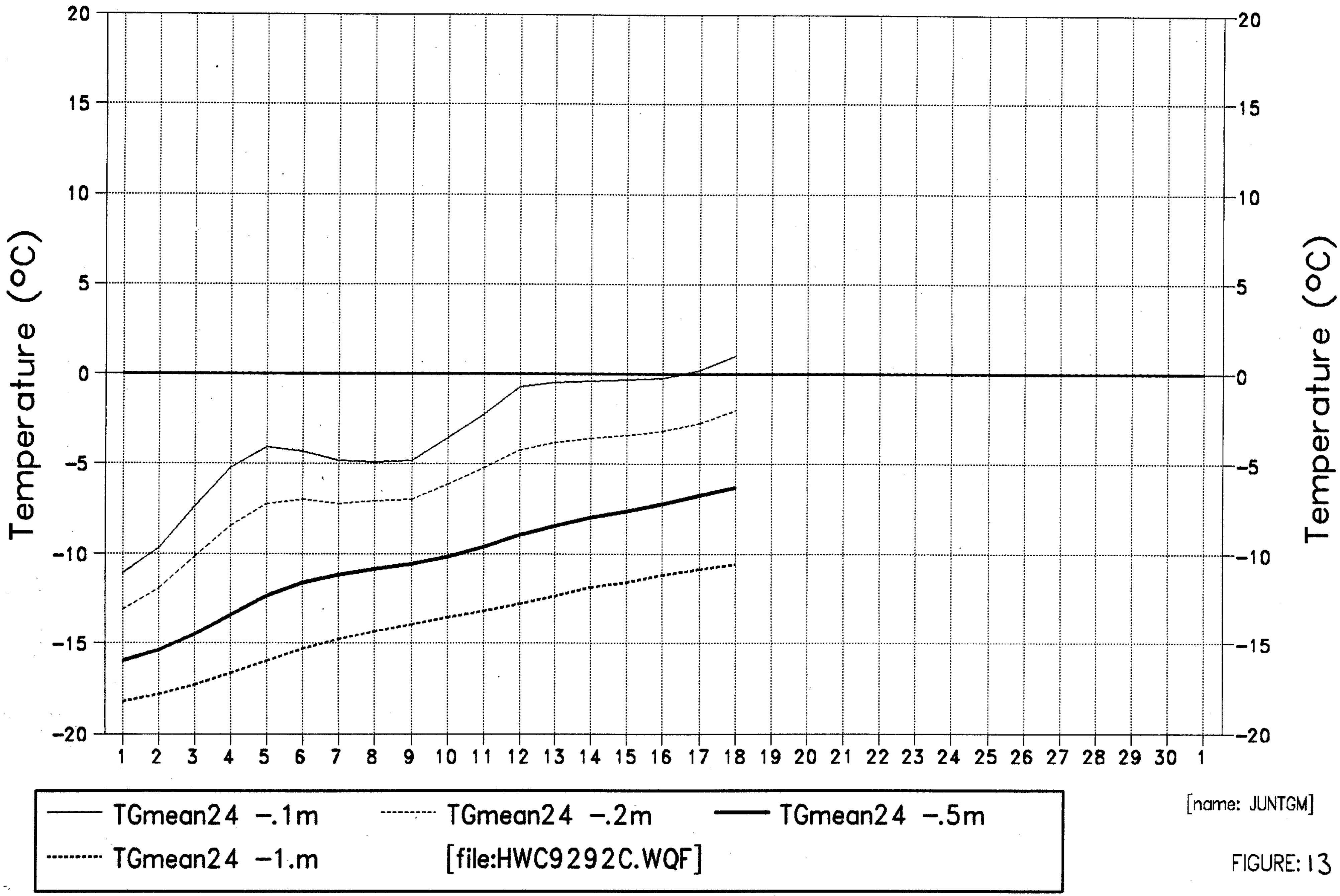
HWC(AWS): CALCULATED DAILY WIND SPEED
May 1992



[name: MAYWSM]

FIGURE: 12

HWC(AWS): CALCULATED DAILY TEMPERATURE
June 1992



[name: JUNTGM]

FIGURE: 13