

Preliminary observations from monitoring of the Greenland ice sheet

Data report from the ICEMON Project

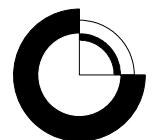
Andreas P. Ahlstrøm & Anne Munck Solgaard



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1. Introduction

This report presents the data material collected during the ICEMON project, funded by the Danish Environmental Protection Agency under the programme "Danish Cooperation for the Environment in the Arctic – Dancea". The present report thus supplements the previously published Final report from the ICEMON project by Bøggild & Laursen: "Monitoring the Greenland ice sheet margin", GEUS Report 2005/83, which contains the general description of the project and its accomplishments. The principal aim of the ICEMON project has been develop and test an automated ground based monitoring concept on the Greenland ice sheet. It has served as a demonstration project, from which important lessons have been learned regarding the technical, logistical and physical possibilities and limitations that operations on the Greenland ice sheet margin imply. Lessons that have immediately been put to use in the ensuing monitoring efforts.

This report presents the data that was acquired during the project by area, station, year and data type. It is intended to provide an overview of the data material rather than present any analysis. The data contained in this report are available in digital format from the Geological Survey of Denmark and Greenland on request. As is evident from this report, carrying out automated observations on the Greenland ice sheet is a challenging endeavour. However, the limited amount of success in obtaining continuous, reliable data in this project is outweighed by the experience gained in solving such a task on an operational level. This experience is now utilized in the Programme for Monitoring of the Greenland Ice Sheet (PROMICE) where observations from automatic mass-balance stations developed through the experience gained in ICEMON play an important role (Ahlstrøm and others, 2008).

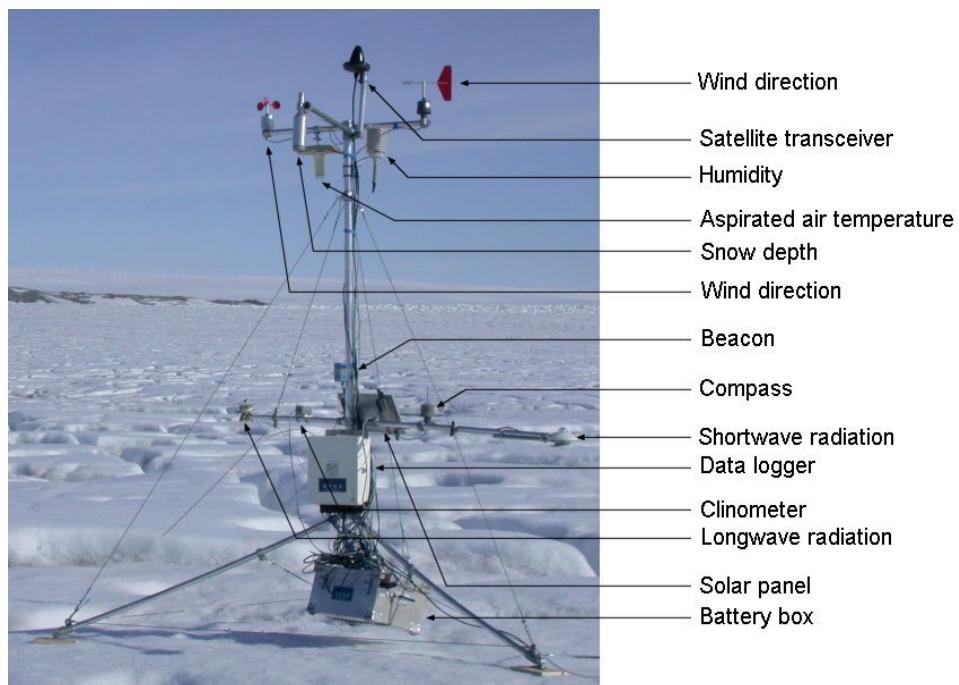


Figure 1. The station setup for the fully equipped ICEMON stations

The transects (ie. groups of stations positioned in the same region but at different elevations) here termed Nuuk, Qaqortoq and Tasiilaq that were deployed during the ICEMON project has been retained with some changes in the subsequent monitoring programme PROMICE:

- 1) The Nuuk transect has been moved from the calving outlet glacier Narsap Sermia to the landbased glacier Qamarnarsup Sermia, since positions on calving outlet glaciers poses a constant threat to the survival of the stations (such glaciers are faster moving, more crevassed and eventually transports the stations into the fjord). The move to Qamarnarsup Sermia was further supported by the existence of a decadal record of mass-balance and climate from this glacier retrieved by GEUS in the 1980s (then GGU) and the still functional camping hut on the nearby rock. The new transect abbreviation is "NUK".
- 2) The Qaqortoq transect has likewise been moved from the faster flowing parts of the glacier Sermilik Bræ towards the eastern slower moving part of the same glacier. Sermilik Bræ is also a fast-flowing calving glacier that has experienced a retreat of >5 km over the last few years. The new transect abbreviation is "QAS", named after the only significant settlement in the vicinity, Qassimiut.
- 3) The Tasiilaq transect has been moved slightly in order to place it along a known, safe route over the ice sheet. This means that the stations can now be visited using only ground-based transport from Isortoq, a nearby settlement. This saves expensive helicopter logistics, involves the local population and economy and is more environmentally sound.

The final report from the ICEMON Project and an overview publication on the new Programme for Monitoring of the Greenland Ice Sheet (PROMICE) can be obtained from GEUS by reference to:

Bøggild, Carl Egede & Ellen Laursen (2005): *Monitoring the Greenland ice sheet margin*, GEUS Report 2005/83.

Ahlstrøm, A.P., P. Gravesen, S.B. Andersen, D. van As, M. Citterio, R.S. Fausto, S. Nielsen, H.F. Jepsen, S.S. Kristensen, E.L. Christensen, L. Stenseng, R. Forsberg, S. Hanson, D. Petersen (2008): *A new programme for monitoring the mass loss of the Greenland ice sheet*, Review of Survey Activities 2007, 61–65.

2. Maps of the station areas

Three transects in southwestern, southern and southeastern Greenland were established for the project. These sites were selected to be representative of different climatological regions of the ice sheet margin, yet relatively accessible from nearby heliports to reduce the logistical costs.



Figure 1. Positions and names of stations in the Nuuk transect overlaid on a true colour satellite image map. The transect has now been moved to the smaller glacier in the lower right hand side of the image.

Figure 2. The station "Nuuk 3" as found in August 2007 – inaccessible from the helicopter without climbing gear.



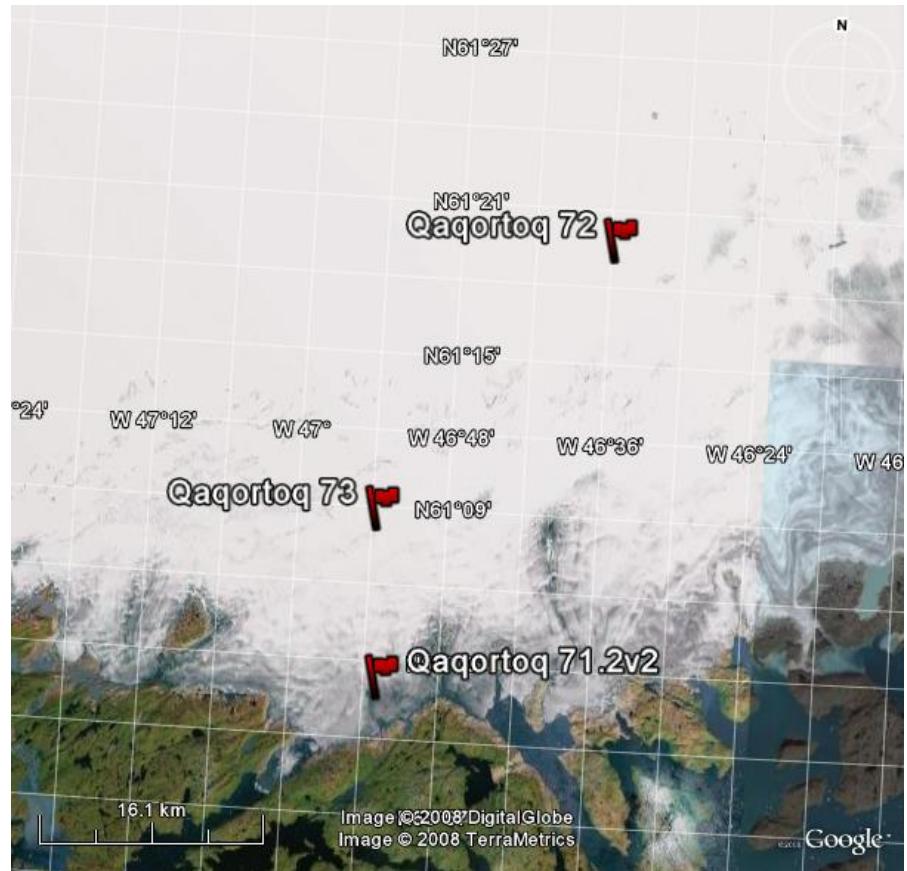
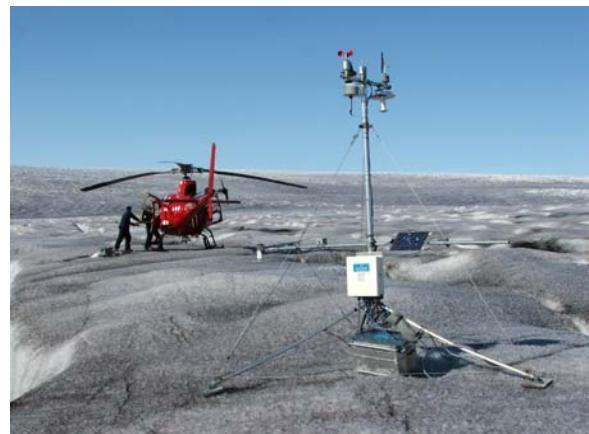


Figure 3. Positions and names of stations in the Qaqortoq transect overlaid on a true colour satellite image map. The transect has been continued without the Qaqortoq 72 station which is in the accumulation zone of the ice sheet and with Qaqortoq 73 moved 6-7 km NE..

Figure 4. August 2007 – “Qaqortoq 71.2v2” is found in good health.



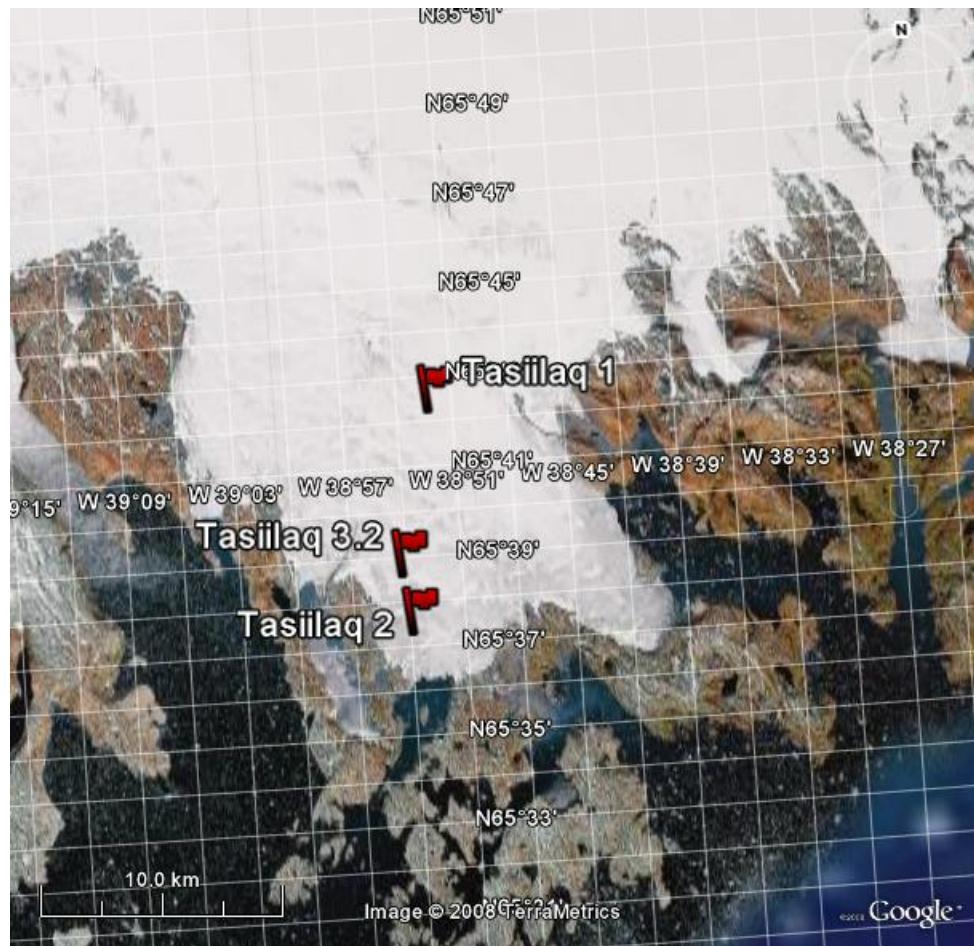


Figure 5. Positions and names of stations in the Tasiilaq transect overlaid on a true colour satellite image map. The transect has been continued without the Tasiilaq 2 station which was lost without trace, probably due to a piteraq (a strong downslope wind from the ice that can be devastating).

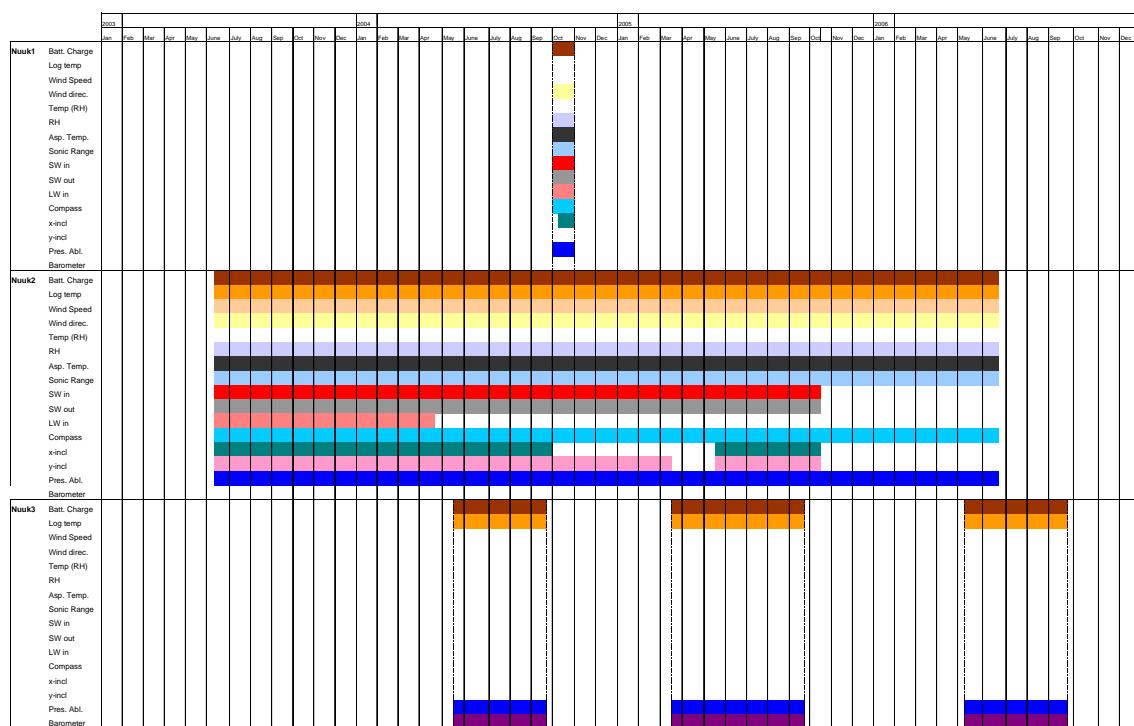
Figure 6. The state of “Tasiilaq 1” by August 2007.



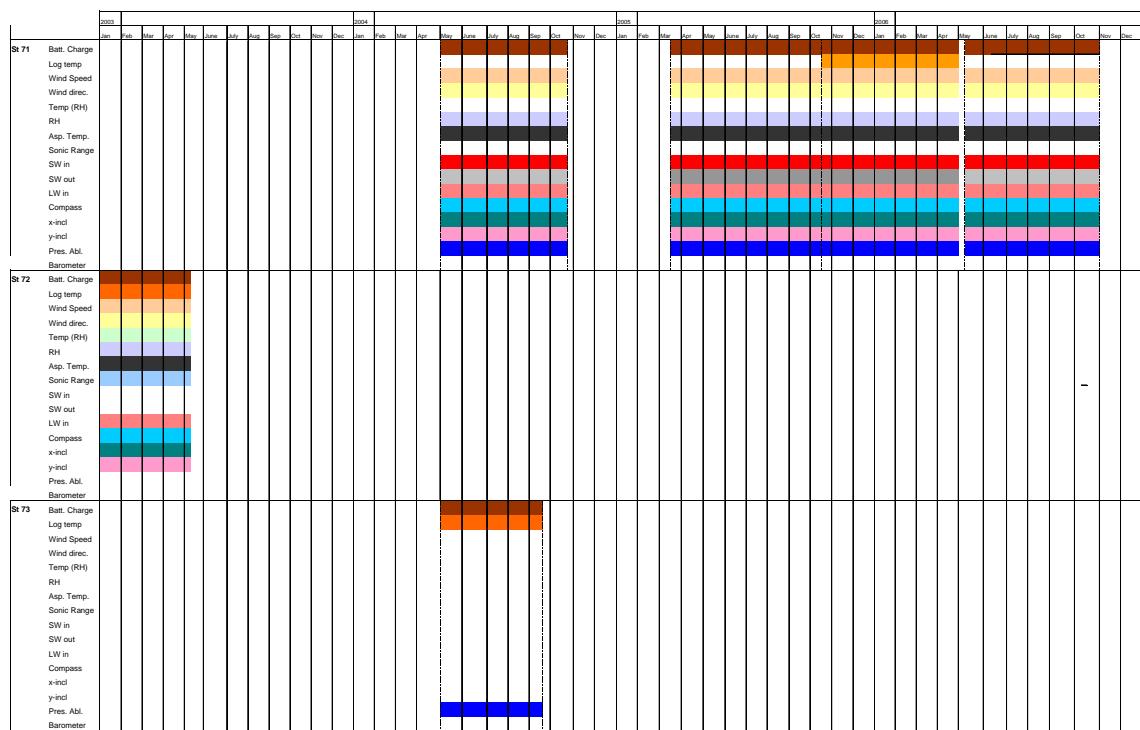
3. Temporal data coverage

The following sheets are intended to provide an overview of the temporal coverage of data from each instrument on each station. The next chapter contains plots of the actual data obtained. The colour bars indicate during which periods useful data is available. The quality control was manual, ie. all data was scrutinized by the authors for physical consistency and instrument-related issues. However, data that was judged to be correctly acquired for the present purpose might still not be valid for particular use, e.g. incoming shortwave radiation may be deemed useless for surface energy-balance calculations if the station inclination was above a certain tilt. Such considerations have not been included in this report, but can be deduced from comparing the relevant data series.

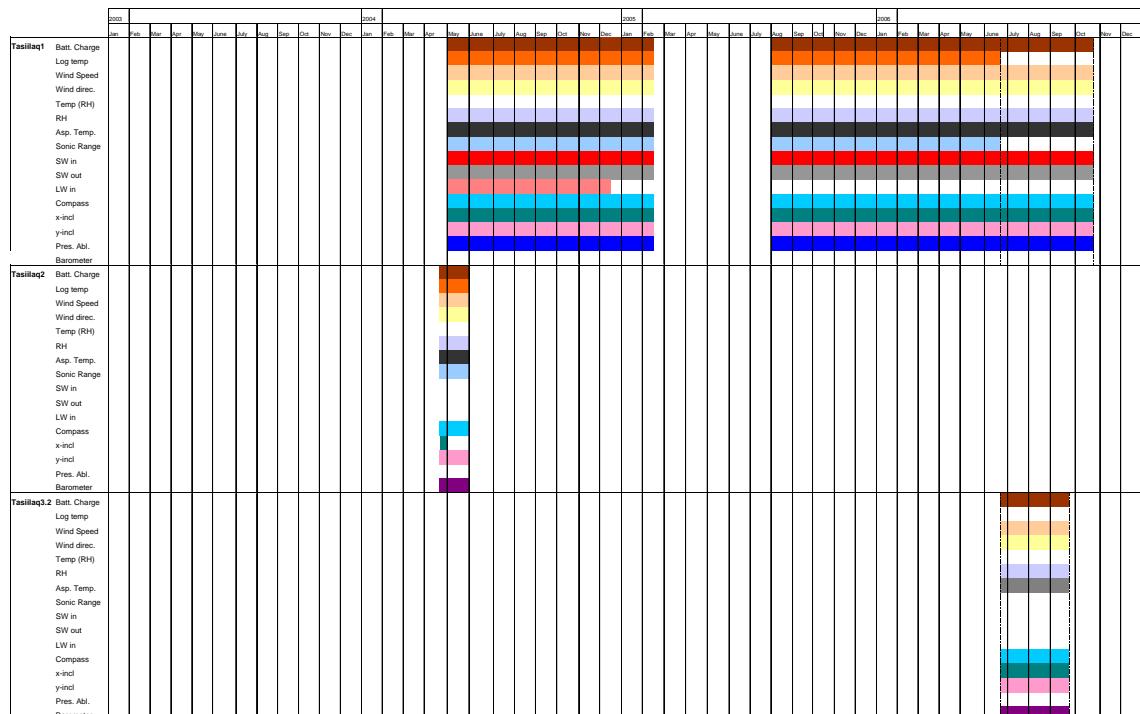
3.1 Nuuk transect



3.2 Qaqartoq transect



3.3 Tasiilaq transect



4. Station data sheets

Visiting GEUS personnel mentioned: CEB: Carl Egede Bøggild, SN: Søren Nielsen, SPO: Steffen Podlech, CM: Christoph Mayer, APA: Andreas P. Ahlstrøm, RSF: Robert S. Fausto, DVA: Dirk van As, SIBA: Signe Bech Andersen, MCIT: Michele Citterio, MOLA: Morten Langer Andersen.

4.1 Station Nuuk 1

Pos. 06-2003: $64^{\circ} 38,204$ N; $050^{\circ} 00,761$ W; c. 100 m a.s.l. (CEB)

Pos. primo 2005: Station lost? (no SatCom signal received)

Pos. 27-07-2006: Original pos. c. 2.5 km from glacier front (APA, SN)

Instrument/type	Brand	Serial no.	Remarks
Data logger	Campbell	X11526 or XE4804	ID 300
Wind speed, type	Aanderaa	53	
Wind direction type 2053	Aanderaa	655	
Humid- ity/Temperature HMP45D	Vaisala	Y0510075	
Asp. Temperature T302	Vector	1114	
Sonic Ranger SR50M-45	Campbell	C1739	
Albedometer CM6B/7B	Kipp&Zonen	020344	
PIR CG 4	Kipp&Zonen	030644	
Compass Type 2053	Aanderaa	GEUS 01	Wind direction without vane
Inclinometer NS25/E2	HLPlanar	0525	
Ablation NT1400	Ørum&Jensen	576	
Solar panel		?	
Batteries LC-X1228-P	Panasonic	6 x 28 Ah	
Avalance transm.S2	Barryvox	?	
Satcom easyTrack	Thrane&Thrane	03109298	ISN 4TT08749 06ED Inmarsat 492388 065

4.2 Station Nuuk 2

Pos. 06-2003: $64^{\circ} 44,174$ N; $049^{\circ} 29,555$ W; c. 900 m a.s.l (CEB)

Pos. 08-2005: Station lost ? (No SatCom)

Pos. 27-07-2006: $64^{\circ} 43,873$ N; $049^{\circ} 33,032$ W; c. 792 m a.s.l (APA, SN)

Station lost, instruments returned to GEUS 09-2006

Instrument/type	Brand	Serial no.	Remarks
Data logger	Campbell	X11526 or XE4804	ID 301
Wind speed, type	Aanderaa	GEUS 54	
Wind direction type 2053	Aanderaa	536	
Humid- ity/Temperature HMP45D	Vaisala	Y0510076	
Asp. temperature T302	Vector	1076	
Sonic Ranger SR50M-45	Campbell	C1099	
Albedometer CM6B/7B	Kipp&Zonen	020352	
PIR	Eppley lab.	20636F3	
Compass Type 2053	Aanderaa	654	Wind direction without vane
Inclinometer NS25/E2	HLPlanar	0784	
Ablation NT1400	Ørum&Jensen	575	
Solar panel		?	
Batteries LC-X1228-P	Panasonic	6 x 28 Ah	Watertight case, Zarges 45137
Avalance transmitter S2	Barryvox	?	
Satcom easyTrack	Thrane&Thrane	03110432	ISN 4TT08748 E7BF Inmarsat 492388 066

4.3 Station Nuuk 3

Ablation only

Pos. 16-05-2004: 64°41,891' N, 049°45,211' W, ca. xxx m. (CEB, from Daily flight report found in binder 09-05-07)

Pos. 27-07-2006: Search, no luck (APA, SN)

Pos. 2007-08-20: 64°41,43'N 049°48,51'W 517 m.asl. (SN) out of reach due to crevasses

Instrument/type	Brand	Serial no.	Remarks
Data logger	Campbell	X33684	
Ablation NT1400	Ørum&Jensen	574	
Solar panel MSX10L	Solarex	C1020527 2148727	
Batteries LC-X1228-P	Panasonic 2003	3 x 28 Ah (2 + 1)	
Satcom EasyTrac	Thrane&Thrane SN 03109245	4TT087 48B FAC	Inmarsat no. 49 2388 067
Avalance transmitter S2	Barryvox	3000 3025	
Barometer RPT410F	Drück	1900 179	

4.4 Station Qaqortoq 71.2

Position (01-05-2004): $61^{\circ} 01' 00,73''$ N; $046^{\circ} 55' 12.75''$ W; X.XXX m a.s.l.

03-05-2004: Moved to new position: Station 71.2 v 2

Instrument/type	Brand	Serial no.	Remarks
Data logger CR10X 1 Mb ?	Campbell	XE1199	Borrowed from Peer Jørgensen, KU. ID = 73
Windspeed 2740 modified	Aanderaa	GEUS 55	
Wind Direction 2053 ?	Aanderaa	12417	
Hygr./Temp. HMP45D	Vaisala	Y0510077	
Asp. Temperature T302	Vector	1104	
Sonic Ranger SR50	Campbell	C1409	
Albedometer CM7B	Kipp&Zonen	810456	
PIR	Eppley	25872F3	
Compass 2053 ?	Aanderaa	6165	
Inclinometer NS25/E2	HLPlanar Technic	0750	
Ablation NT1400	Ørum & Jensen Modified GEUS	572	Left in the ice. 05-2004: Hose frozen, density like water.
Solar Panel SSX10M LITE	Solarex	C1010816 1792477	
Batteries LC-X1228P	Panasonic	2003-04	3 x 28 Ah

4.5 Station 71.2 v2 april 2004

Pos. 03-05-2004: 61° 01.525' N, 046° 52.270' W, X.XXX m a.s.l (SPO)

Pos. 21-04-2006: 61° 01.466' N, 046° 52.314' W, c. 334 m a.s.l (RSF)

Pos. 05-08-2006: 61°01.474' N, 046°52.319' W, c. 299 m a.s.l (Found, APA, SN)

Pos. 05-08-2006: 61°01.473' N, 046°52.327' W, c. 295 m a.s.l. (New pos., APA, SN)

Instrument/type	Brand	Serial no.	Remarks
Data logger CR10X 1 Mb ?	Campbell	XE1199	New program 2004. 05-08-2006: Progr. stopped?
Wind Speed 2740 modified	Aanderaa	GEUS 55	
Wind Direction 2053 ?	Aanderaa	12417	
Hygr./Temp. HMP45D	Vaisala	Y0510077	
Asp. Temp. T302	Vector	1104	
Sonic Ranger SR50	Campbell	C1409	Not working, returned to GEUS
Albedometer CM7B	Kipp&Zonen	810456	
PIR	Eppley	25872F3	Dome smashed, Returned to GEUS 05-08-2006
Compass 2053 ?	Aanderaa	6165	05-08-2006: problems with alingment
Inclinometer NS25/E2	HLPlanar Technic	0750	
Ablation NT1400	Ørum & Jensen	585	New, ¾" pvc, 25.75m, 50% Et-glycol 05-08-2006: Refilled, 23,1 m hose above ground.
Solar Panel SSX10M LITE	Solarex	C1010816 1792477	
Batteries LC-X1228P	Panasonic	2003-04	3 x 28 Ah
SatCom EasyTrac	Thrane&Thrane	4TT087 SN 04115937	Inmarsat no. 49 2388 093
Barometer RPT410F	Drück	422 D1F	
Loggercase with wir- ing panel	Campbell	1900 182	
Tripod			05-08-2006: Wire-tightener removed, no spring
New plugs for batt. box., New batt.cable?			"Unofficial" plug on battery box Only one 12V supply

4.6 Station Qaqortoq 72

Pos. 25-05-2001: $61^{\circ}18' 54.75''$ N; $046^{\circ}35' 08.47''$ W; 1.250 m a.s.l. (SPO)

Pos. 16-05-2002: Not determined (Almost snowed over) (CEB)

Pos. 15-08-2002: Not determined (Moved to surface) (SPO, CM)

Pos. 04-2006: Not found at original pos. (Snowed over ?) (RSF)

Pos. 27-07-2006: Not found (In clouds) (APA, SN)

Instrument/type	Brand	Serial no.	Remarks
Data logger CR10	Campbell	SN E7361	File ID = 72
Storage module 1, SM 192	Campbell	SN E5722	
Storage module 2, SM 192	Campbell	SN E5558	
Wind speed	Aanderaa	004	2 pulses/sec = 1.19m/sec
Wind direction 2750	Aanderaa	SN 1127	Placed parallel to compass
Temp./Hyg. HMP35A	Vaisala	72	
Asp. temp. T302	Vector	SN 1136	Pt 100 sensor
Sonic ranger SR50	Campbell	SN C1062	
P.I.R.	EPLAB	SN 20705F3	Points towards west $4.93 \mu\text{v}/\text{w/m}^2$
Compass Type 2864	Aanderaa	SN 203	328° = geographical north Misvisning 32°W
Inclinometer	HLPLANAR TECH-NIC NS25/E2 GEUS	72	X = East/West East = +, West = - Y = North/South South = +, North = - Y-direction placed horizontal
Solar panel	AEG		9 W
Batteries	ES 12-24		3x24 Ah

4.7 Station Qaqortoq 73

Pos. 03-05-2004: 61°08'01.54" N; 046°53'03.66" W; xxx m a.s.l. (SPO)

Pos. 21-09-2005: Returned to GEUS

Instrument/type	Brand	Serial no.	Remarks
Data logger CR10X	Campbell	XE4115	
Avalance Transmitter S2	Barryvox	3000 3005	
Ablation NT1400	Ørum & Jensen	584	¾" pvc, 28.8m, 50% Ethylenglycol
SatCom EasyTrac	Thrane&Thrane SN 04115999	4TT087 3E1 52D	Inmarsat no. 49 2388 095
Solar panel MSX10L	Solarex	I 101112121 02 666	
Batteries	Panasonic		Bought Feb. 2004, Watertight case 3x24 Ah (2+1)

4.8 Station Tasiilaq 1

Pos. 27-05-2004: 65°42.207' N, 038°51.916' W, c. xxx m.o.h (CM)

Pos. 03-08-2005: 65°42.163' N, 038°51.926' W, c. 585 m.o.h (Bent Hasholt)

Pos. 25-04-2006: 65°42'07.8" N, 038°51'55.9" W, c. 591 m.o.h ? (APA)

Pos. 26-06-2006: 65°42,135 N, 038°51,936W, c. 580 moh. (APA, SN)

Pos. 2007-08-15: 65°42,094'N, 038°51,948'W, 589 m.asl. ? (SN, DVA, SBA, MCIT)

Instrument/type	Brand	Serial no.	Remarks
Data logger CR10X	Campbell	XE4110	
Wind speed and direction, type 05103	Young	59304	Shaft broken at retrieval.
Barometer RPT410F	Drück	1900 181	Connected, but not measuring To GEUS 06-2006
Humidity/Temperature HMP45D	Vaisala	06-2006: U122 0002	Z032 0009 to GEUS 06-2006
Asp. temperature T302	Vector	06-2006: 1064	1154 to GEUS 06-2006
Sonic Ranger SR50M-45	Campbell	Not installed	C3564 to GEUS 06-2006
Albedometer CM7	Kipp&Zonen	810460	Both shields missing 06-2006 New upper shield 06-2006
PIR	Eppley		25871F3 to GEUS 06-2006
Compass Type 6100	Pewatron/PJ	GEUS 01	Measuring one channel
Inclinometer NS25/E2	HLPlanar	0616	
Ablation NT1400 Xxx m ¾" hose, 50% water/ehtylene glycol	Ørum&Jensen	581	Sensor installed 18,8 m below surface. Filled 06-2006, new bag Wires exchanged on loggerpanel (shows + values now). Hose above ground 06-2006: 15,1 m. Hose above ground 08-2007: 19,70 m
Solar panel MSX10L	Solarex	I2011121 02927	
Batteries LC-X1228-P	Panasonic	6 x 28 Ah (4+2)	Bought Feb 2004
Avalance transmitter S2	Barryvox	3000 3007	
Satcom easyTrack	Thrane&Thrane	4TT087 SN 04115 745	Inmarsat no. 49 2388 089

Visited and repaired by Bent Hasholt 08-2005, APA 04-2006, APA+SN 06-2006

Retrieved 15-08-2007 SN, DVA, SIBA, MCIT

4.9 Station Tasiilaq 2

Pos. 27-05-2004: 65°37.2' N; 38°53.522 W; ca. xxx m.o.h

Pos. 03-08-2005: NOT FOUND DURING SEARCH (Bent Hasholt)

Pos. 25-04-2006: NOT FOUND DURING SEARCH (APA)

26-02-2007: Declared LOST

Instrument/type	Brand	Serial no.	Remarks
Data logger CR10X	Campbell	XE4966	
Wind speed and direction Type 05103	Young	59305	
Barometer RPT410F	Drück	1900 177	
Humidity/Temperature HMP45A	Vaisala	Z032 0008	
Asp. temperature T302	Vector	1153	
Sonic Ranger SR50	Campbell	C3565	
Albedometer CM6B/7B	Kipp&Zonen	?	Prepared for new instrument (In order)
PIR CG 4	Kipp&Zonen	040726	Sensitivity 14,33 μ V/W/m ²
Compass Type 6100	Pewatron/PJ	GEUS 02	Measuring one channel
Inclinometer NS25/E2	HLPlanar	0640	
Ablation NT1400	Ørum&Jensen	?Is drilled in 27-05-2004: 582	Is connected in the connector provided Just above $\frac{3}{4}$ " PVC, 30,5 m, 50% Ethylenglycol (meant for Tasiilaq 3)
Solar panel MSX10L	Solarex	C1010817 179 2693	
Batteries LC-X1228-P	Panasonic	6 x 28 Ah (4+2)	Bought Feb. 2004
Avalance transmitter S2	Barryvox	3000 3010	
Satcom easyTrack	Thrane&Thrane	4TT087 SN 04115 750	Inmarsat no. 49 2388 090

4.10 Station Tasiilaq 3.2

Pos. 26-06-2006: 65°38,503' N, 038° 53,889' W, c. 278 m a.s.l. (APA, SN)

Day100 2007: No transmission

Retrieved 2007-08-23: 65°38,503'N, 038°53,886'W ? c. 277 m a.s.l. (APA, MCIT, MOLA)

Instrument/type	Brand	Serial no.	Remarks
Data logger CR10X	Campbell	XE4115	
WS + D 05103	RM Young	25830	
Albedometer CM7	Kipp&Zonen		Not installed 06-2006
Tasp T302	Vector	1143	
HMP45D	Vaisala	Y05100 74	Only humidity
Compass	Pewatron/GEUS	03	
Inclinometer NS25-E2	Planar/GEUS	0534	
Satcom easyTrac	Thrane&Thrane SN 04115 885	4TT087 441 903	Inmarsat no. 49 2388 091
Avalance transmitter S2	Barryvox	3000 3006	
Ablation NT1400	Ørum & Jensen Not installed 06- 2006		
Barometer RPT410F	Drück	1900 178	
SR50	Not mounted 06- 2006. KeeKlamp on mast ready.		Prepared as SDI (Logger case, program)
PIR	Not mounted 06- 2006		Prepared (Logger case, program)
Solar panel MSX10L	Solarex	C1010816 179 2518	
Batteries LC-X1228-P	Panasonic	4 x 28 Ah (2 + 2)	Bought Feb. 2004 Extended from 3 to 4 dur- ing visit in June 2006
Tripod			Lower boom not alu, gal- vanized iron. New upper boom

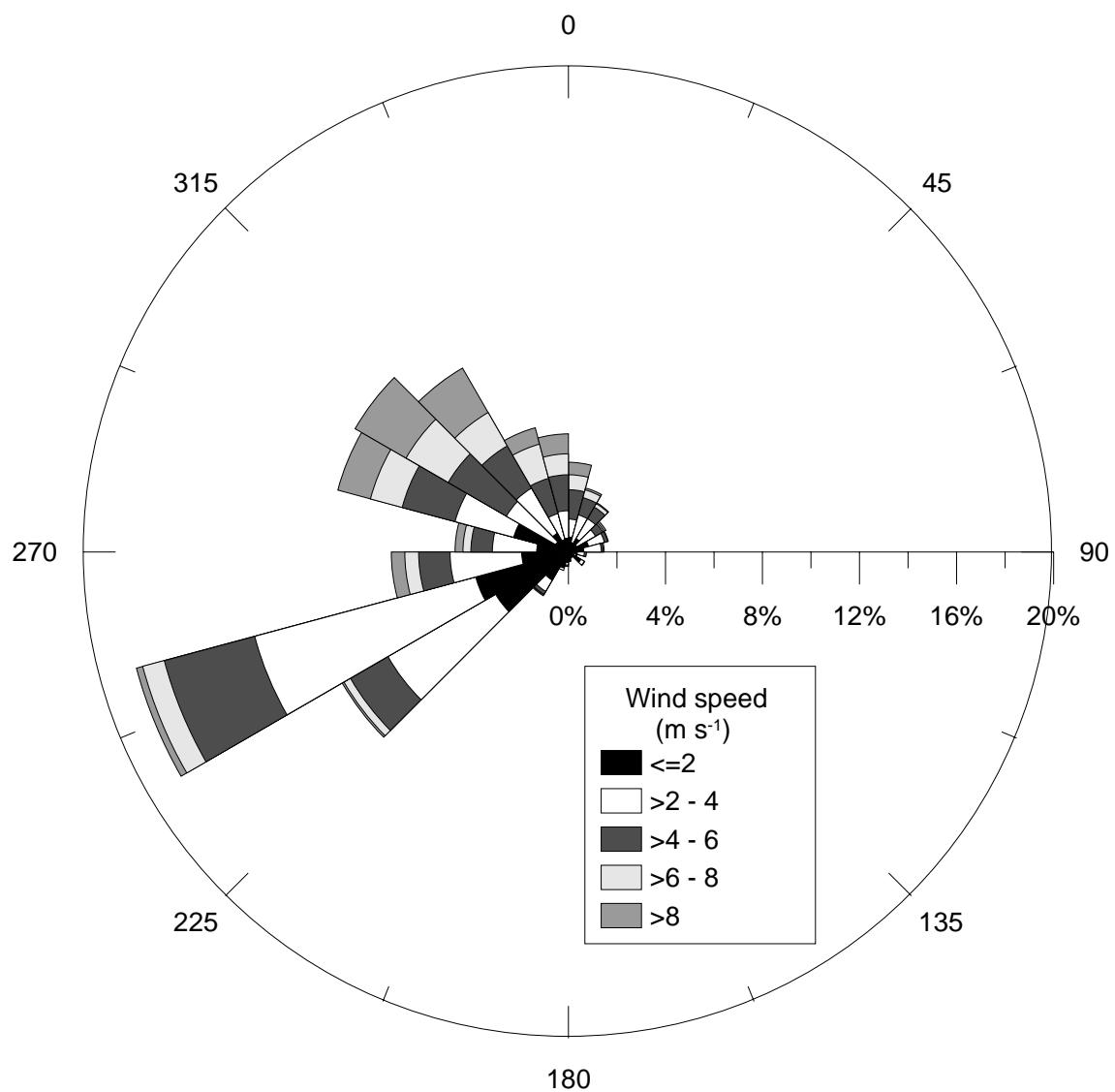
5. Data plots

In the following section, the data collected in the ICEMON project as illustrated in the sheets on temporal data coverage are plotted individually for each instrument, station and year. The plotting has been carried out using a script developed for the plotting software Grapher© from Golden Software. The script requires the input data from the station to adhere to a specific format, ie. it expects a particular data type to appear in a specific column. Such a methodology is required in order to easily obtain detailed and data specific plots from large amounts of data.

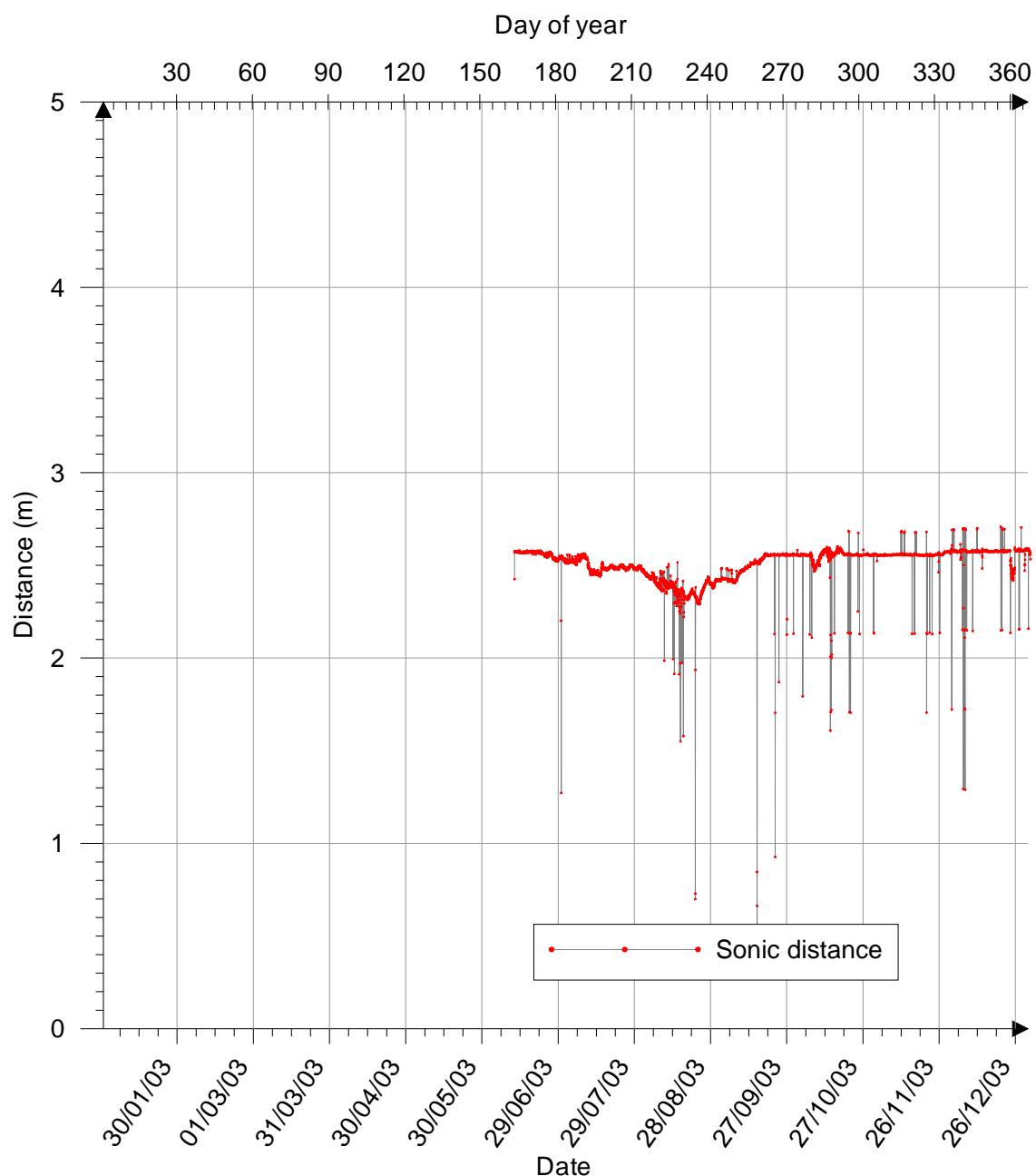
5.1 Nuuk stations

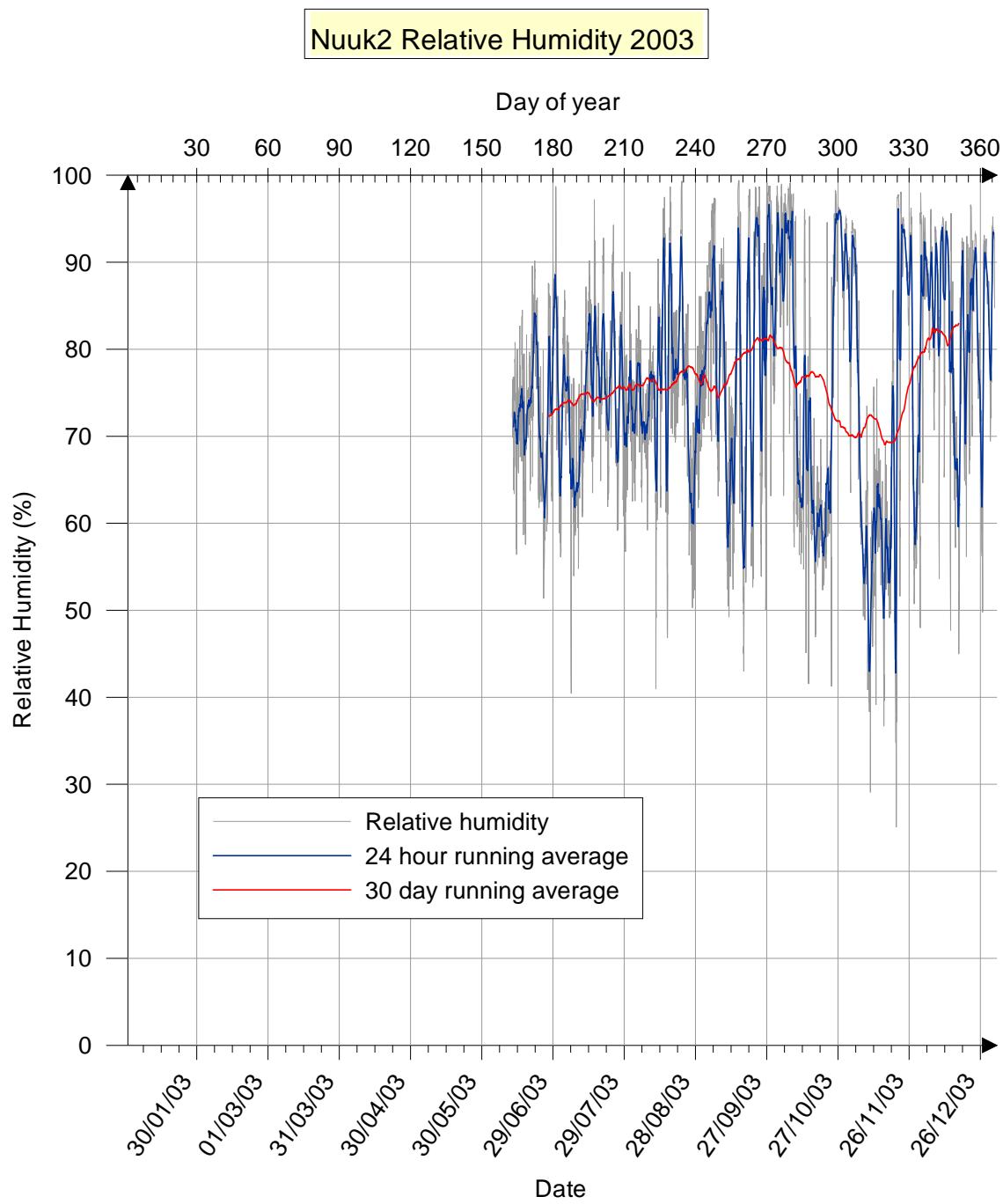
5.1.1 Nuuk stations in 2003

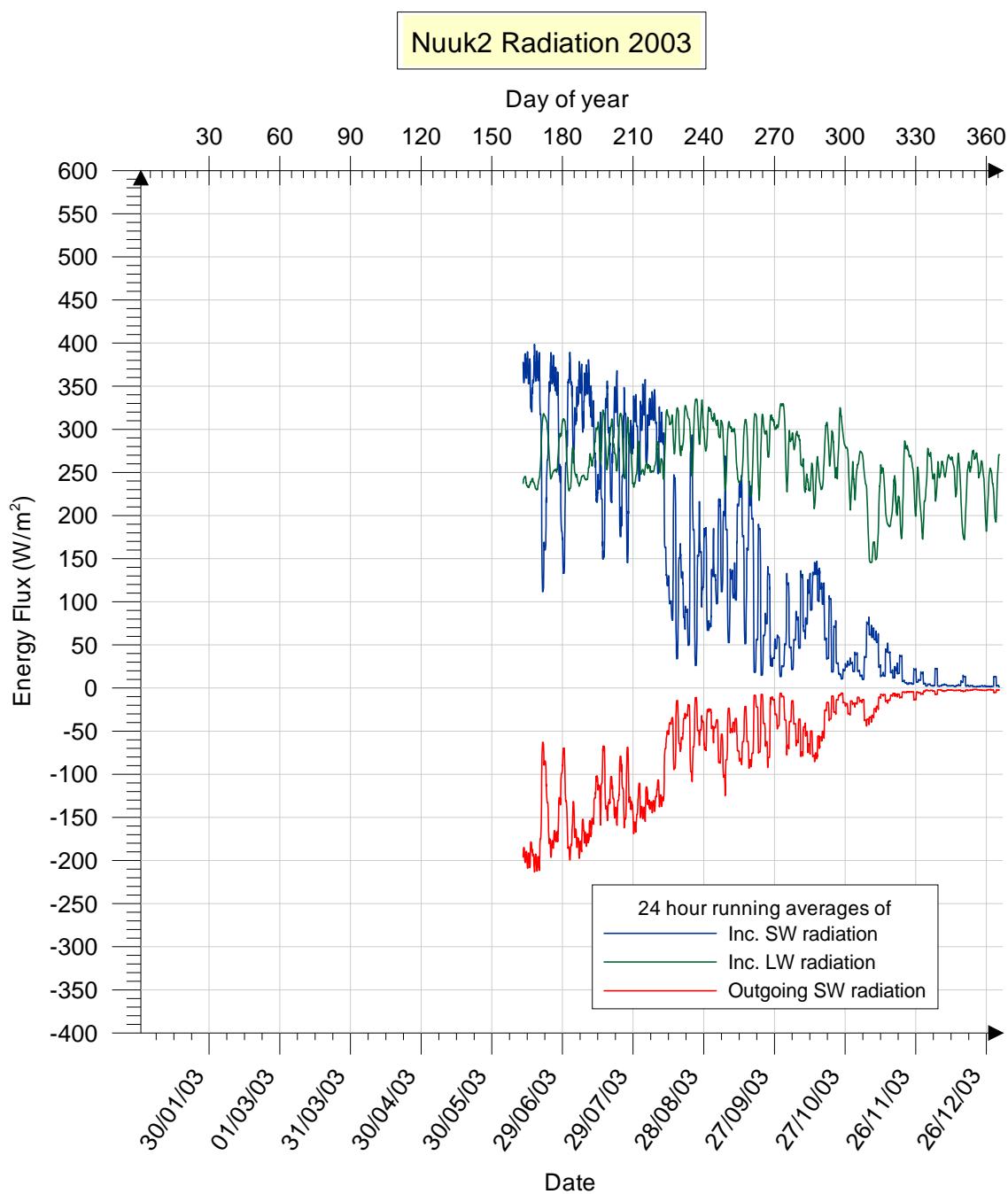
Nuuk2 Wind chart 2003 (June-Dec)

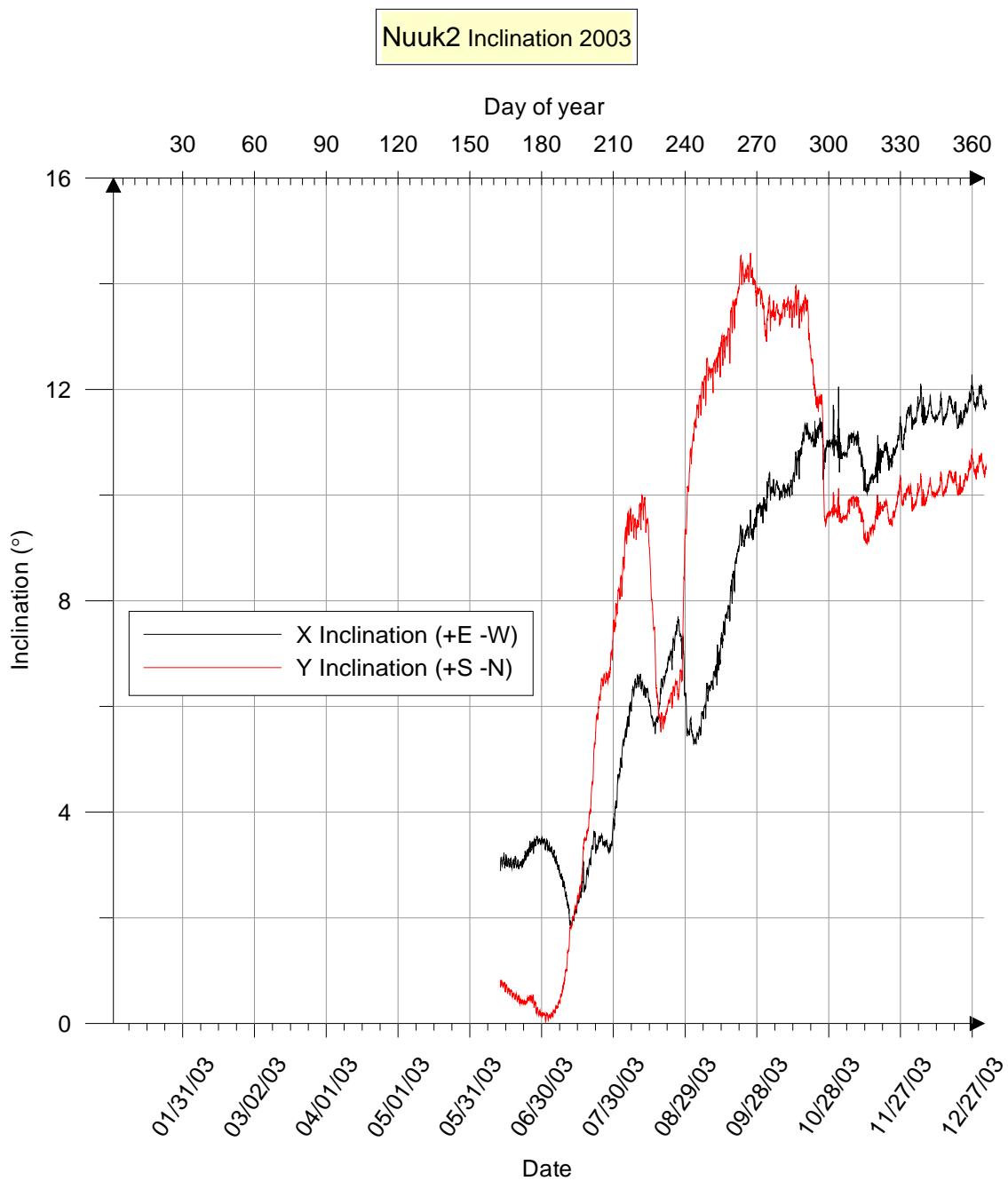


Nuuk2 Sonic Ranger 2003

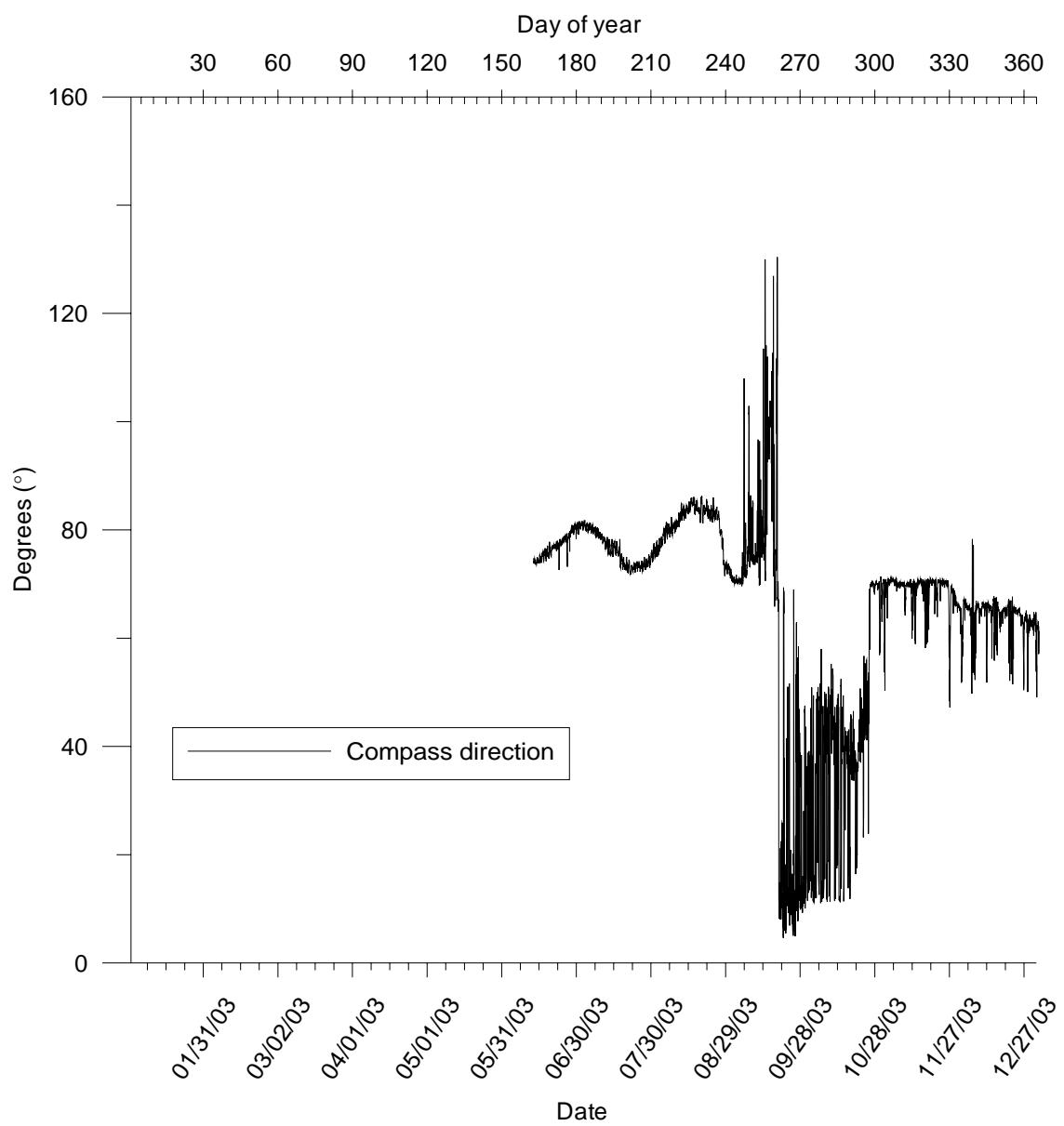


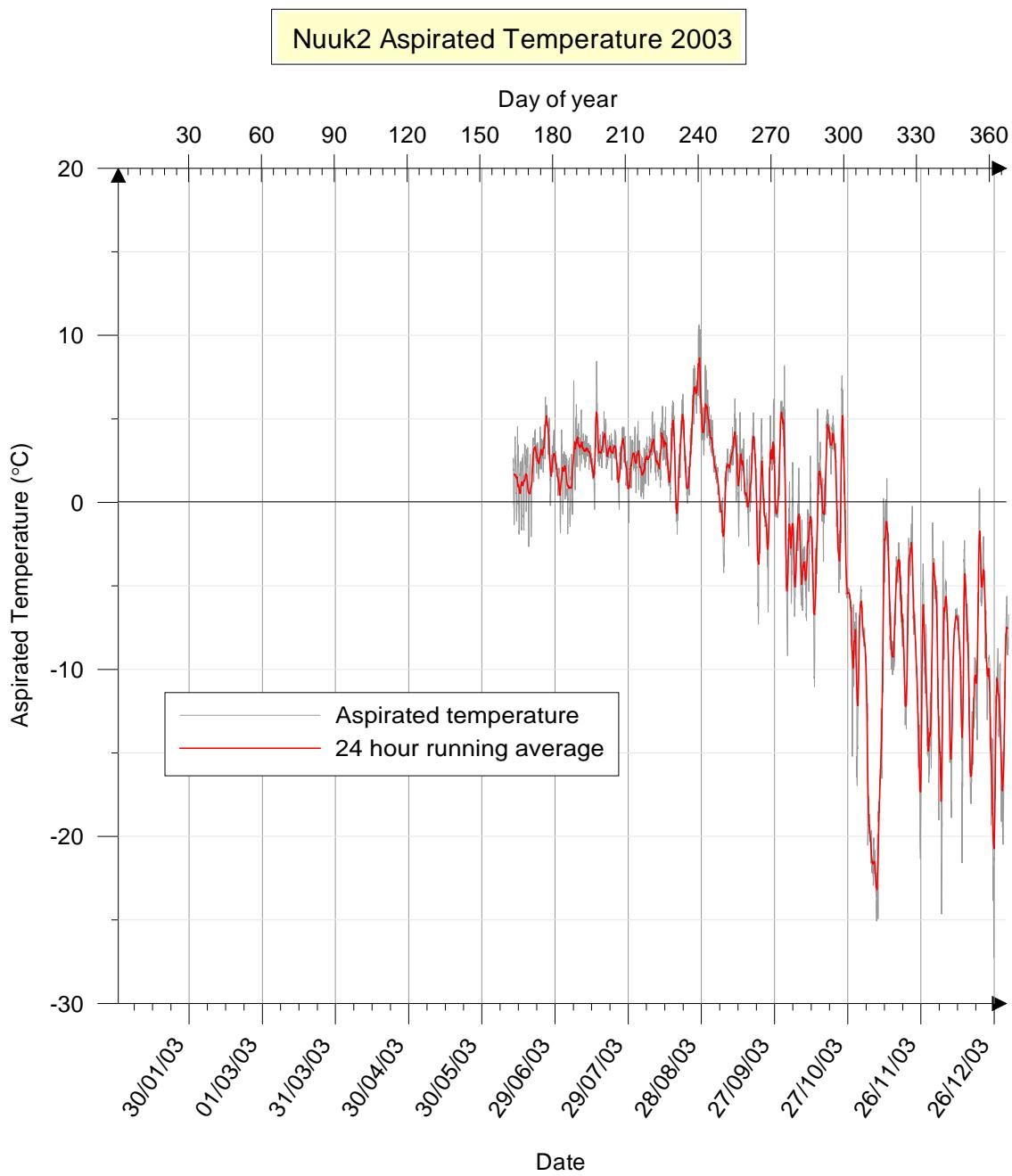




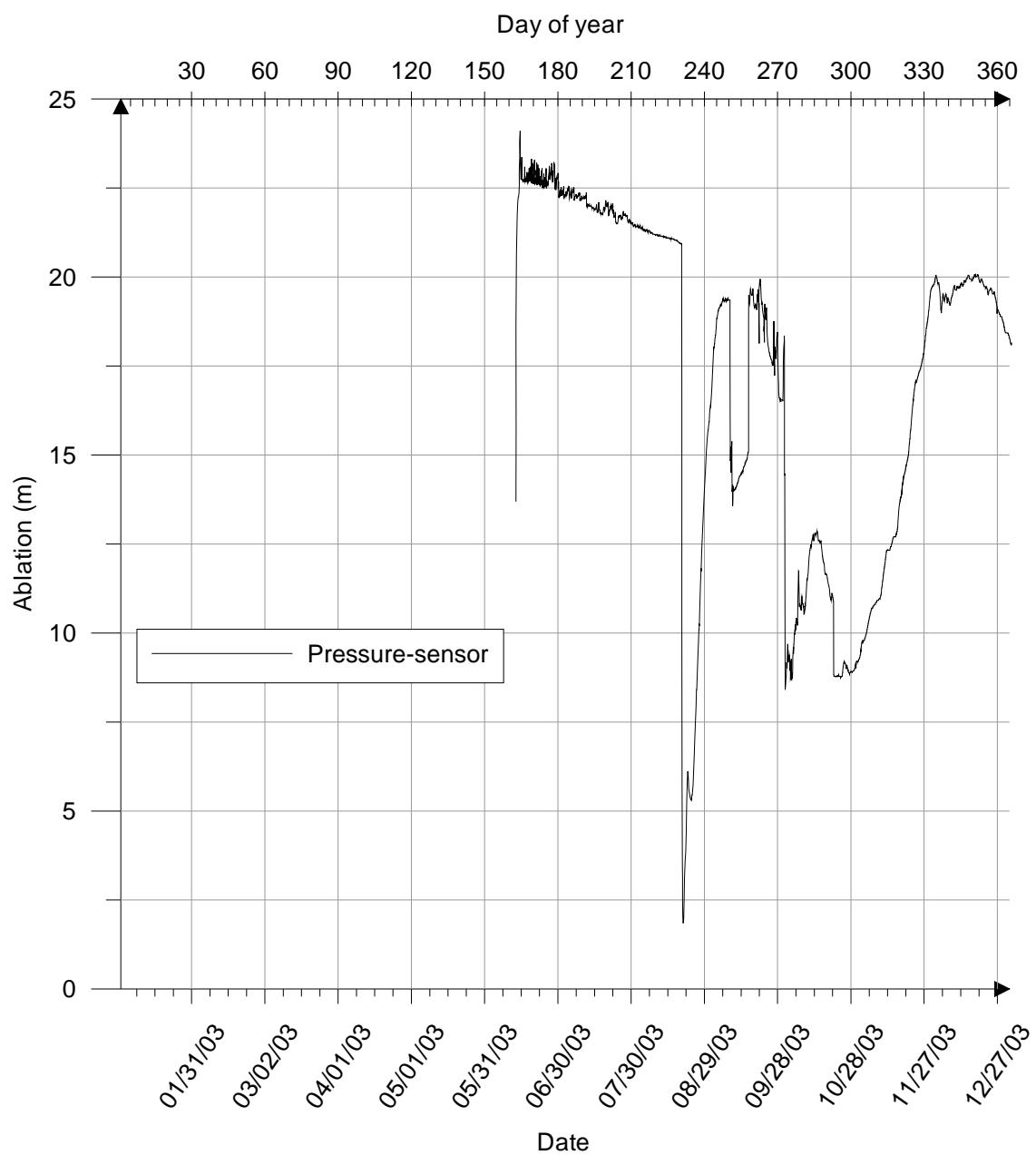


Nuuk2 Compass Direction 2003



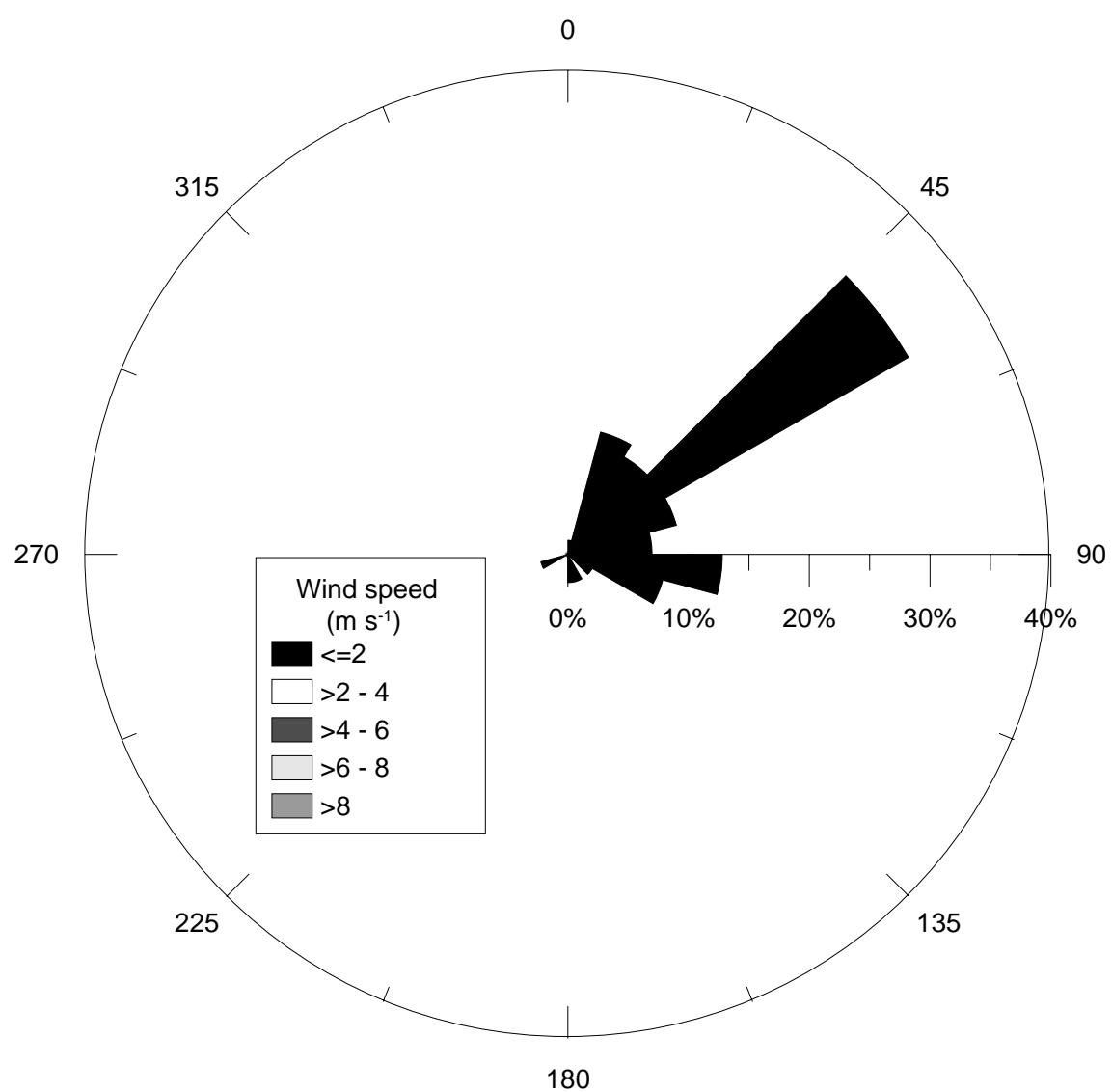


Nuuk2 Ablation 2003

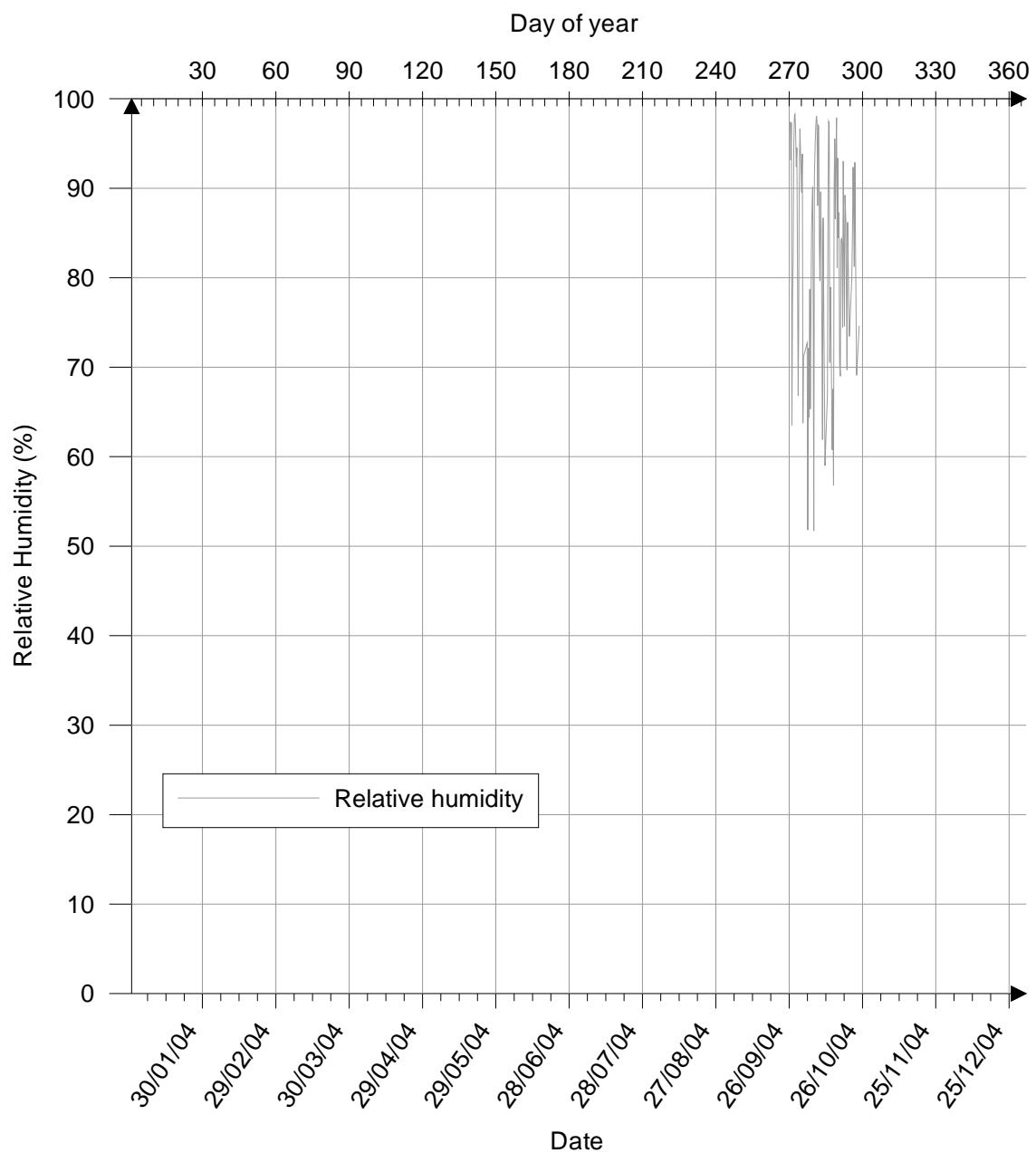


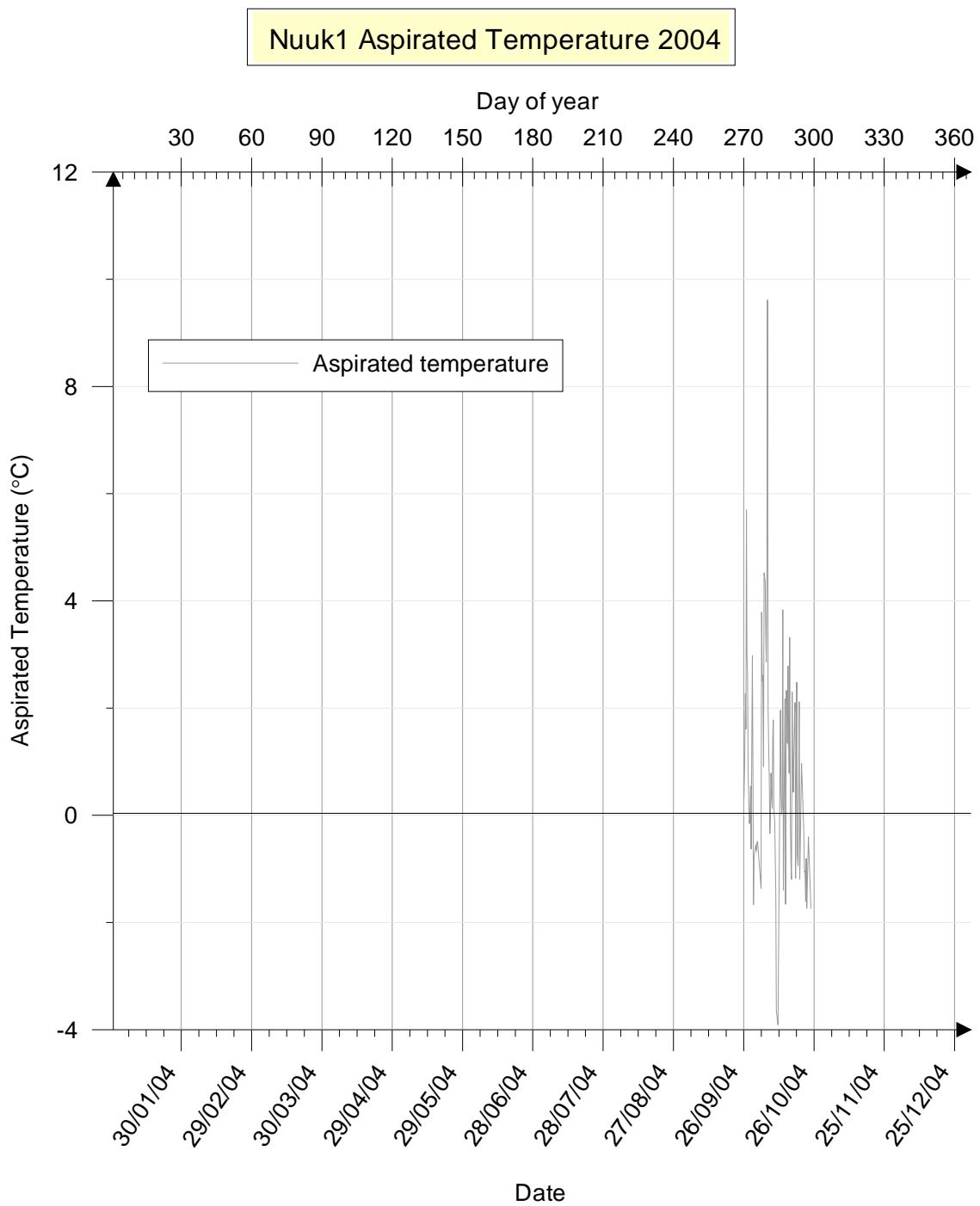
5.1.2 Nuuk stations in 2004

Nuuk1 Wind chart 2004 Oct

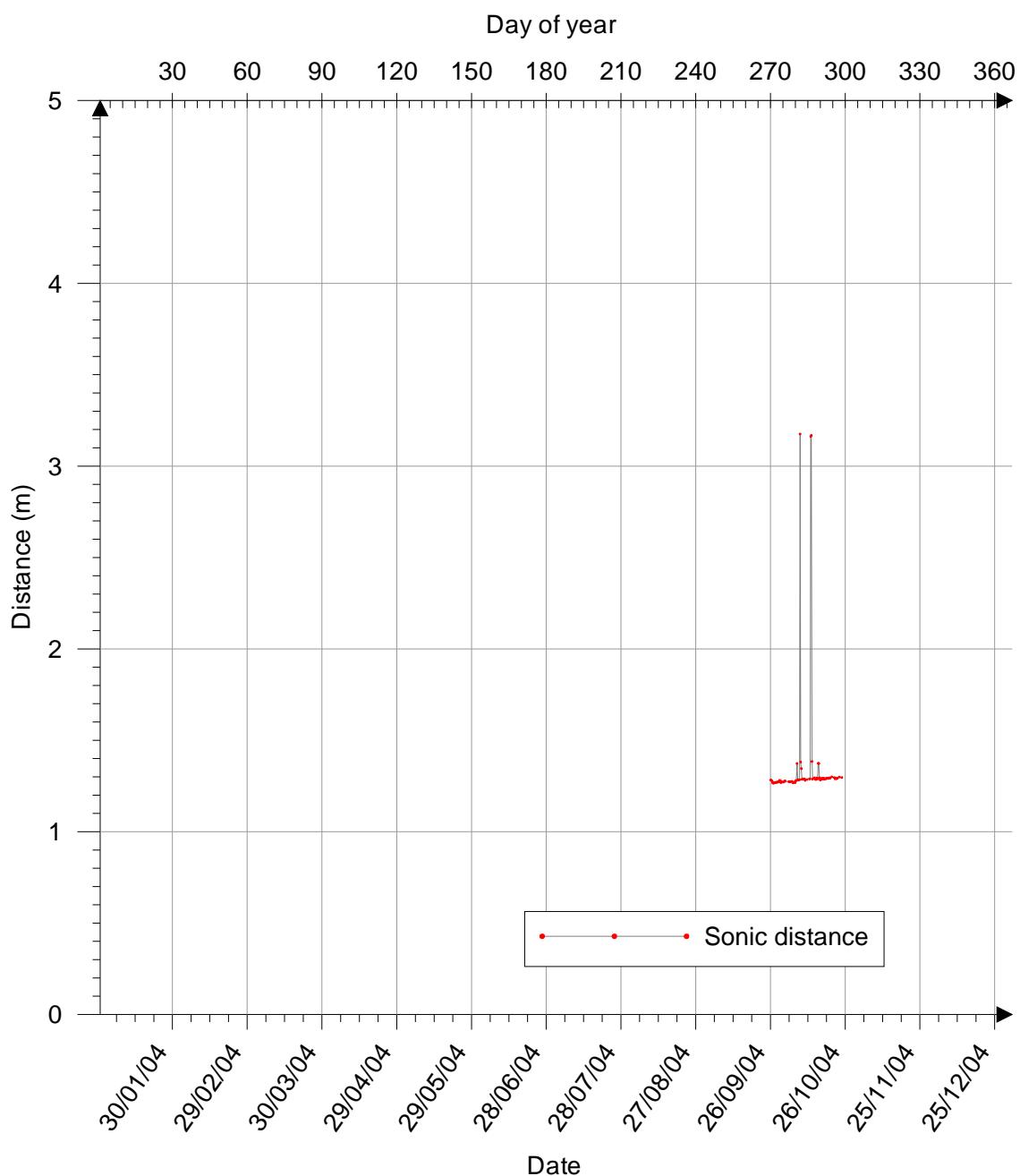


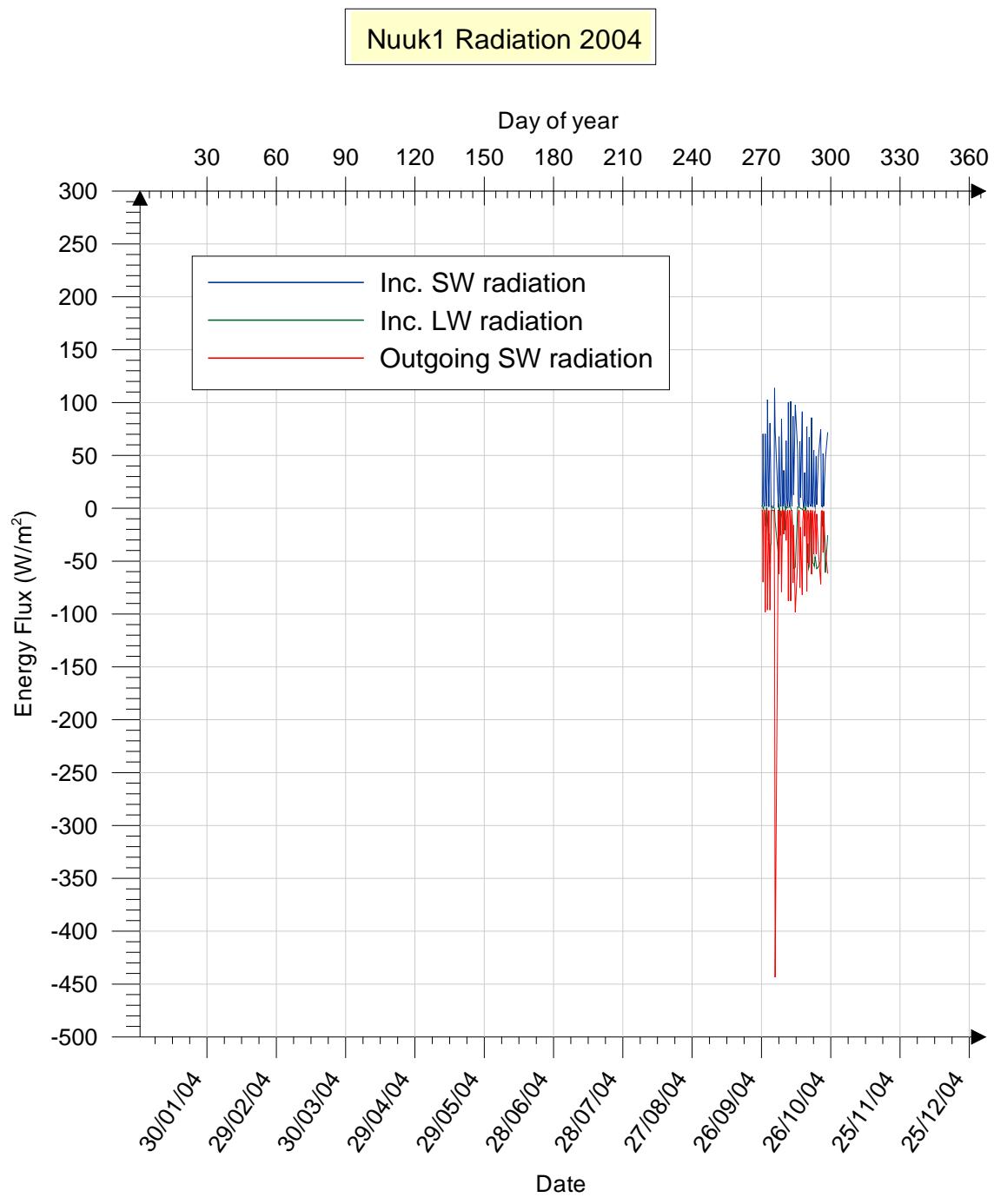
Nuuk1 Relative Humidity 2004



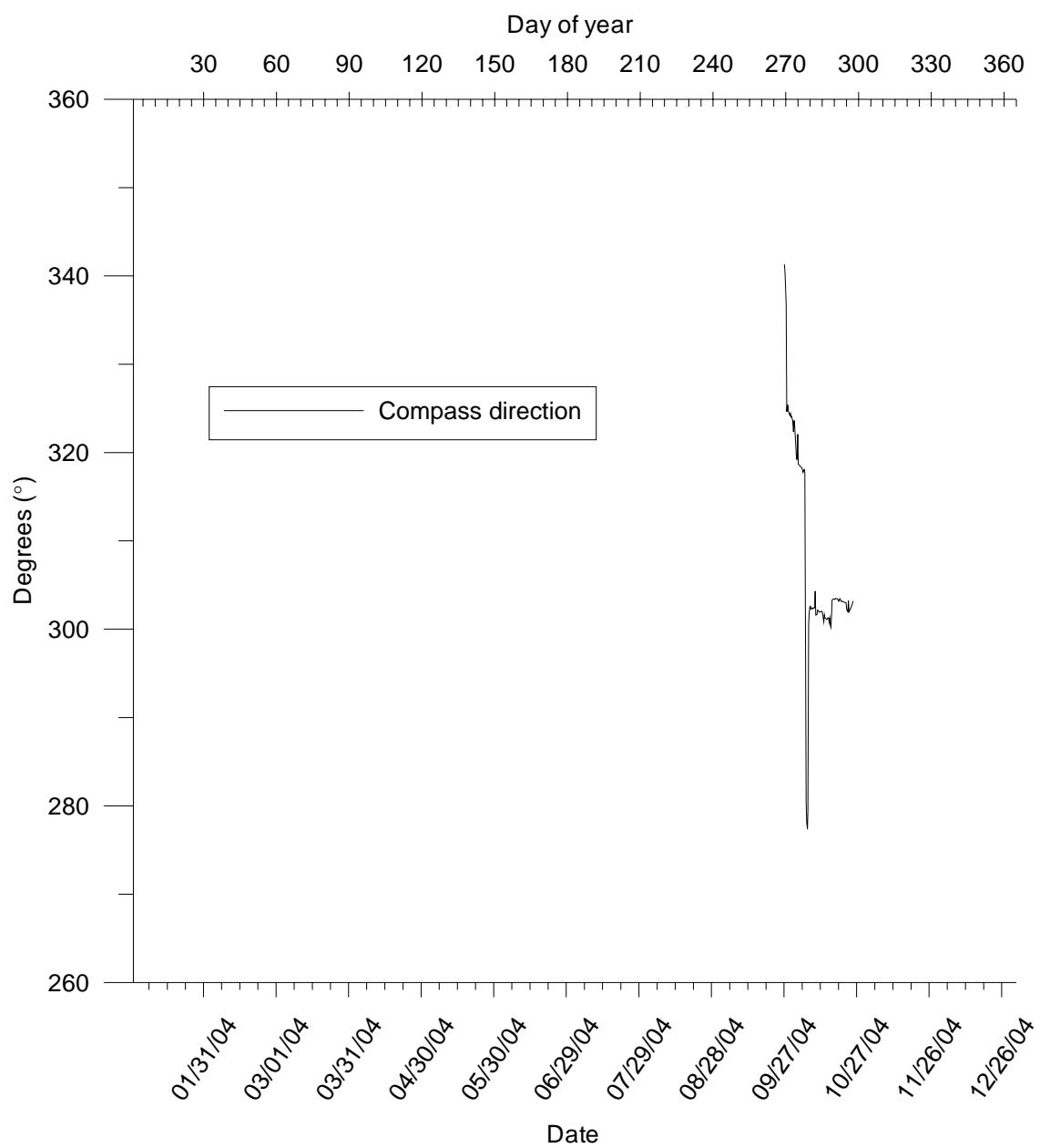


Nuuk1 Sonic Ranger 2004

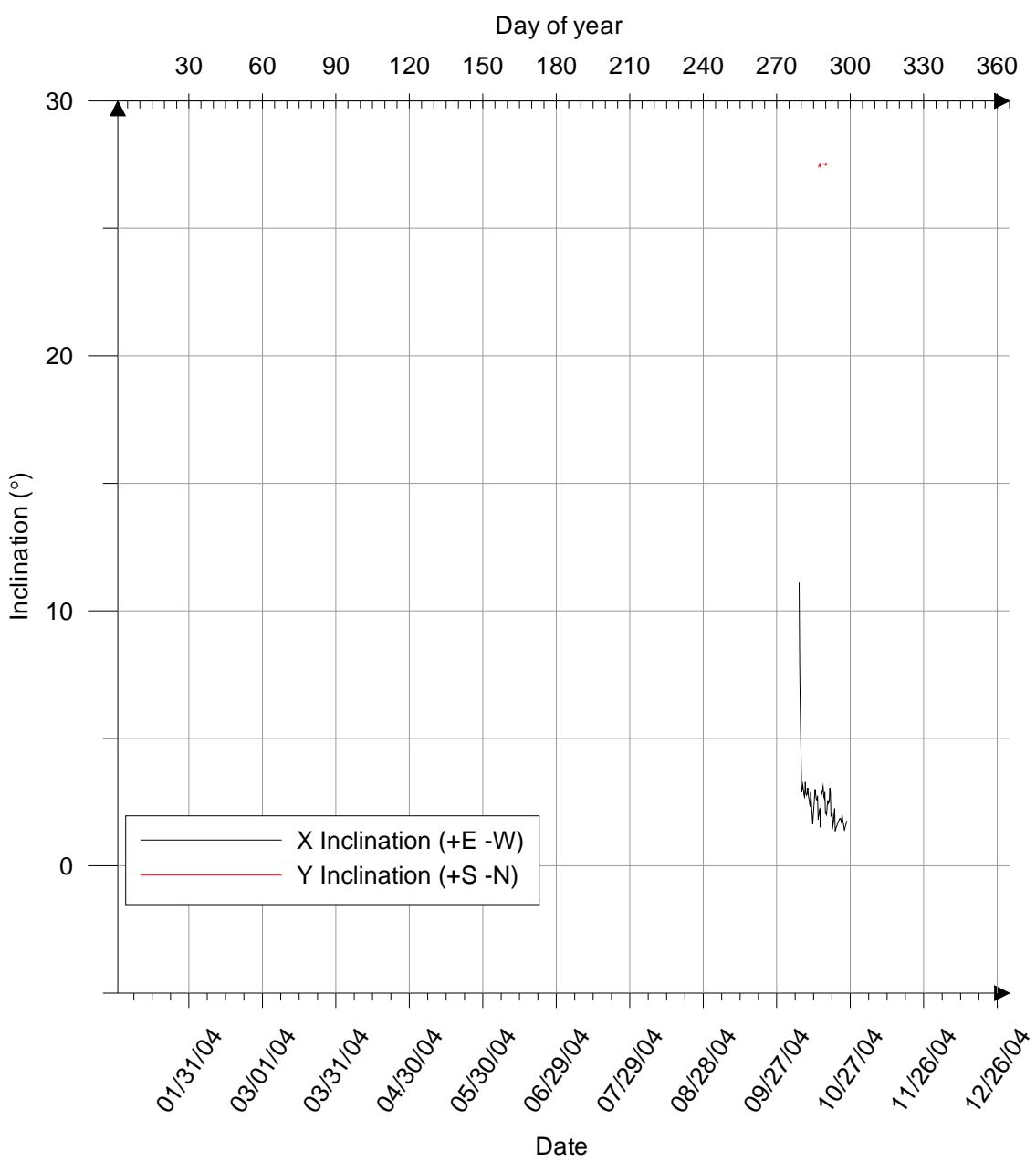




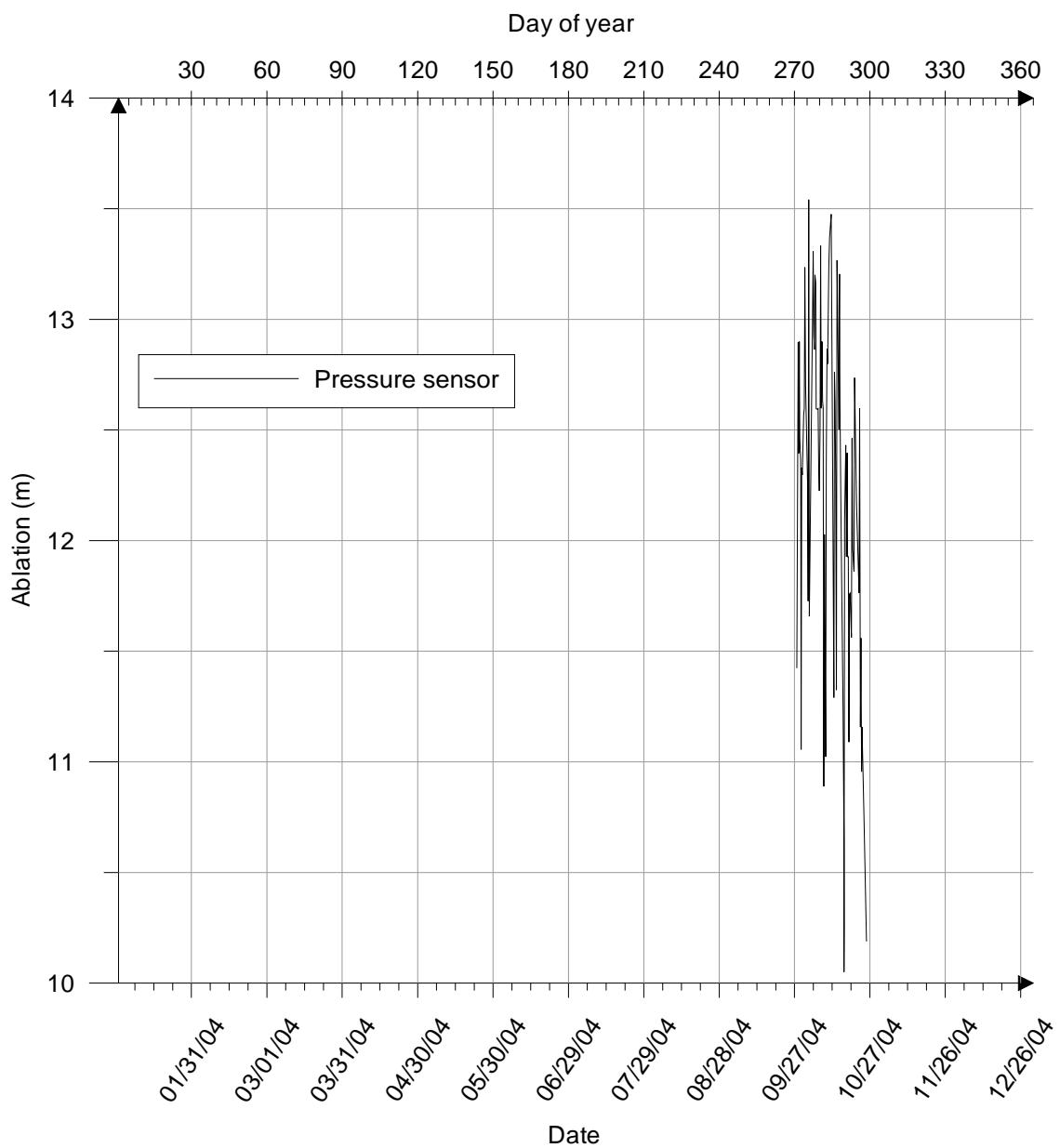
Nuuk1 Compass 2004



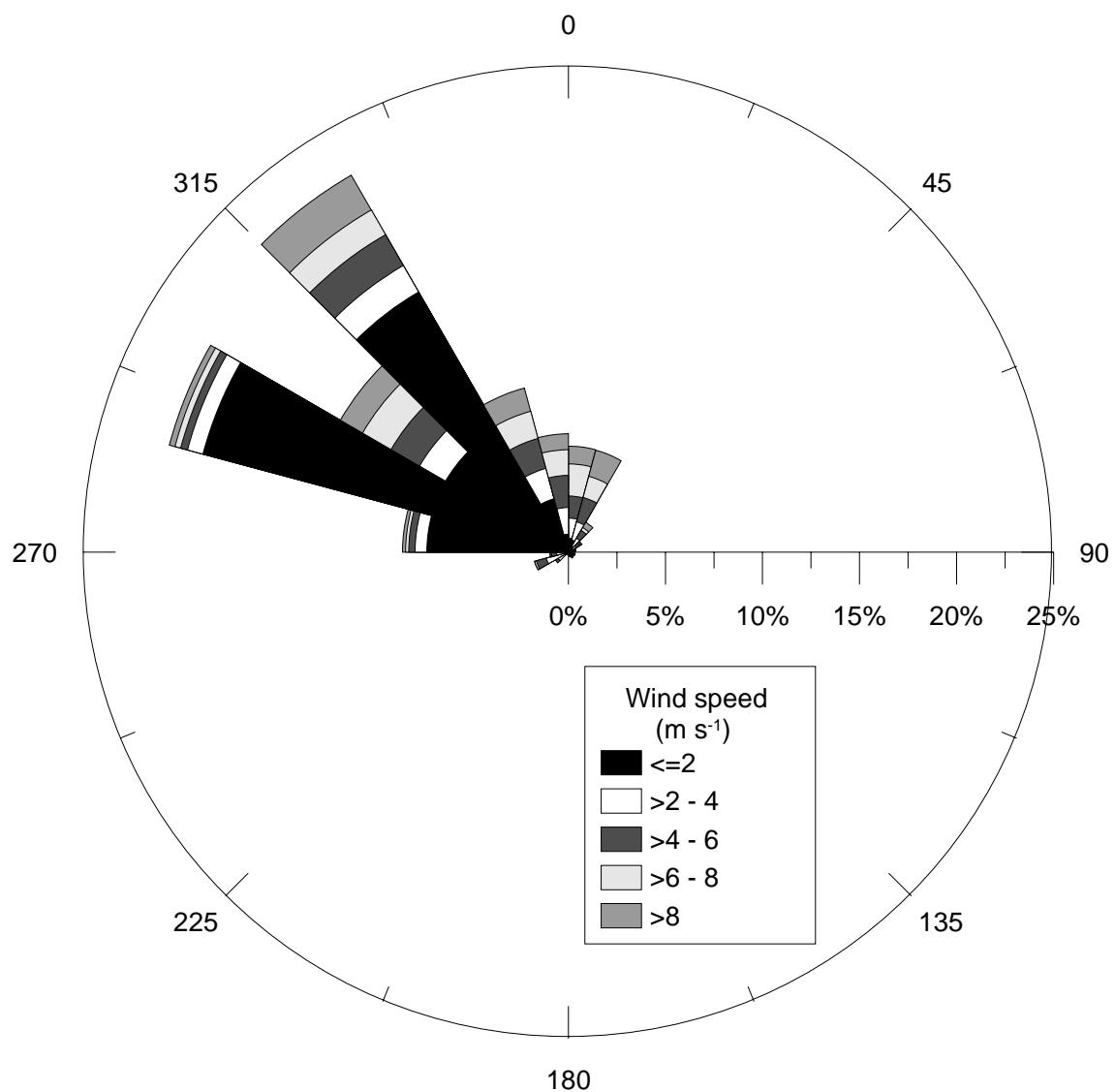
Nuuk1 Inclination 2004

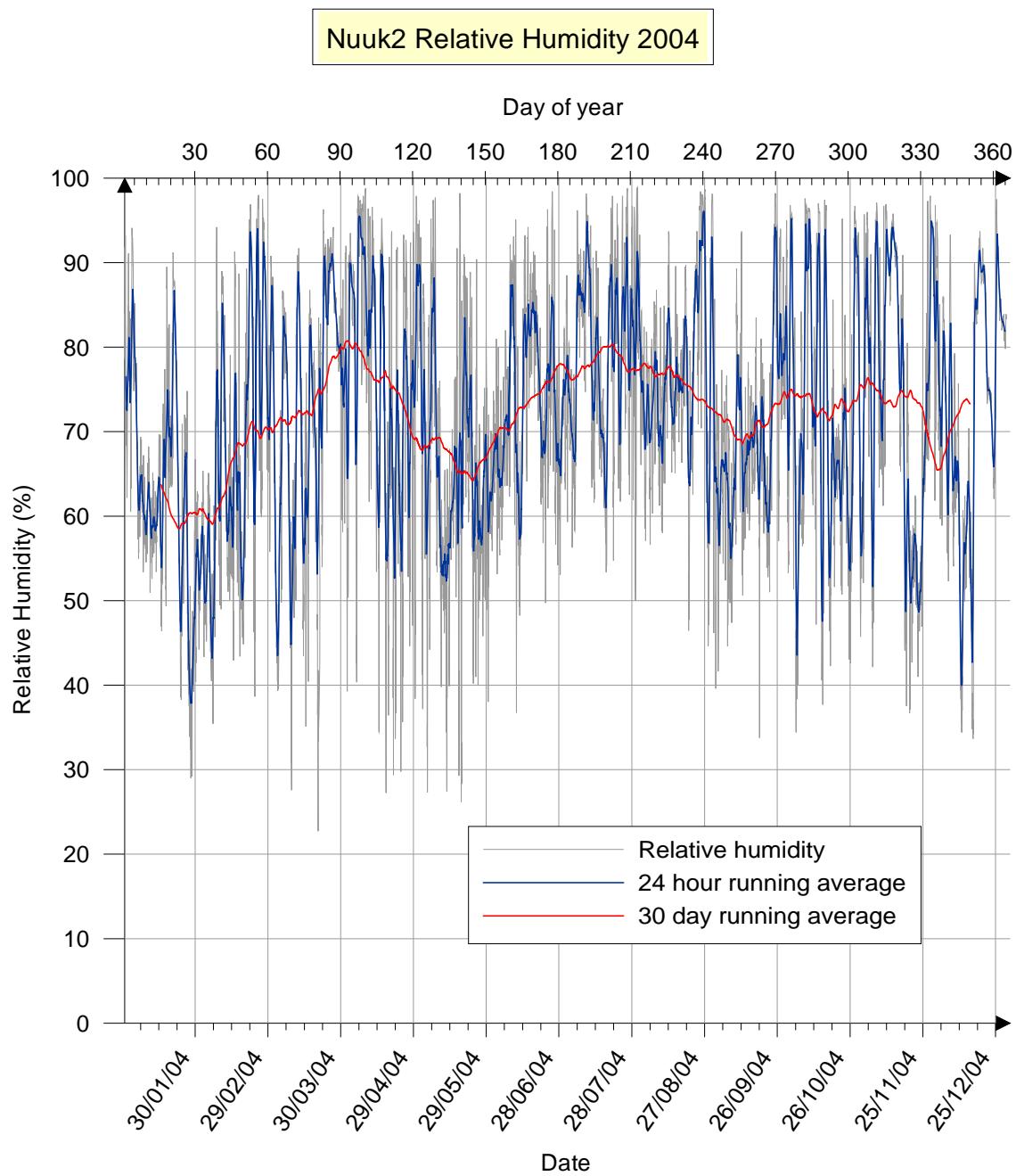


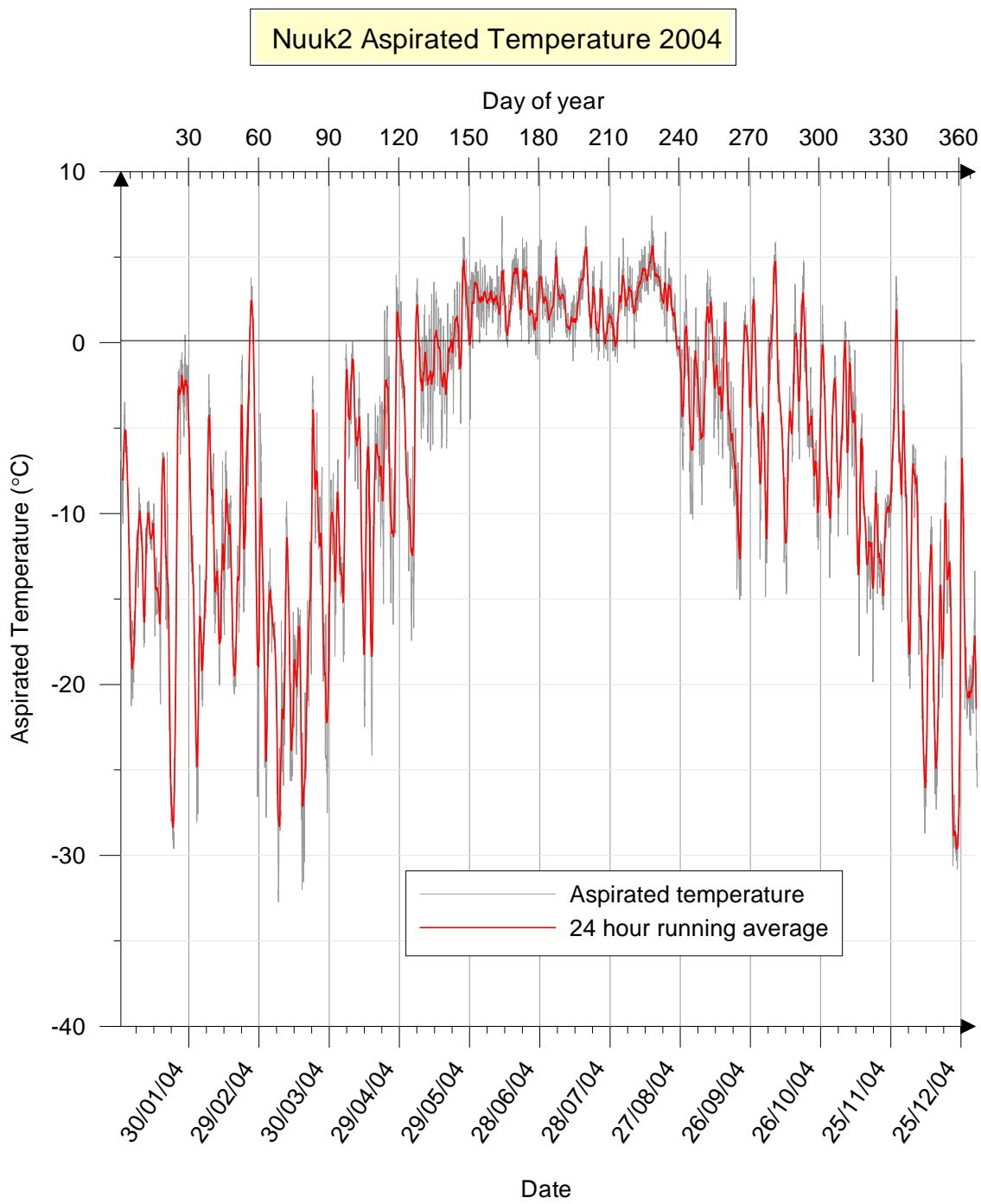
Nuuk1 Ablation 2004

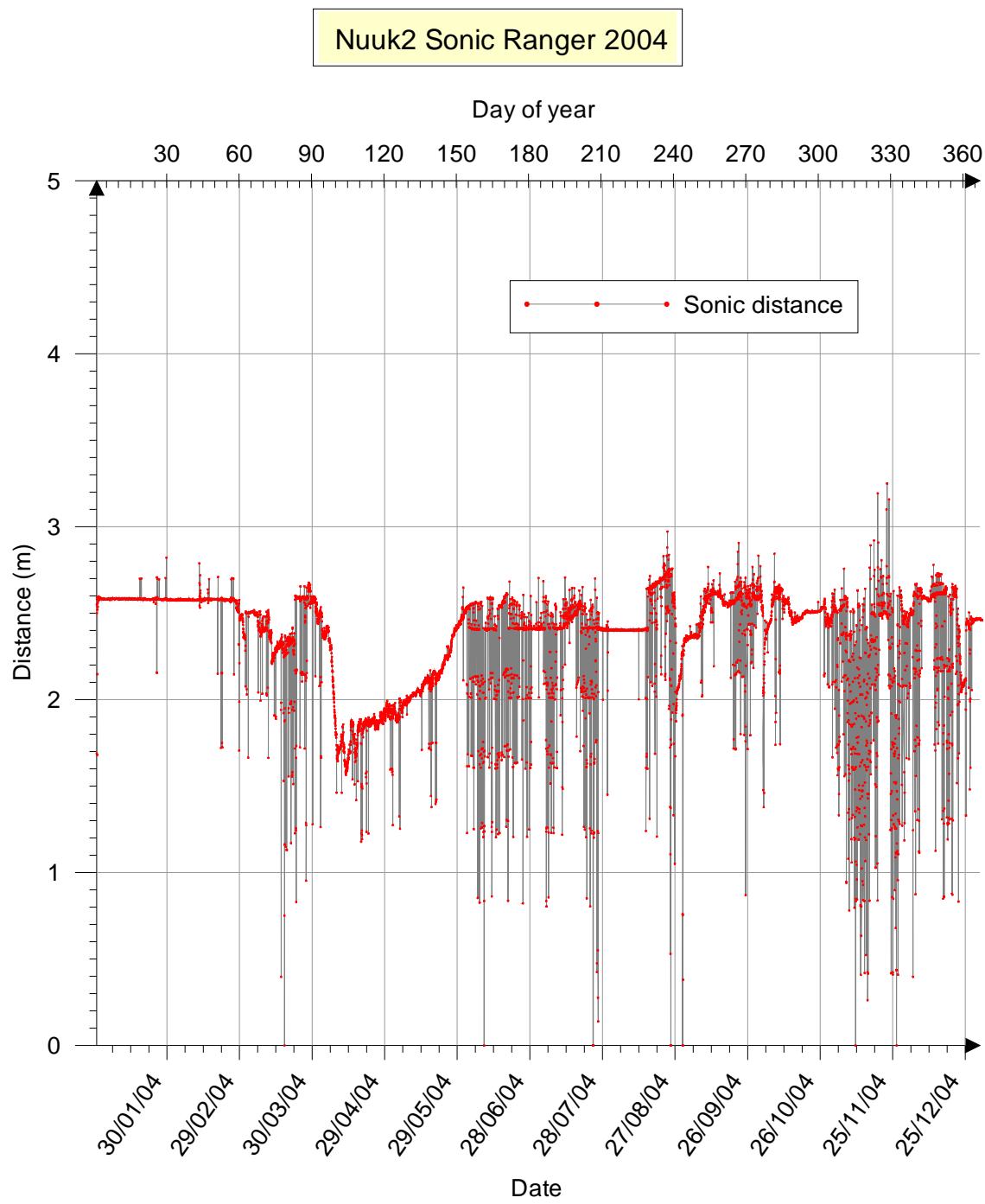


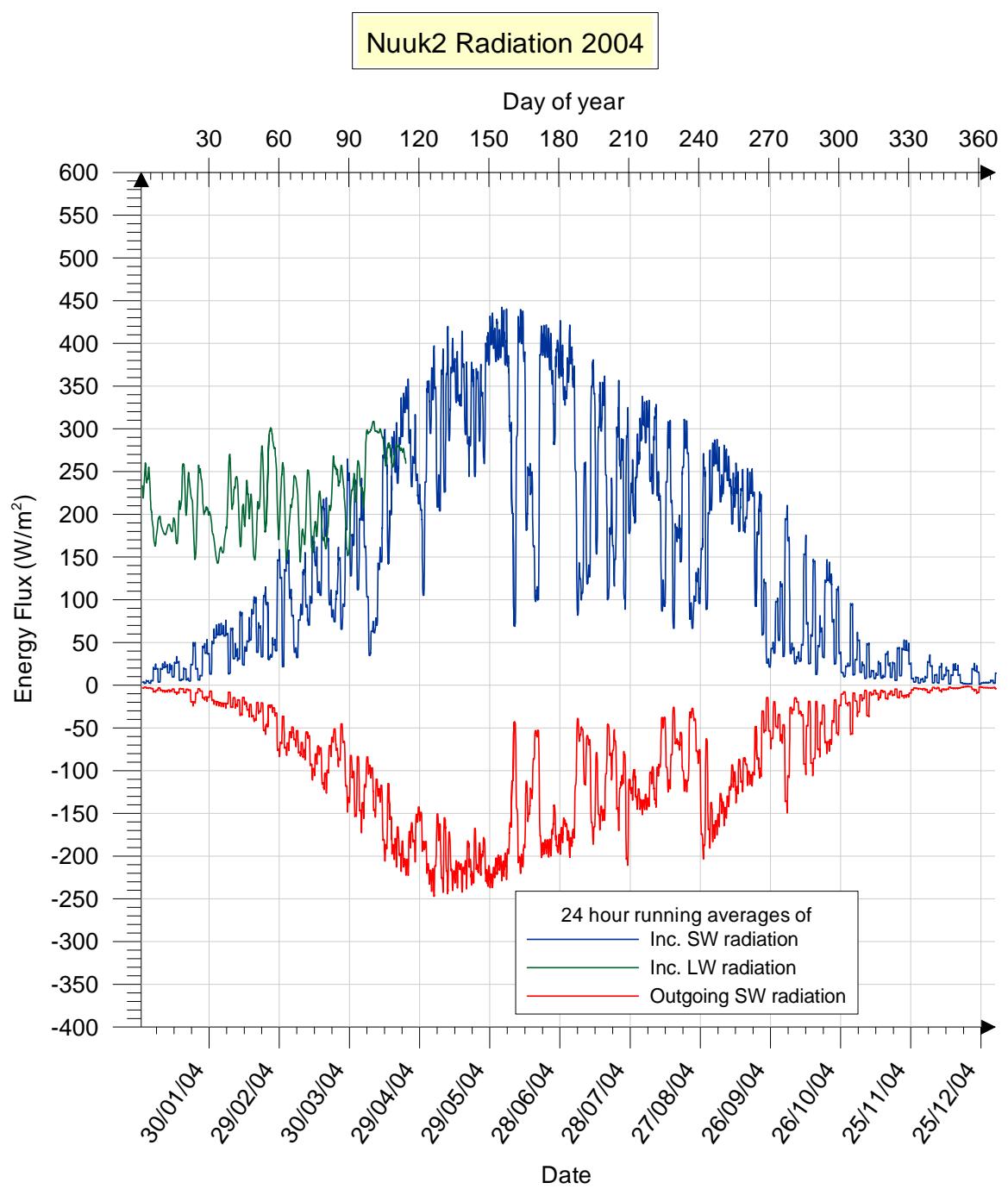
Nuuk2 Wind chart 2004 (Jan-Dec)



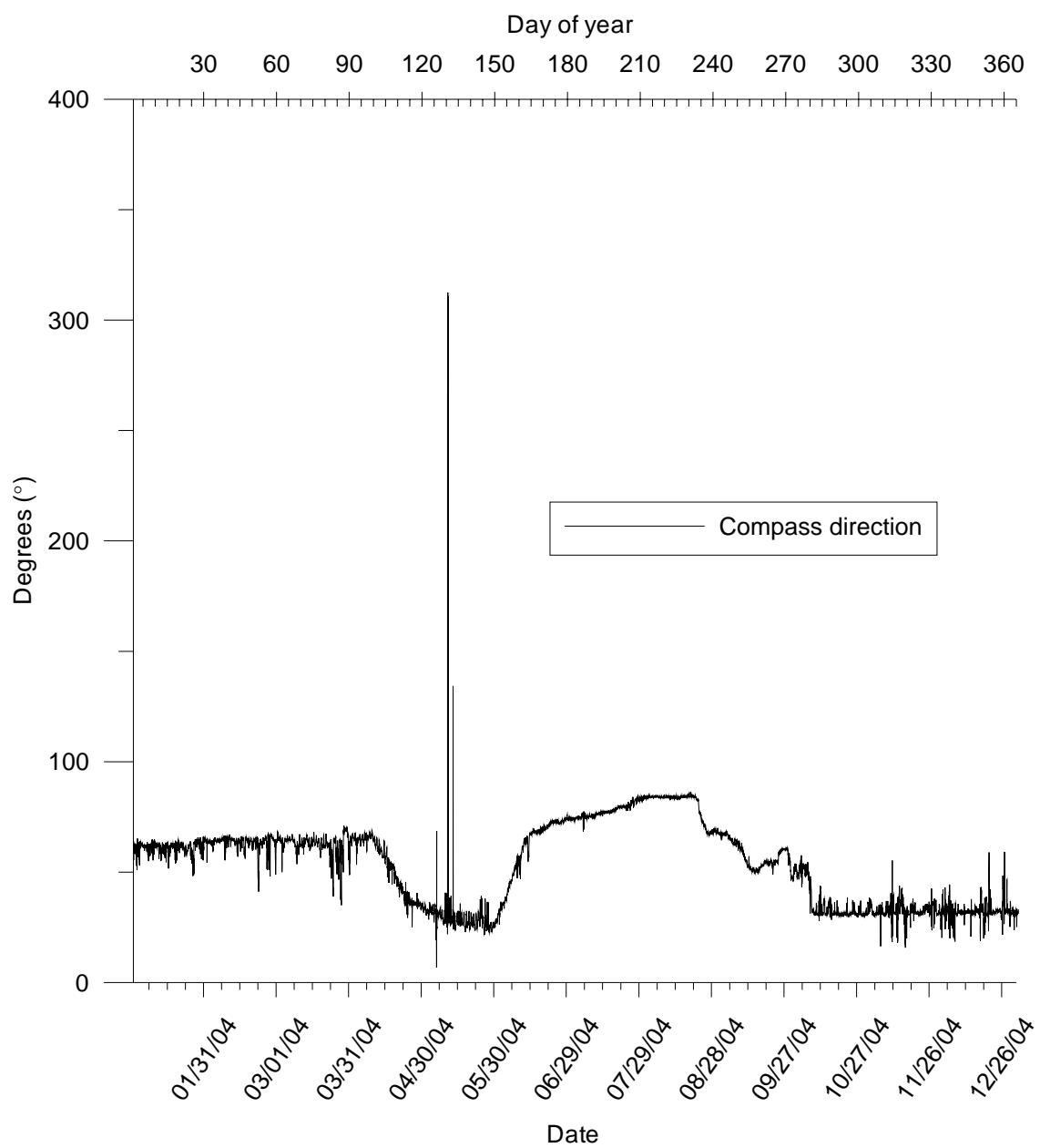


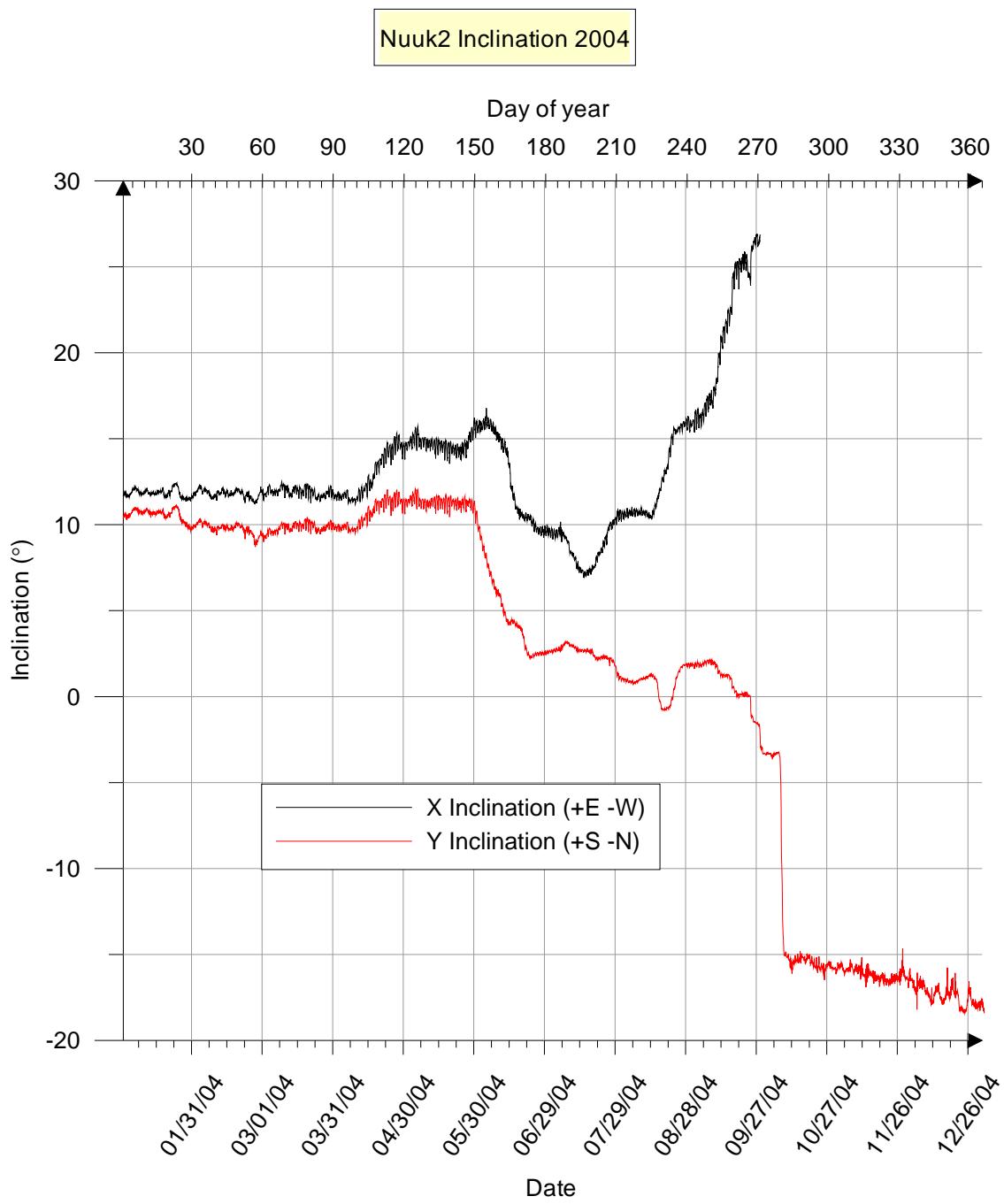


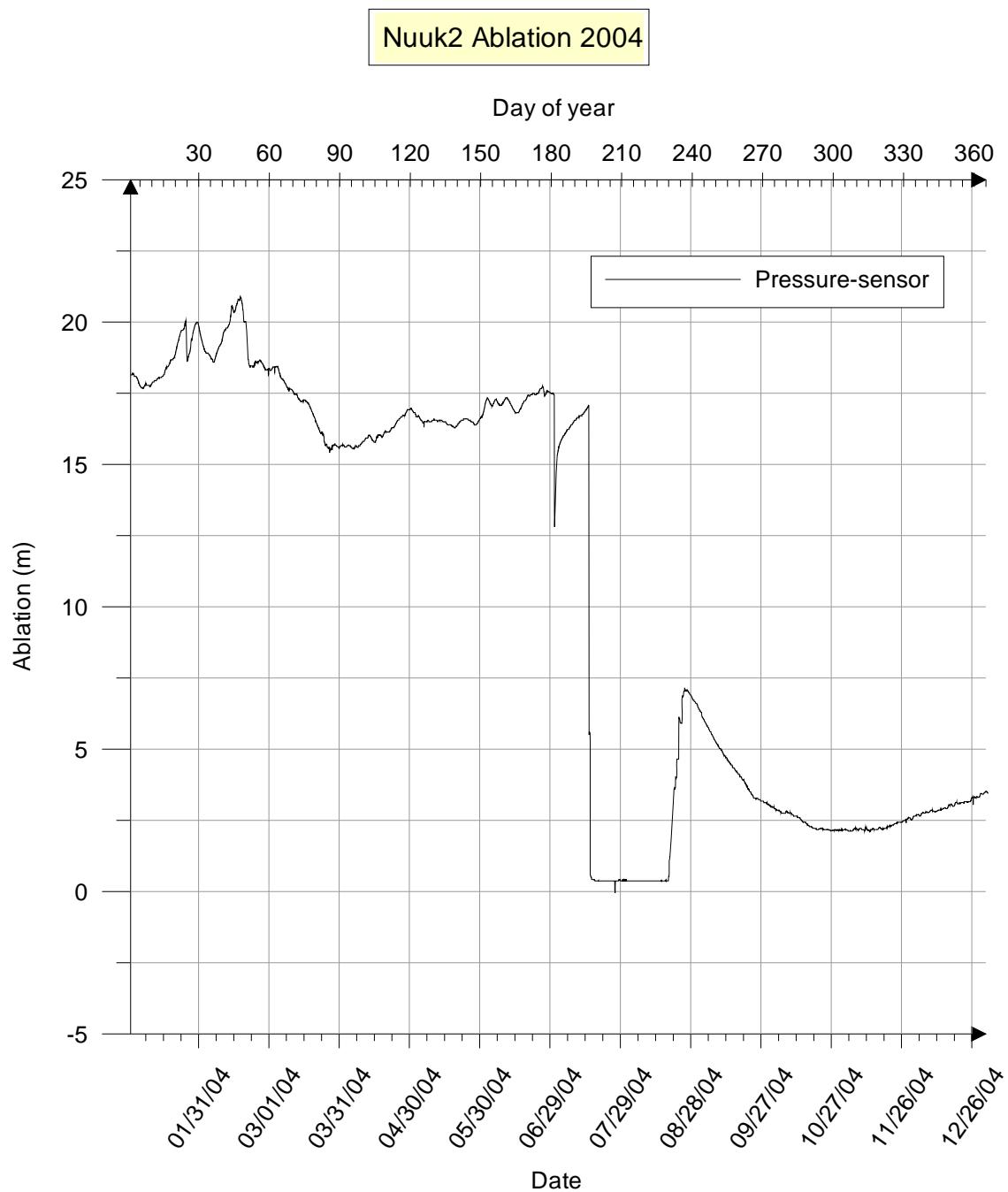


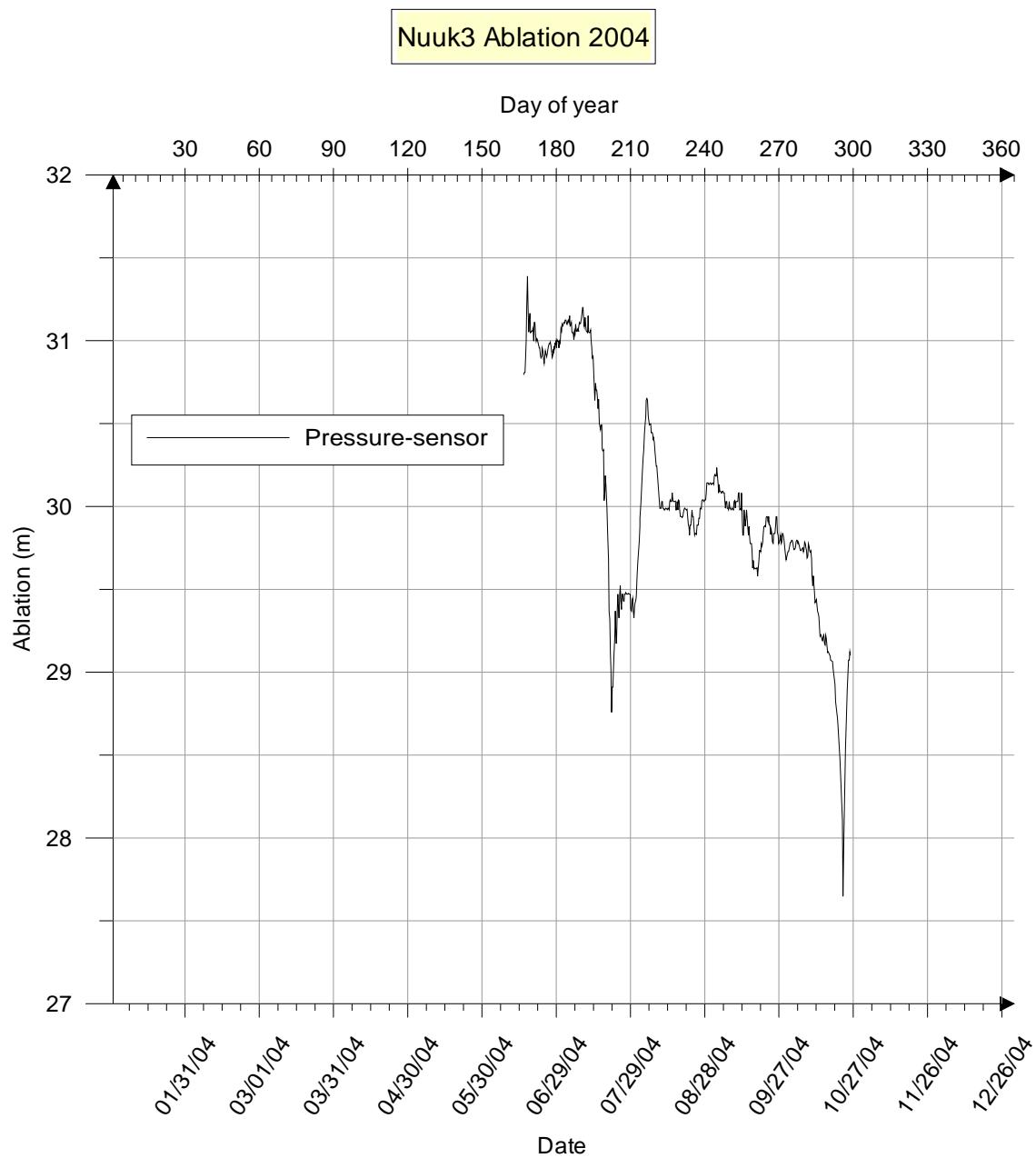


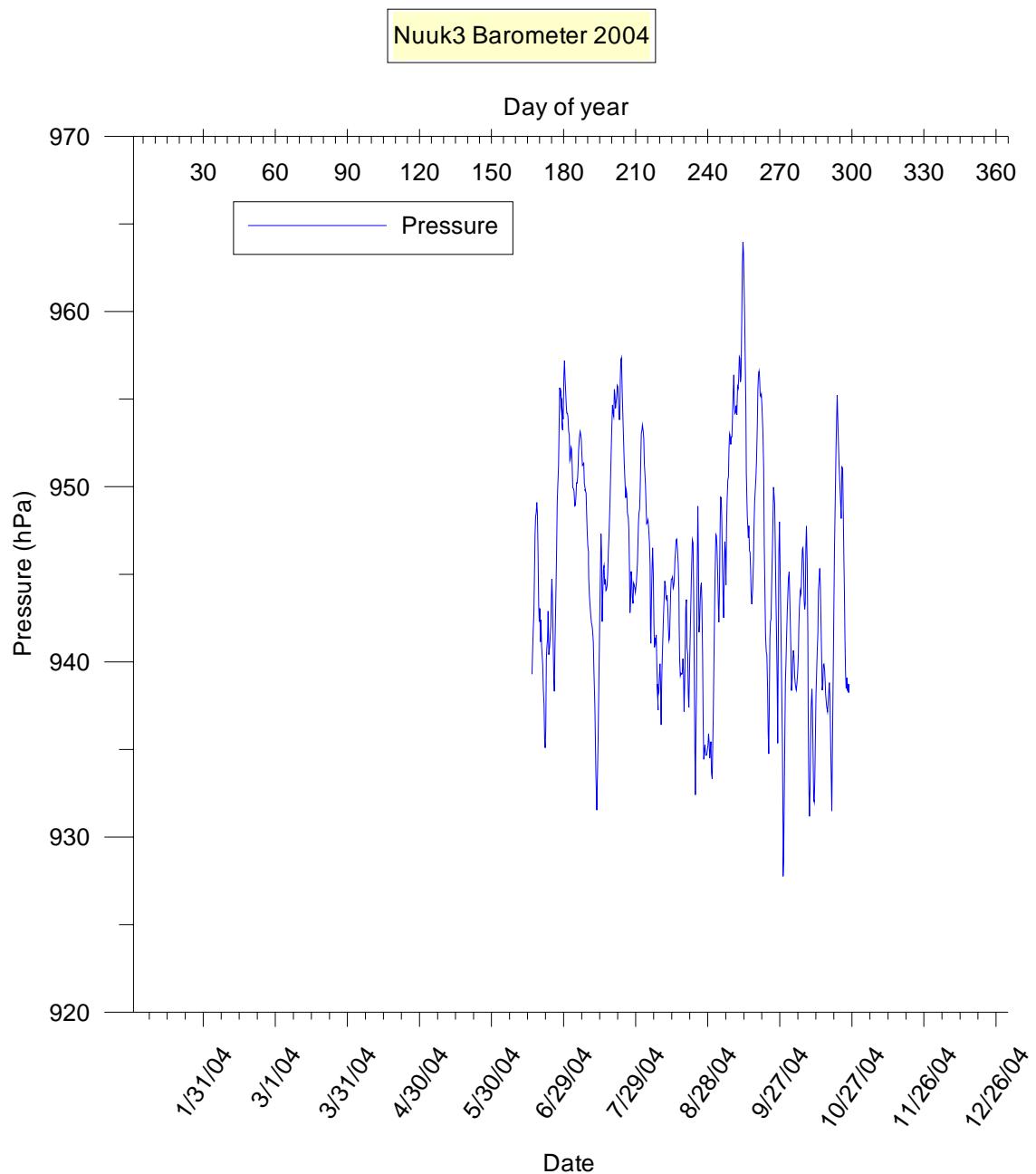
Nuuk2 Compass 2004





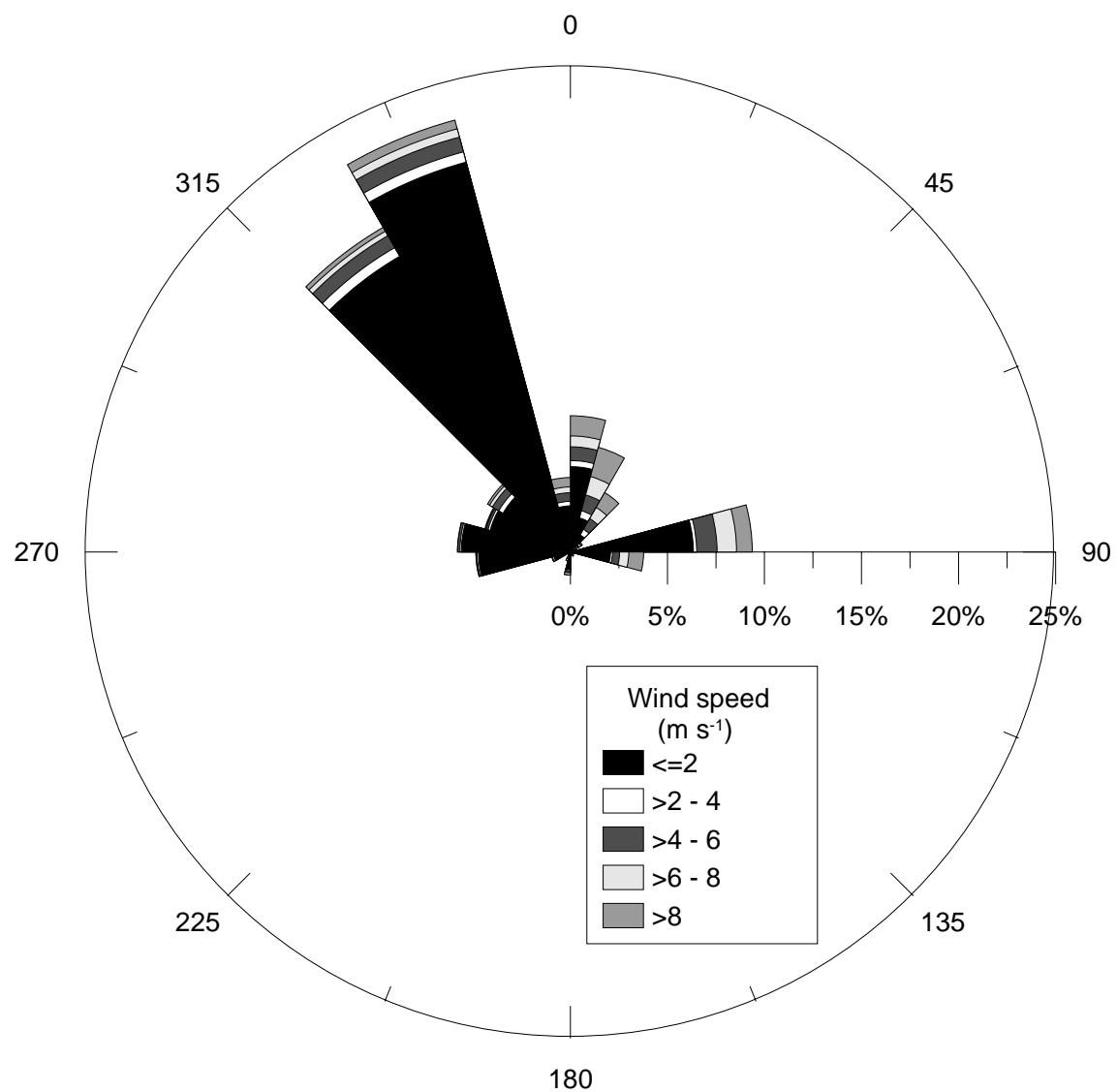


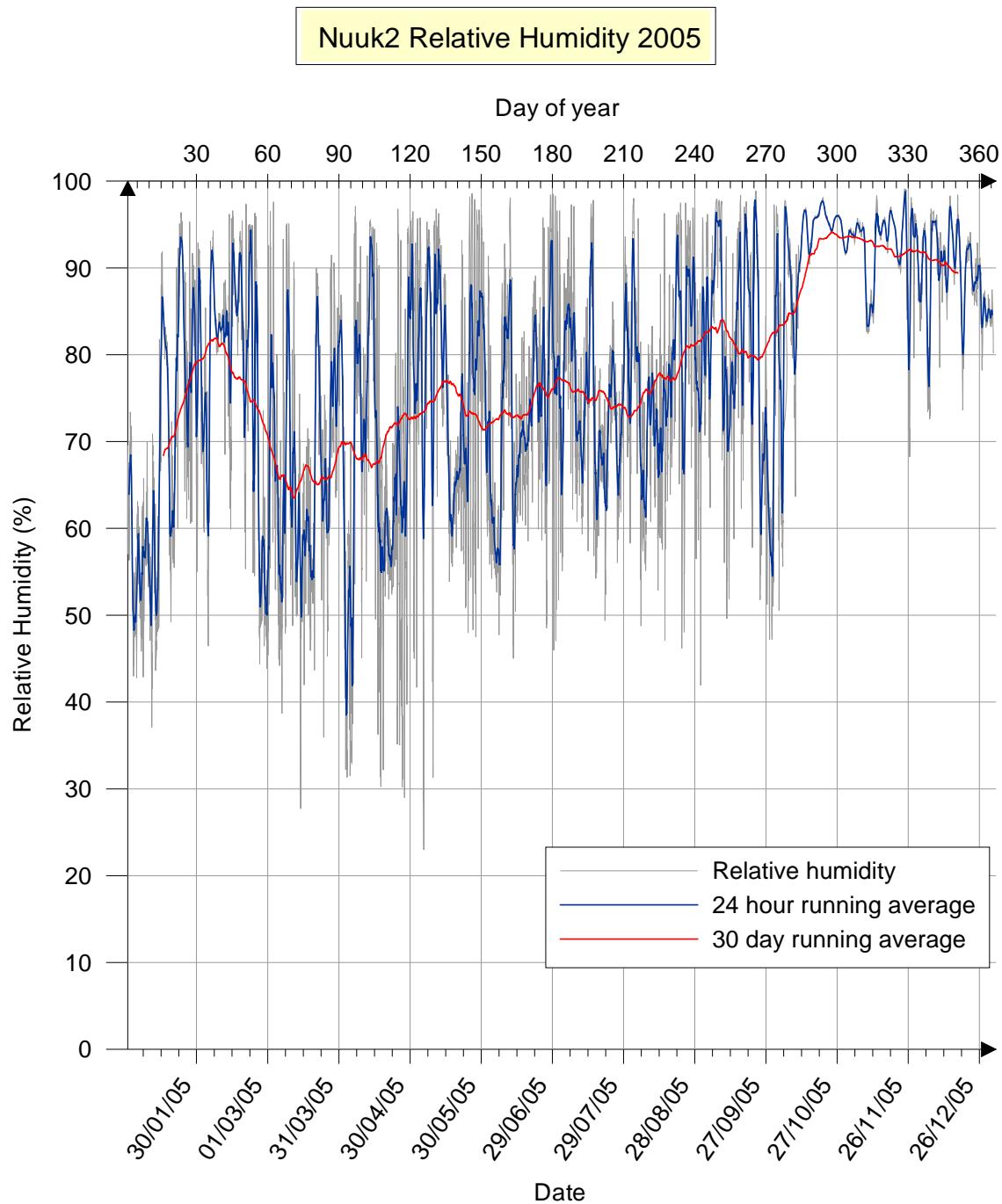


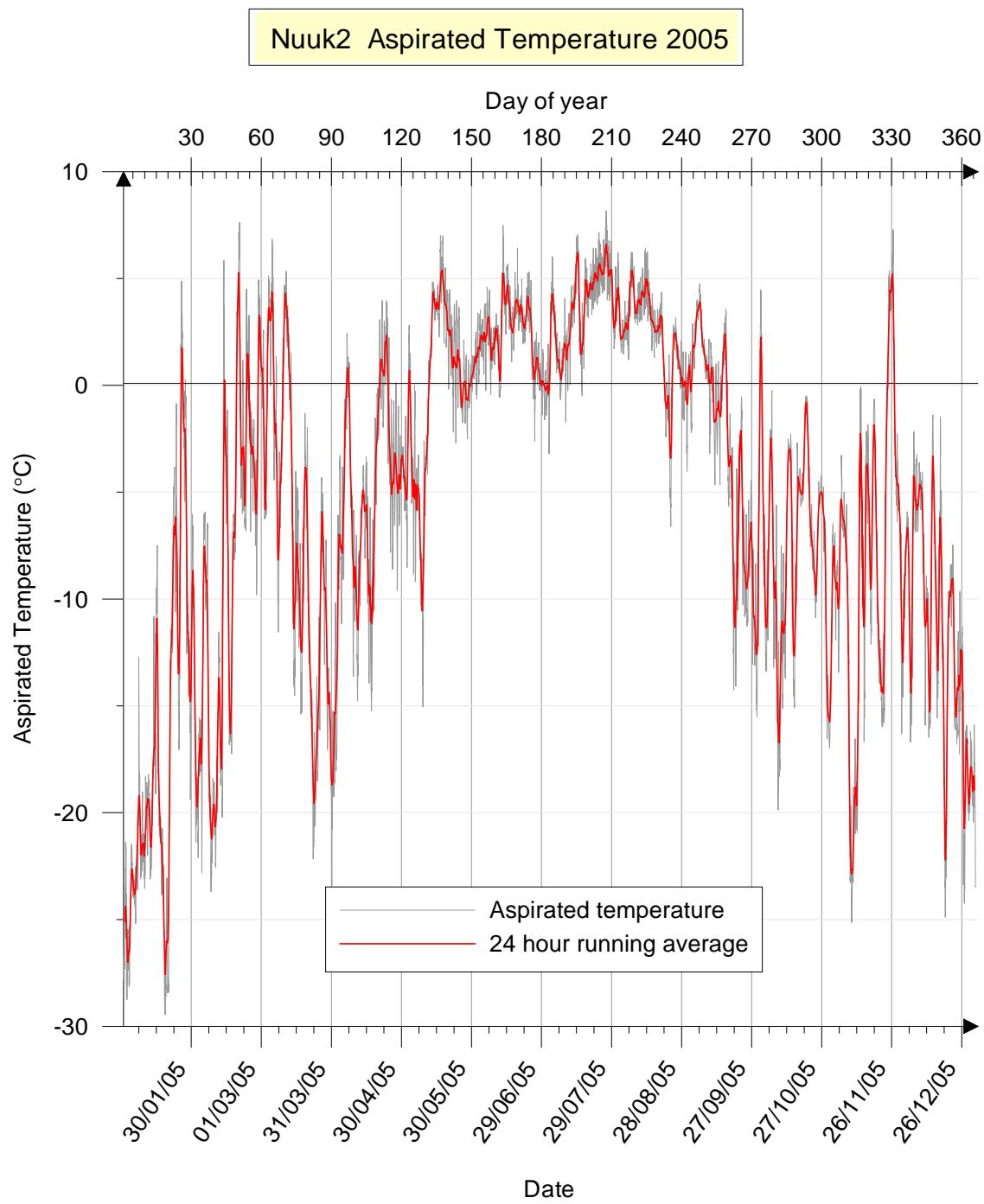


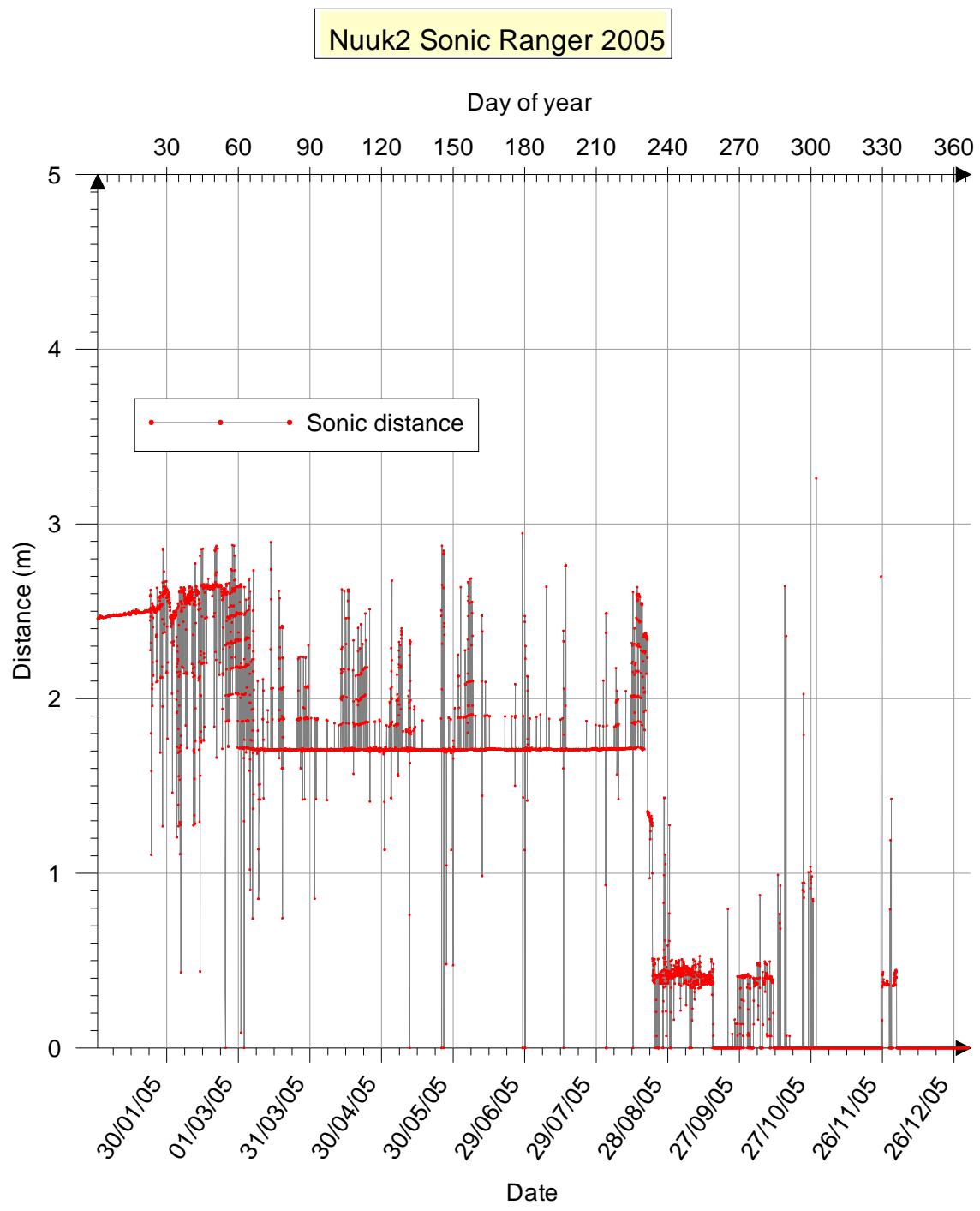
5.1.3 Nuuk stations in 2005

Nuuk2 Wind chart 2005 (Jan-Dec)

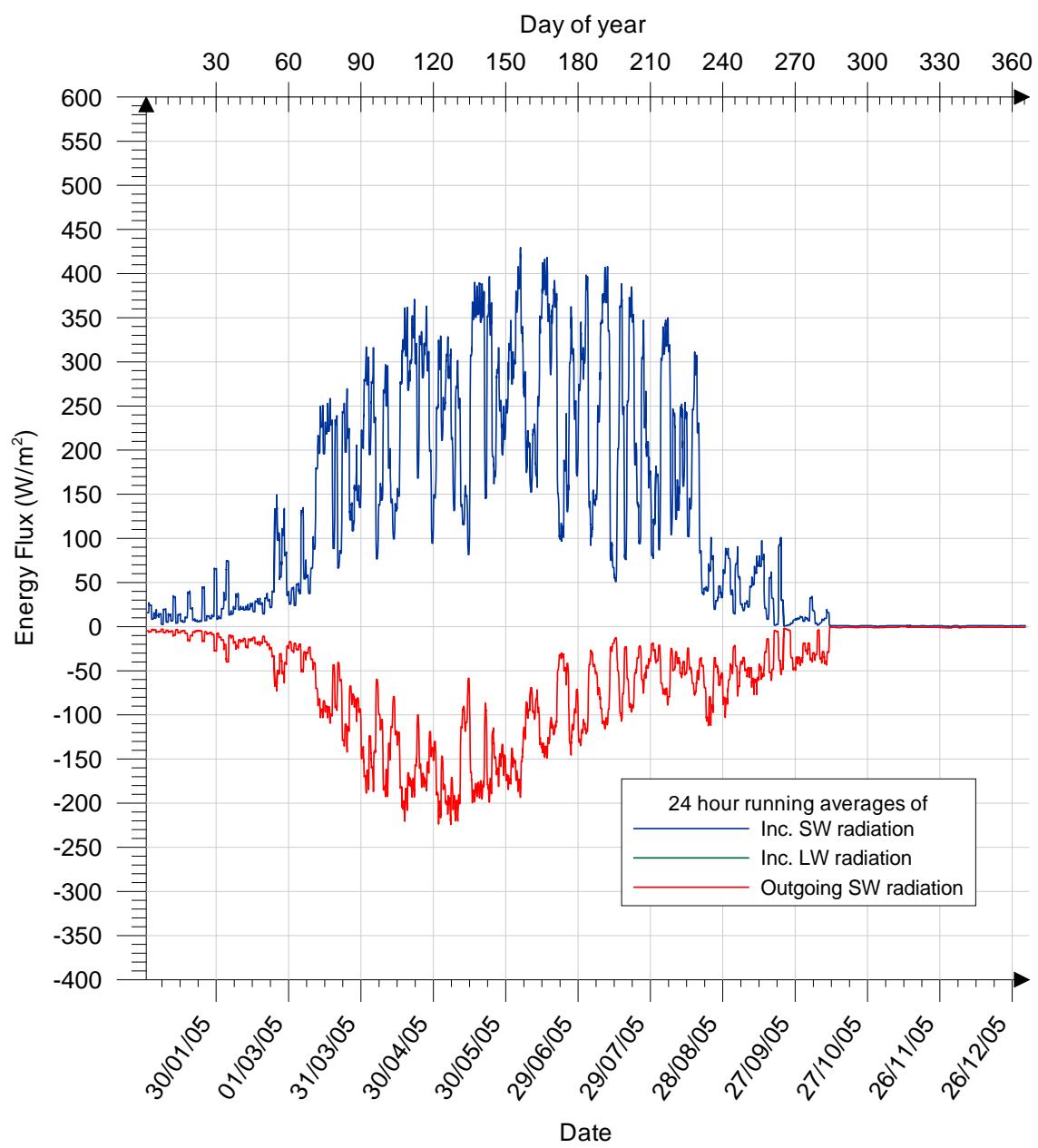


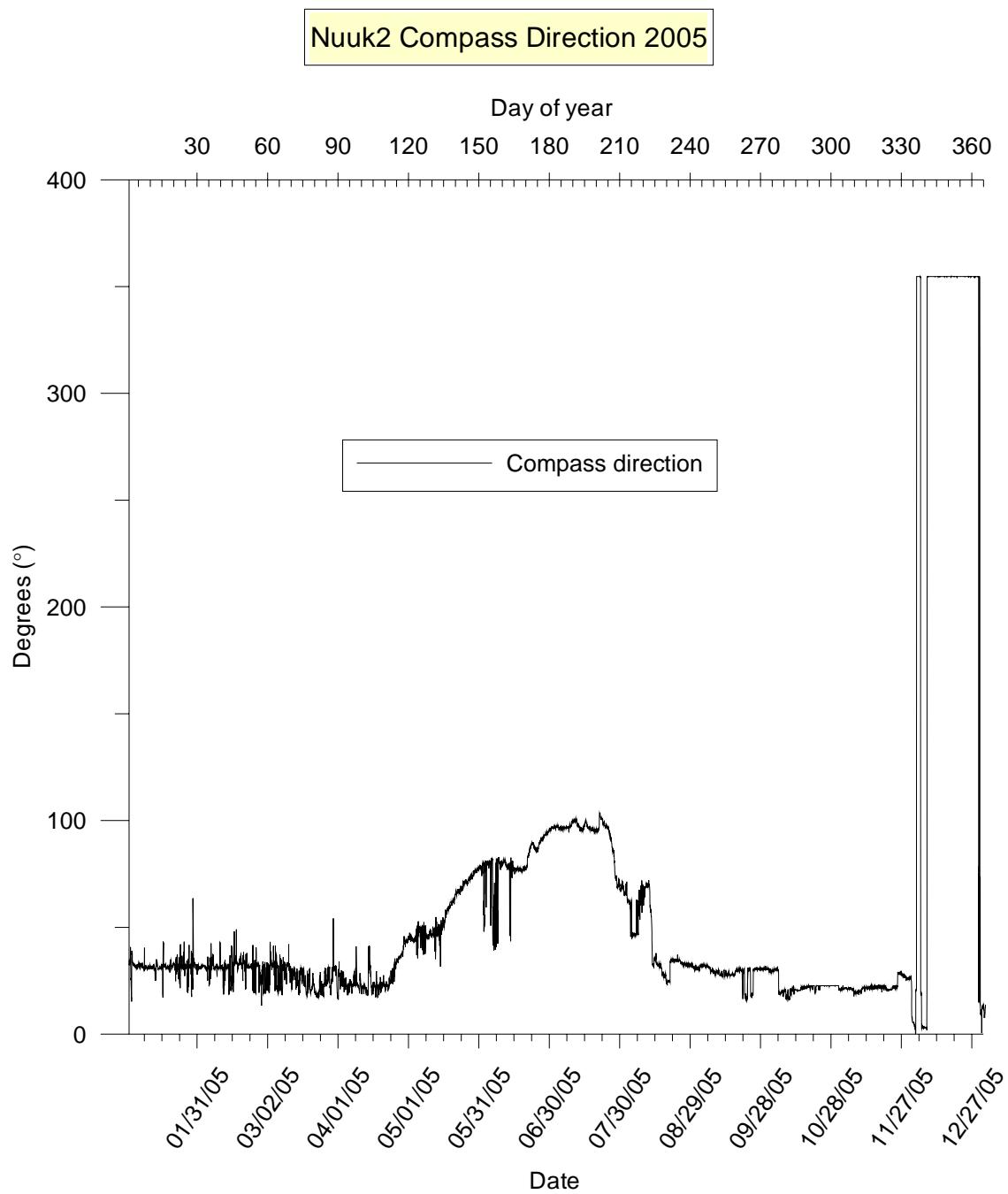


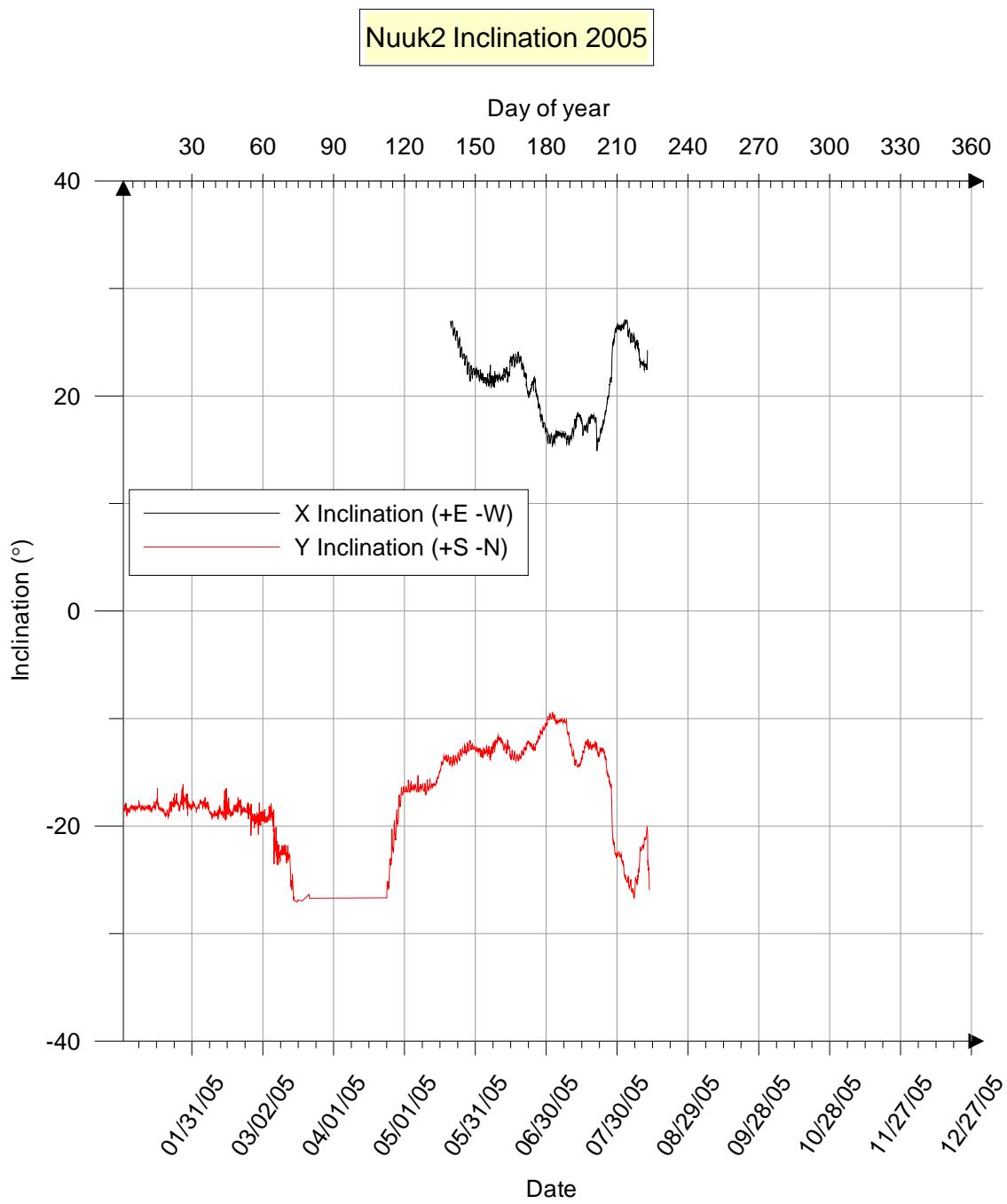




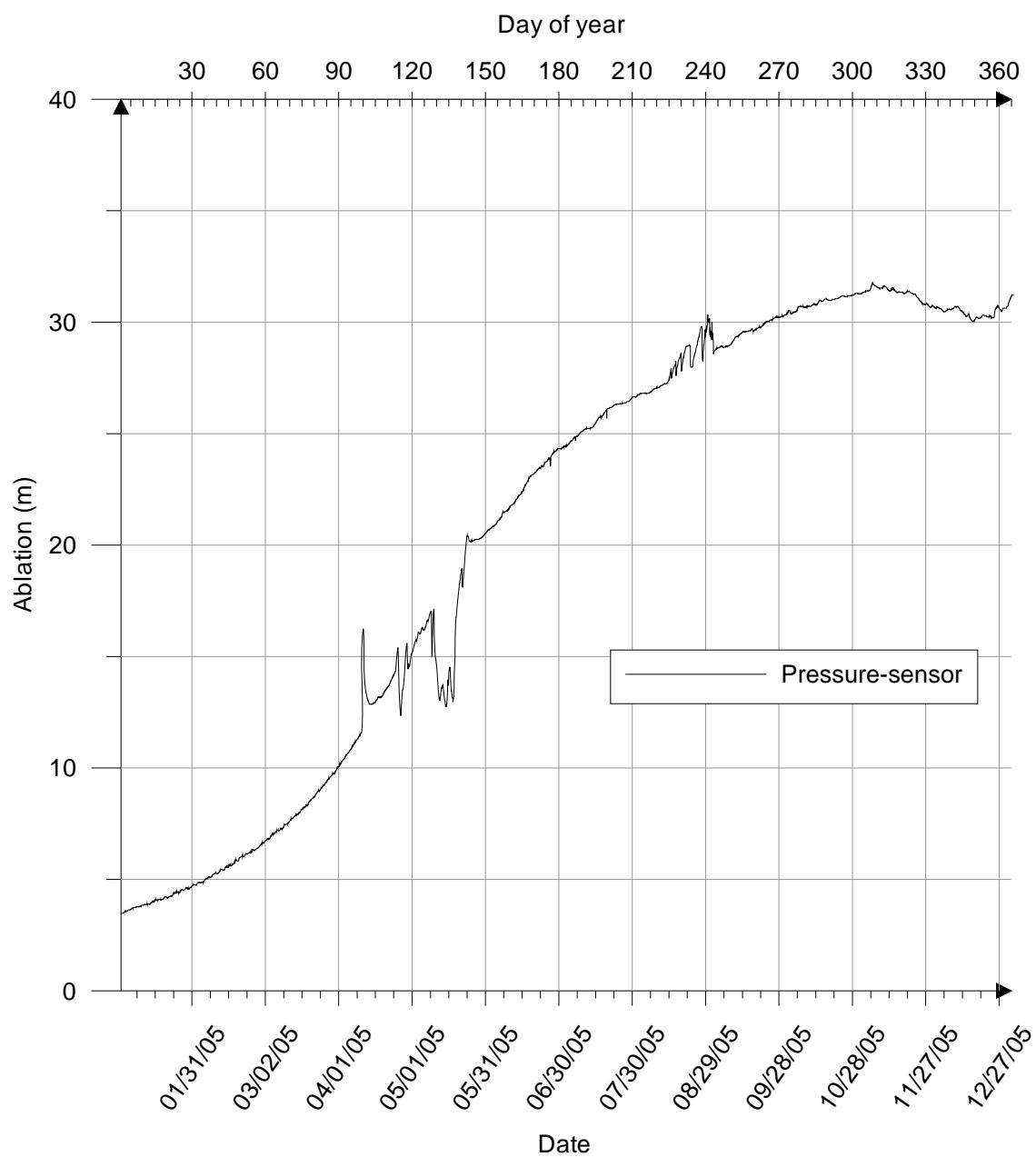
Nuuk2 Radiation 2005



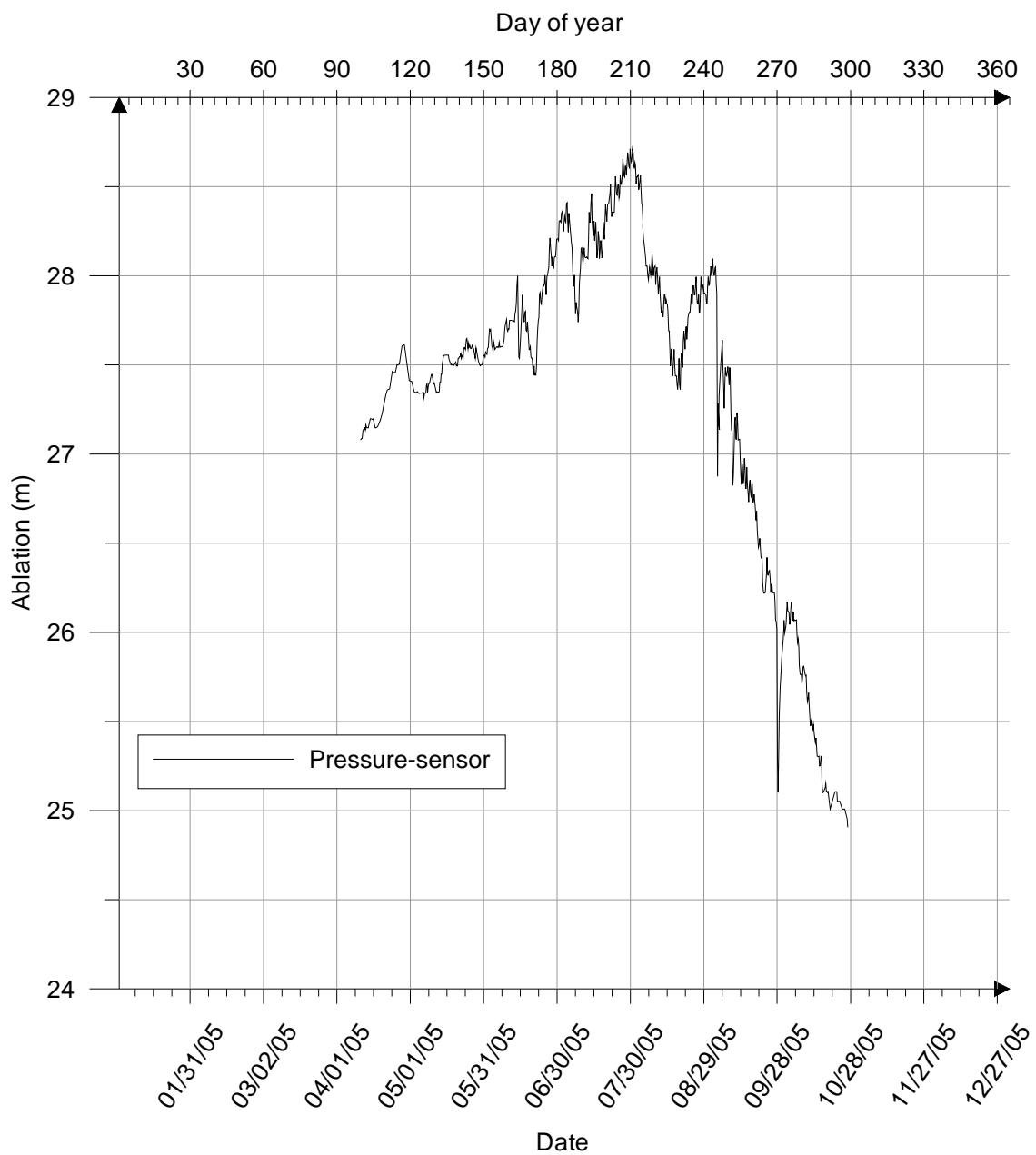


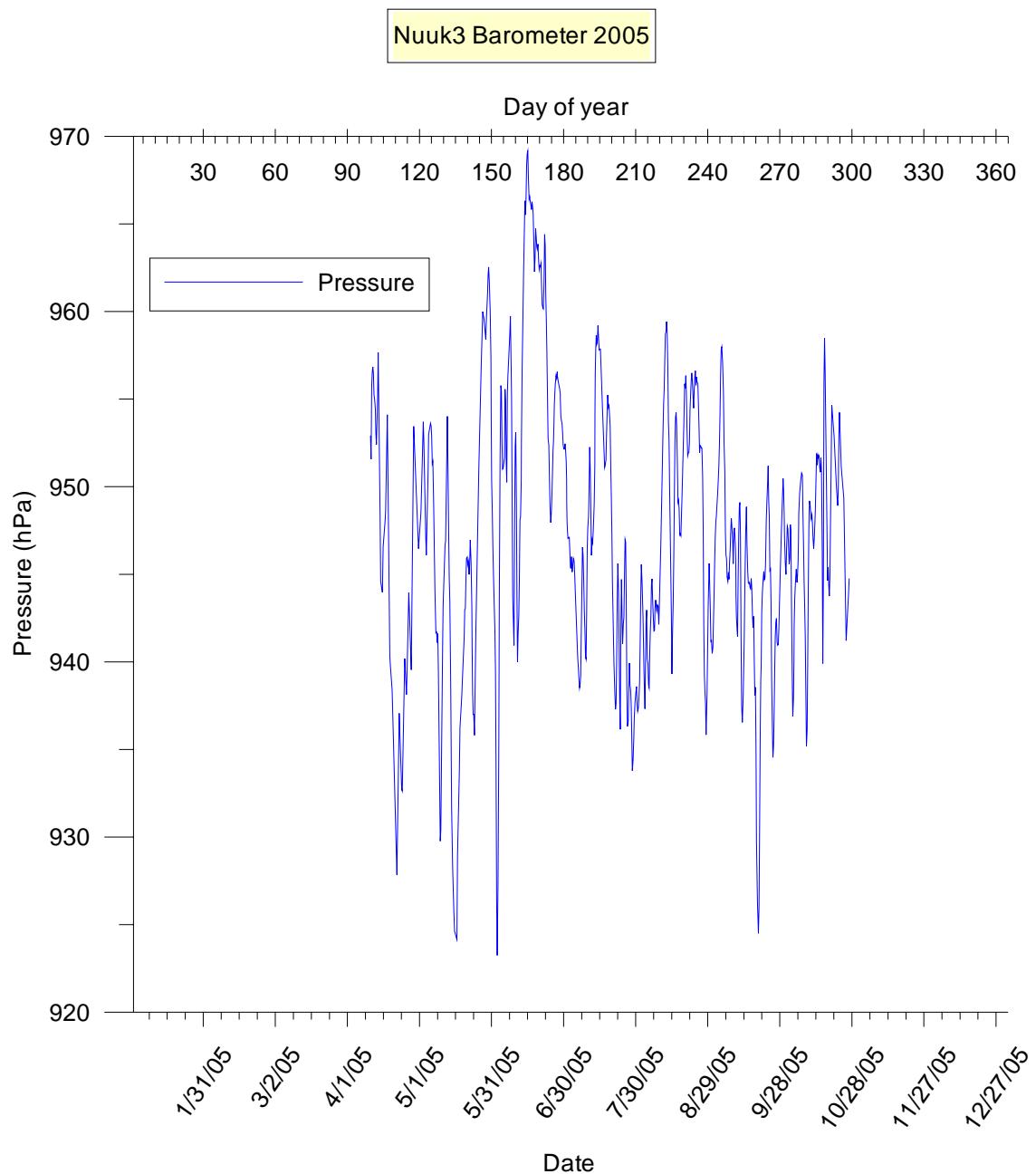


Nuuk2 Ablation 2005



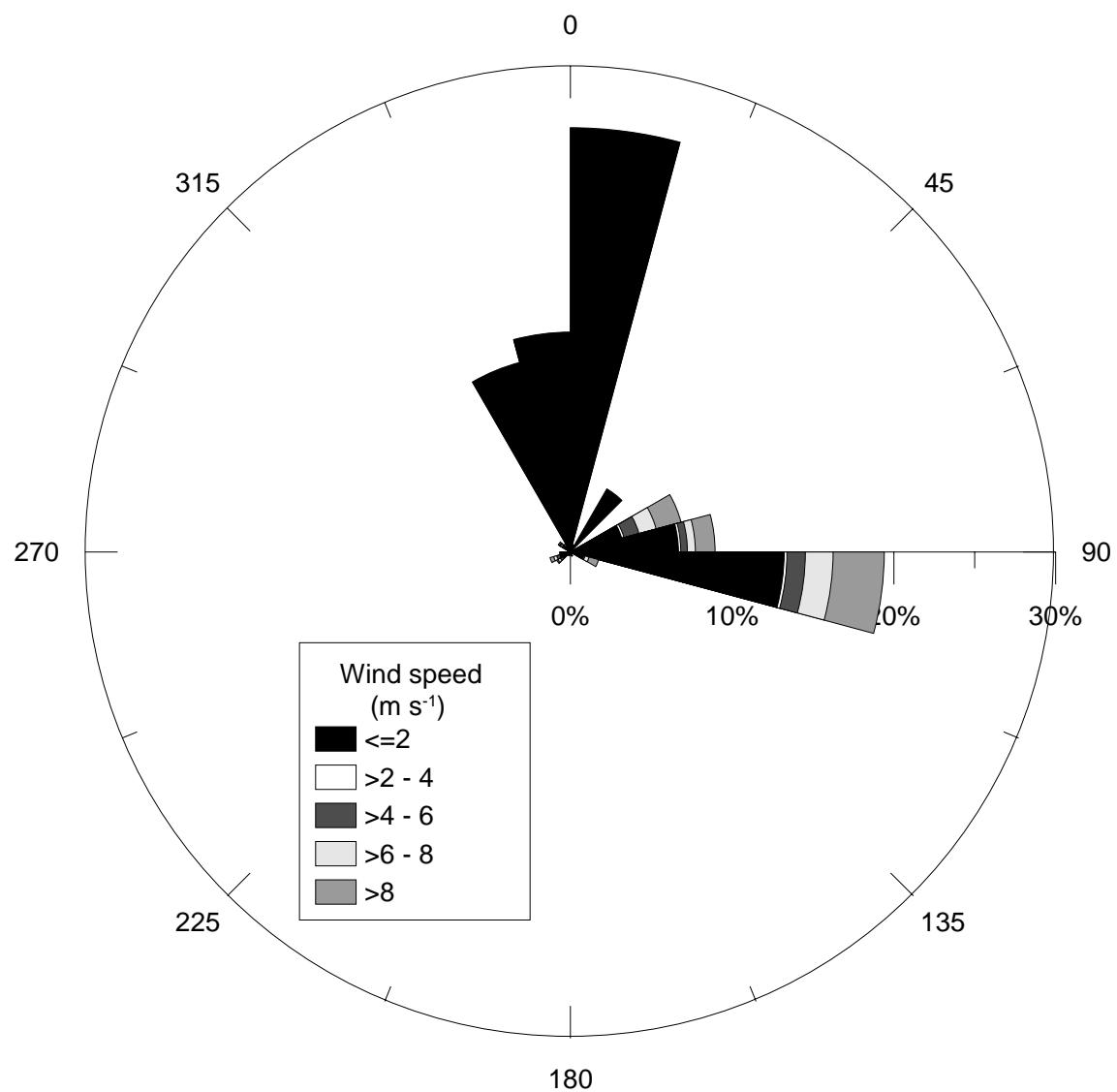
Nuuk3 Ablation 2005

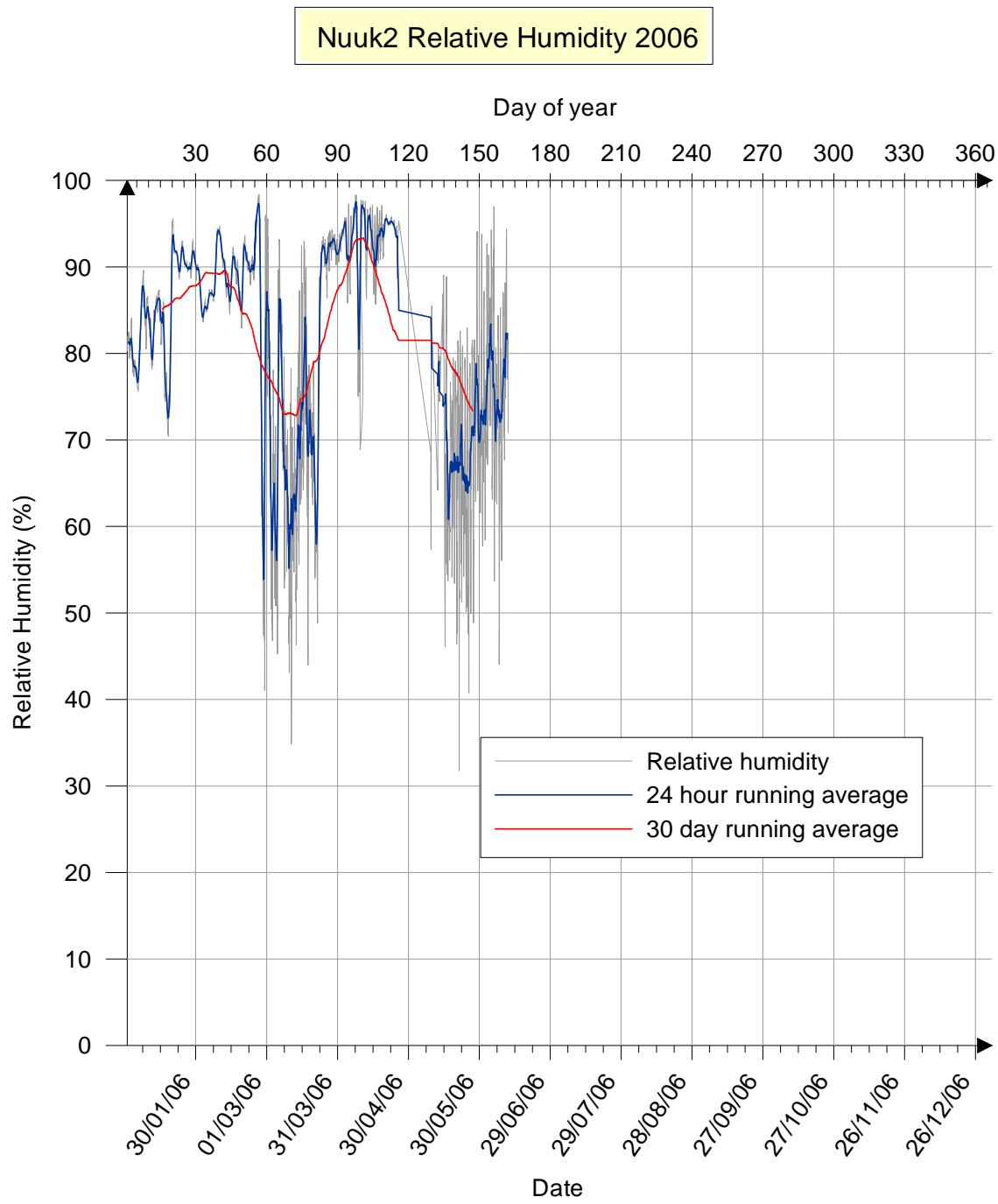


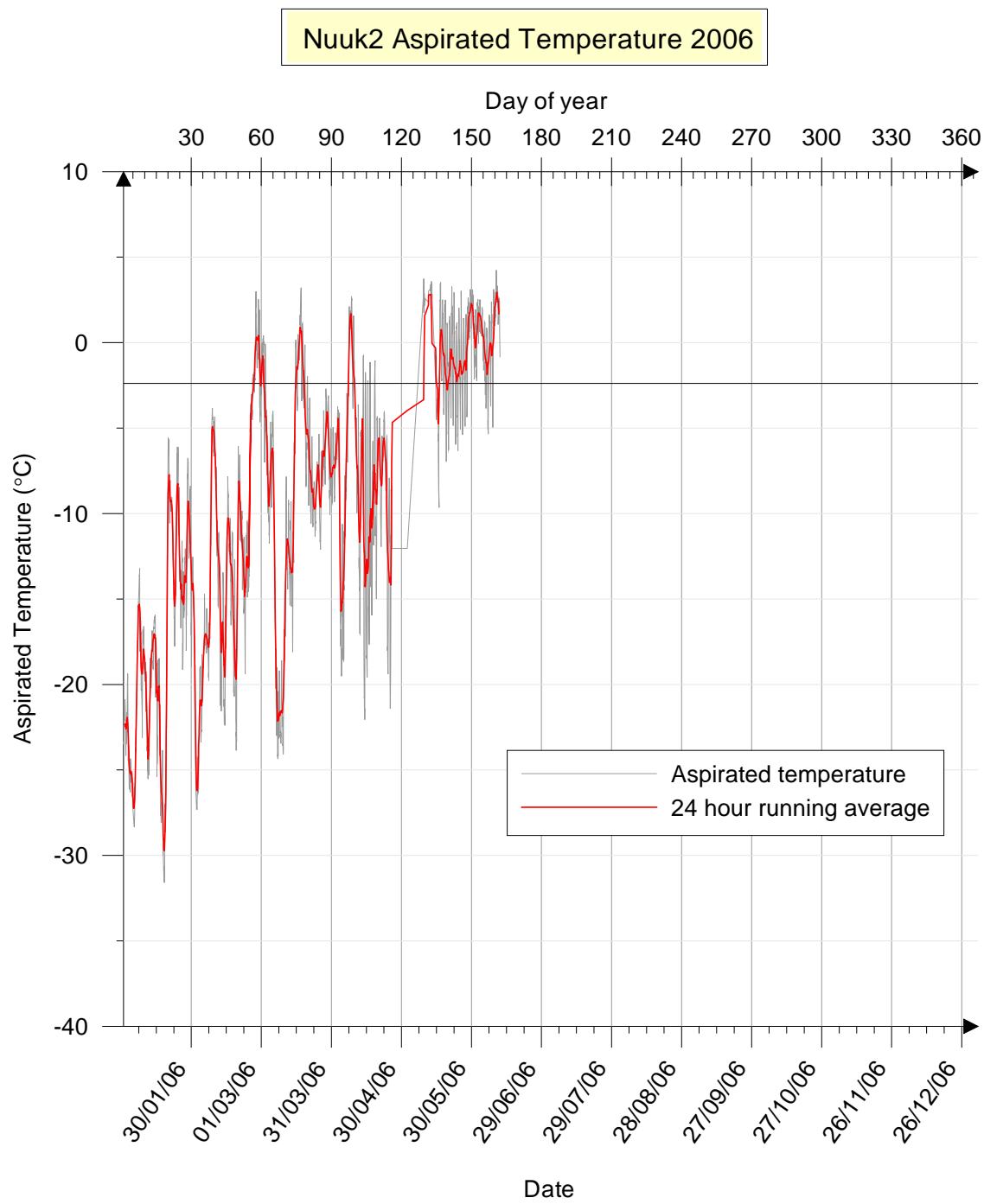


5.1.4 Nuuk stations in 2006

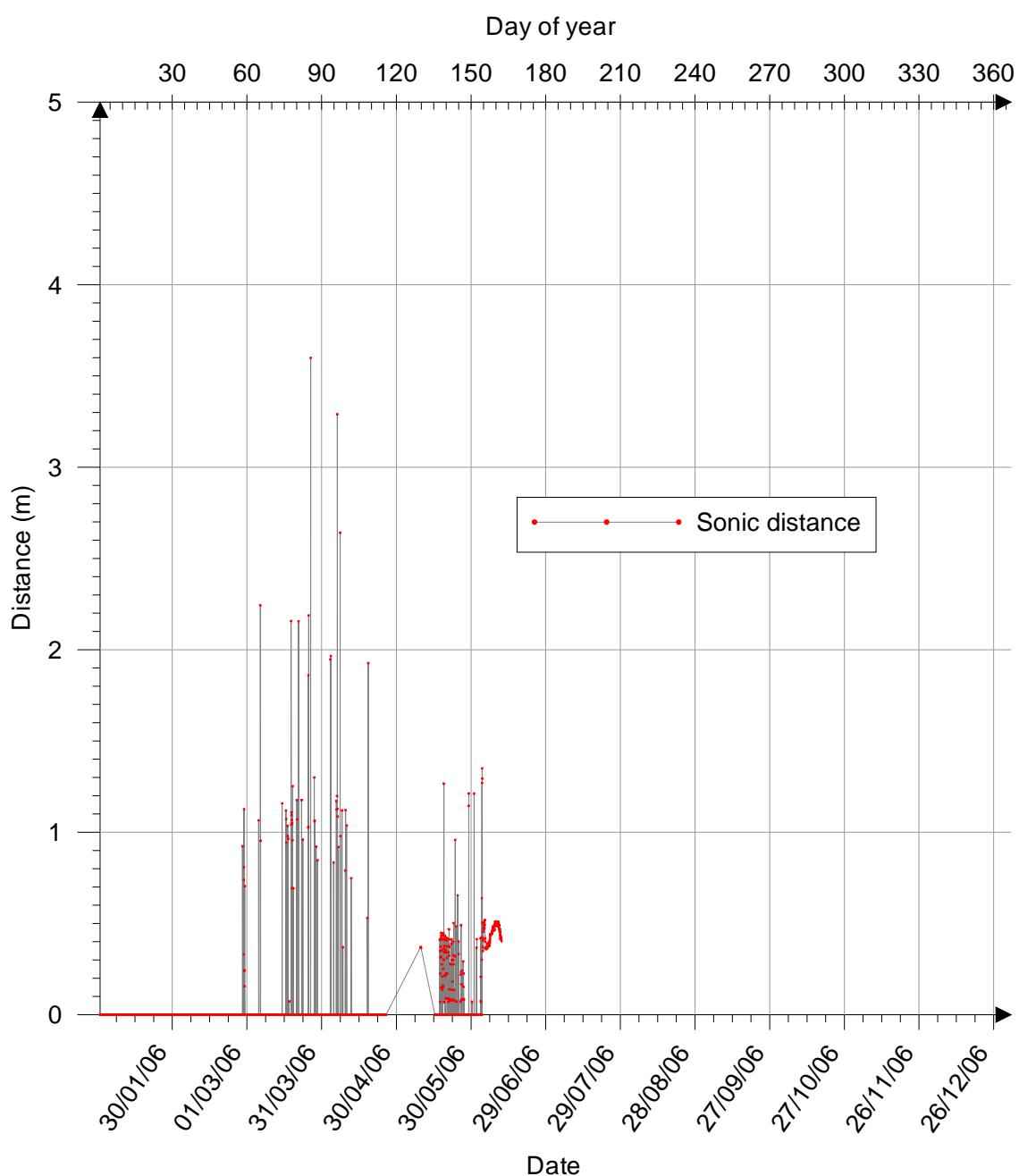
Nuuk2 Wind chart 2006 (Jan-June)



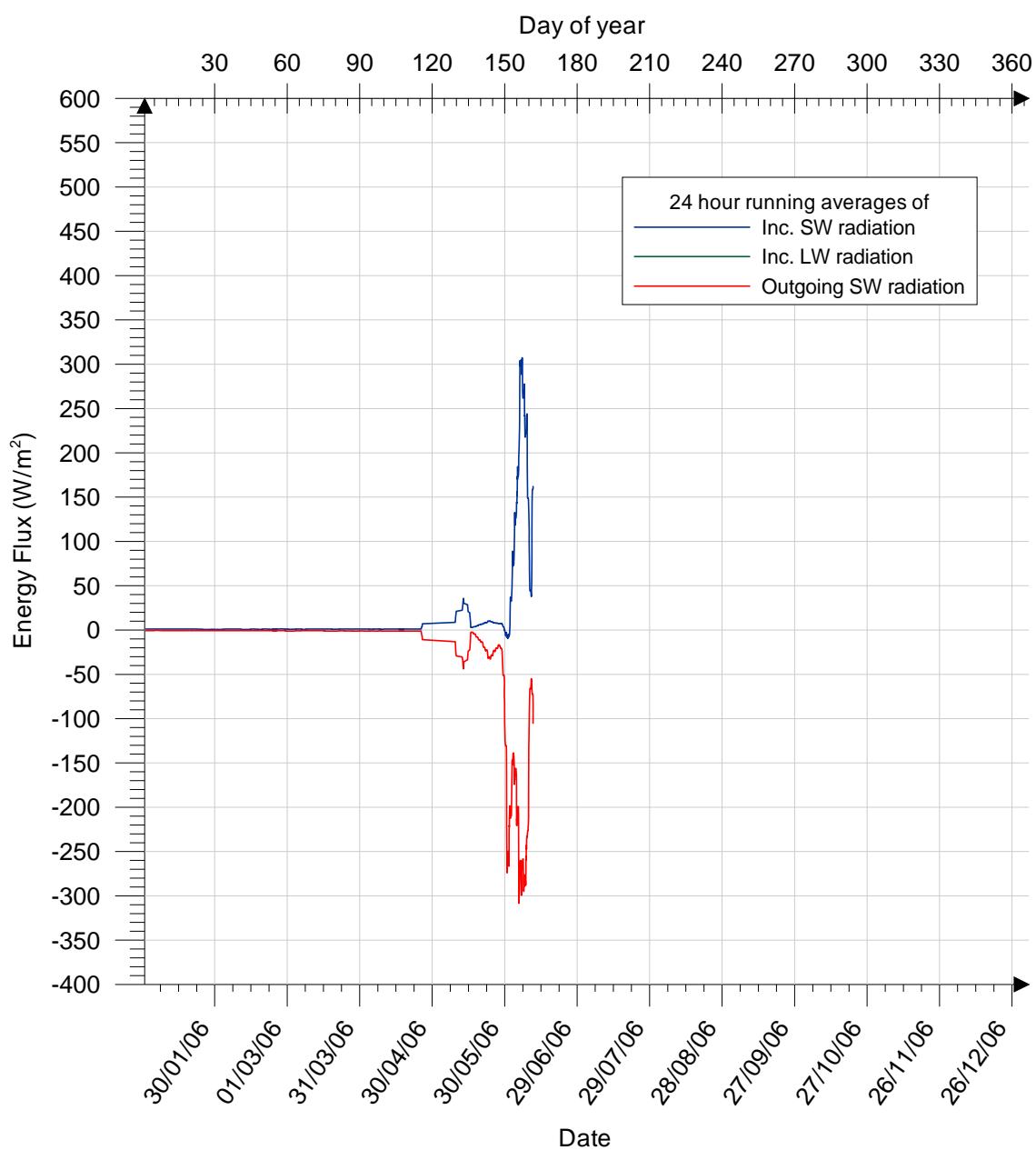




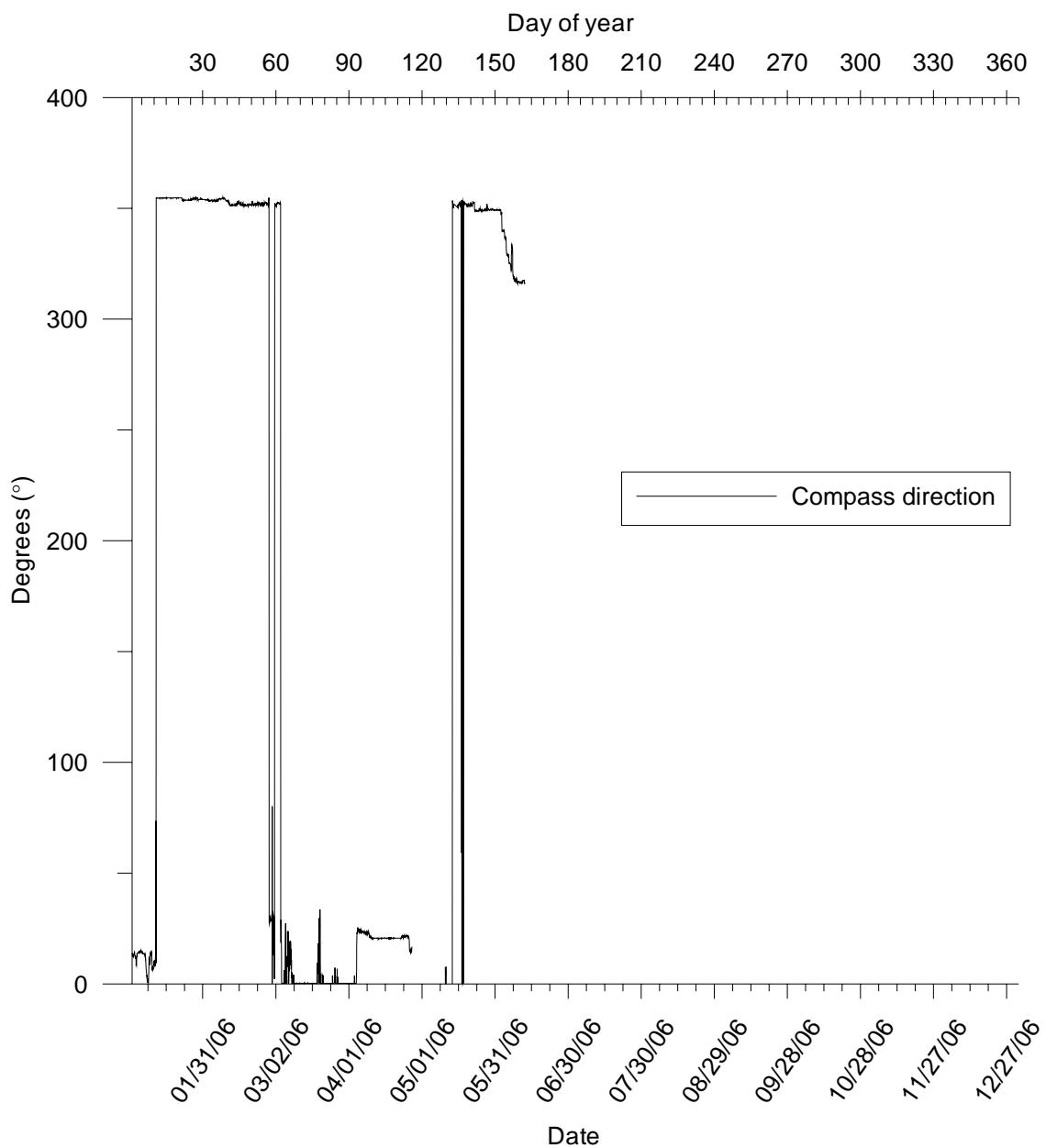
Nuuk2 Sonic Ranger 2006

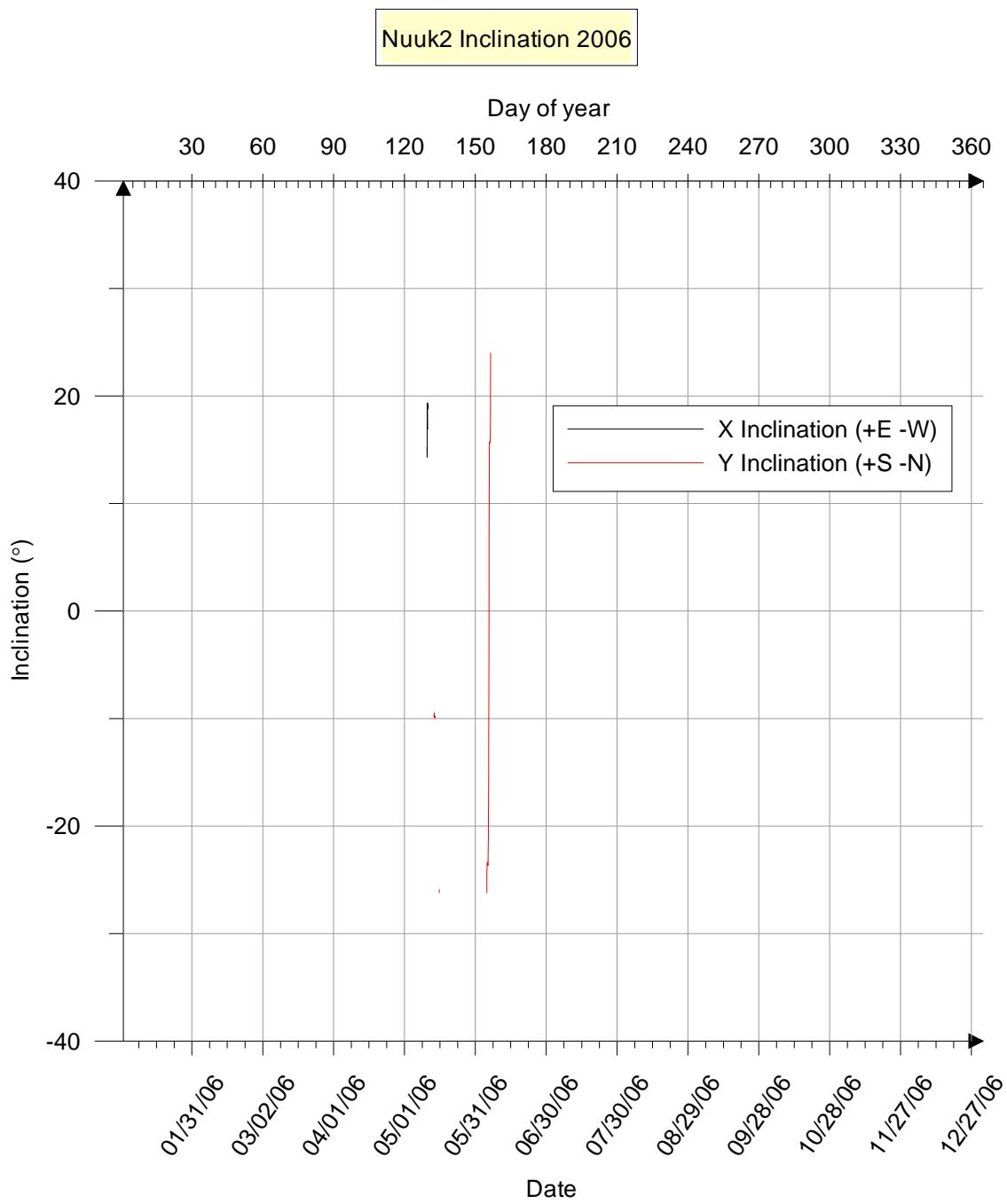


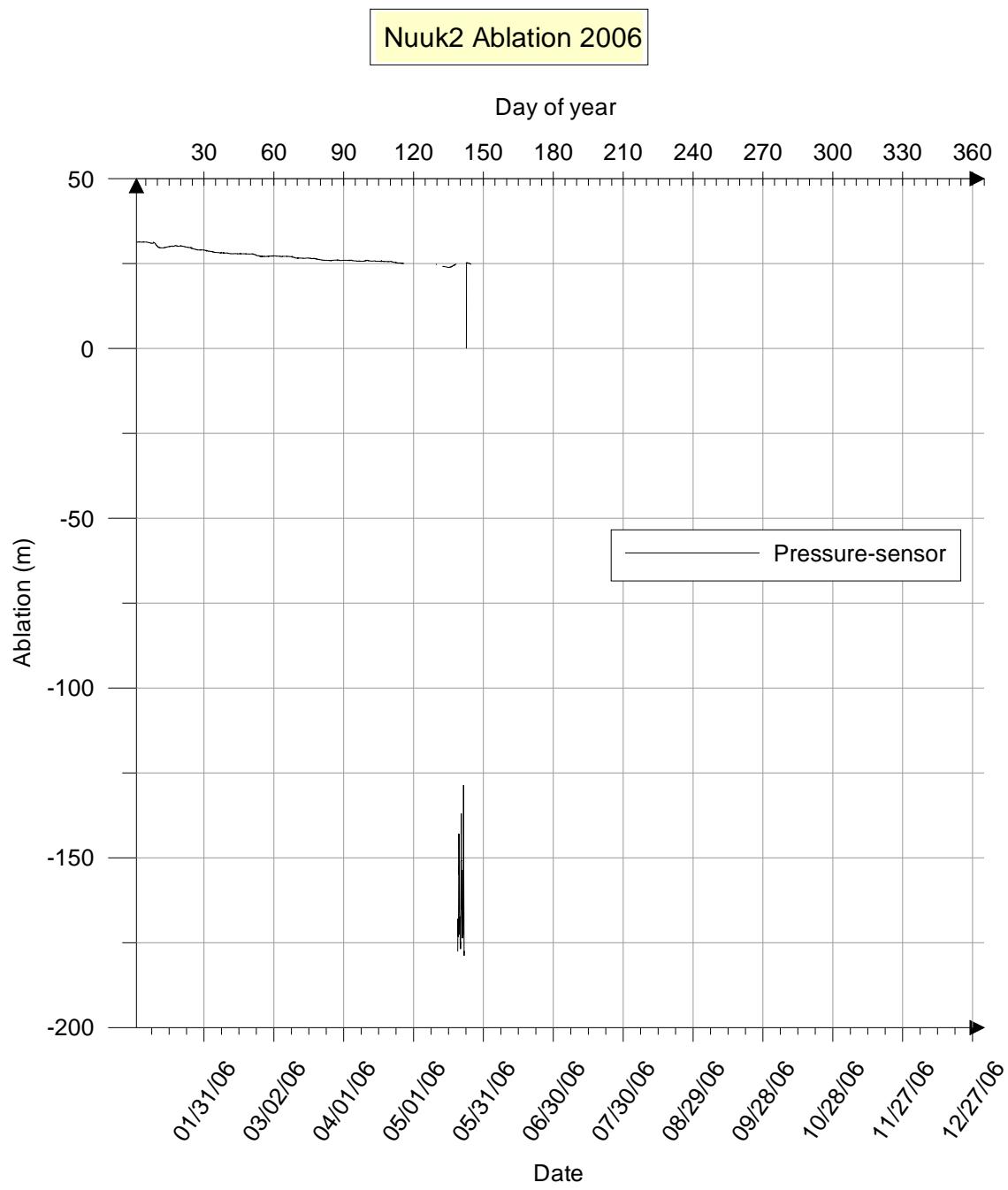
Nuuk2 Radiation 2006



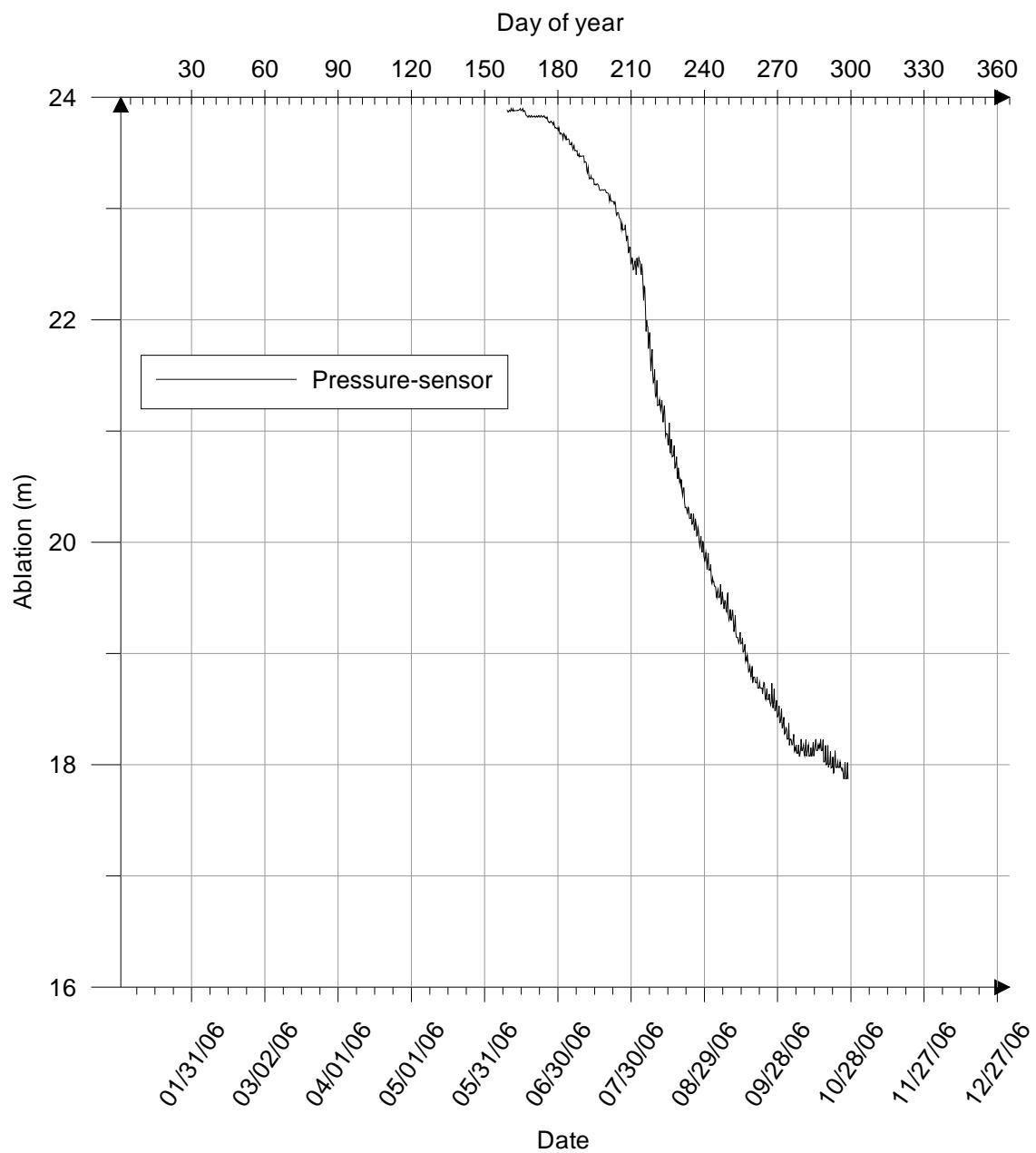
Nuuk2 Compass Direction 2006

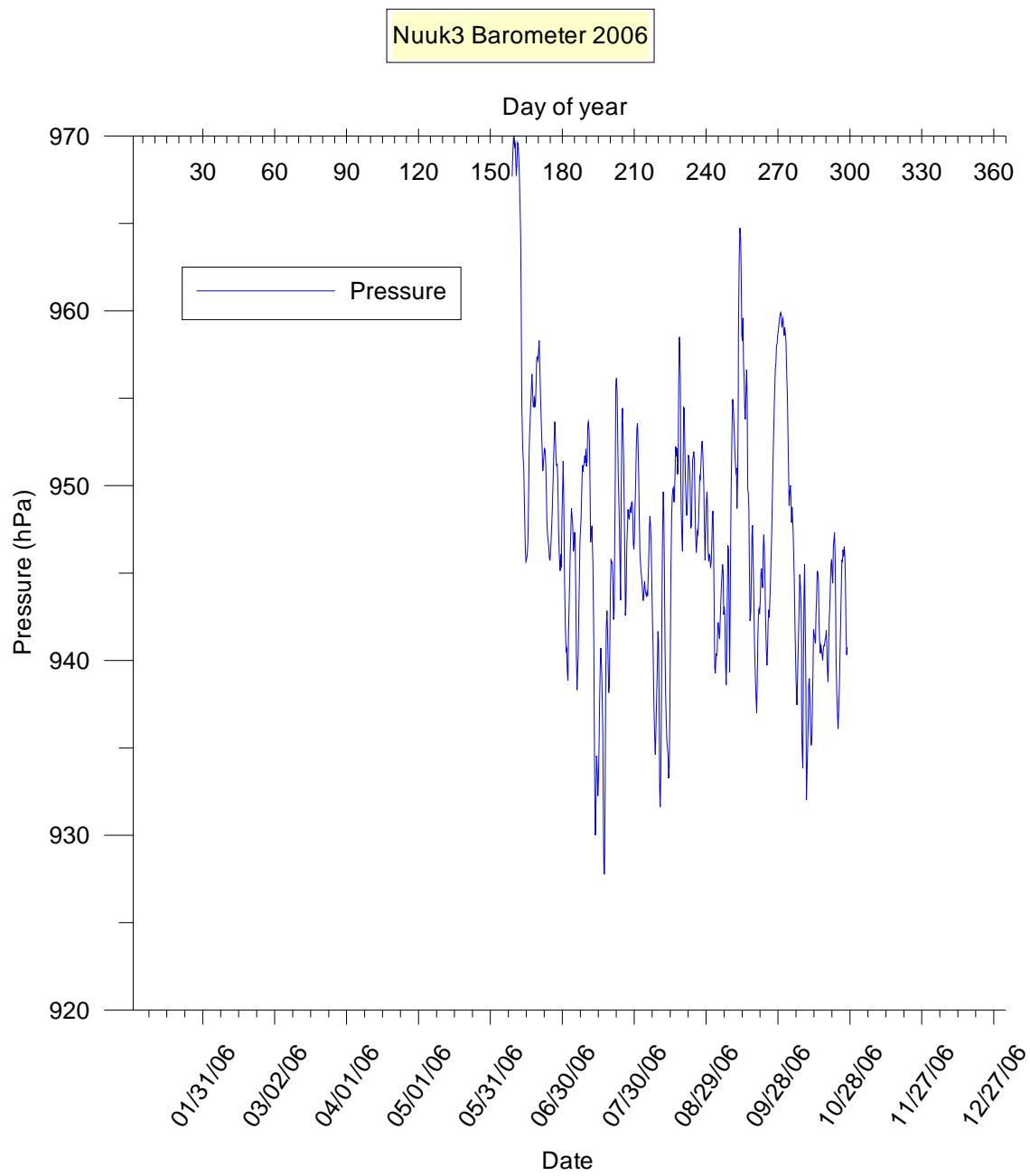






Nuuk3 Ablation 2006

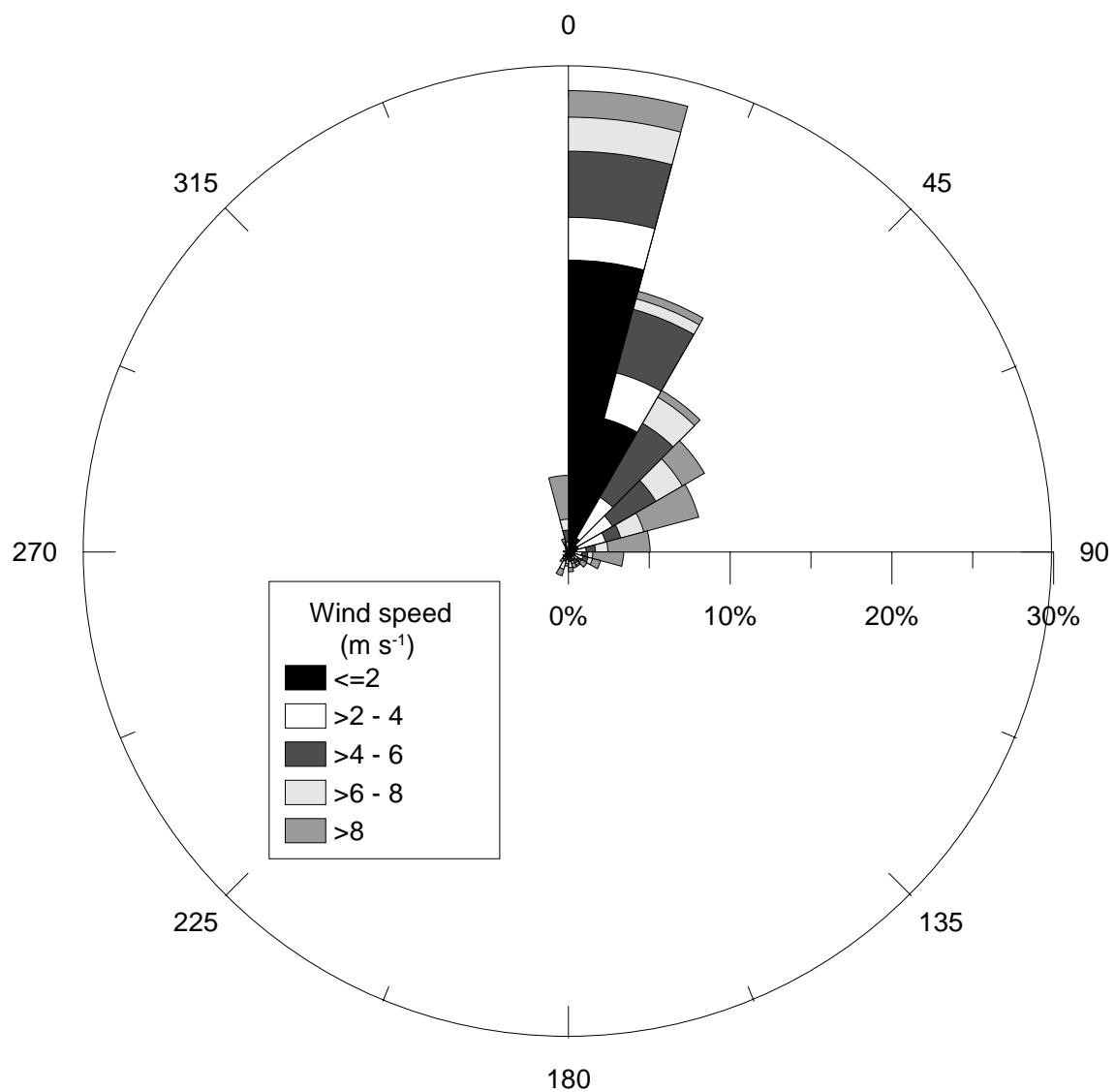




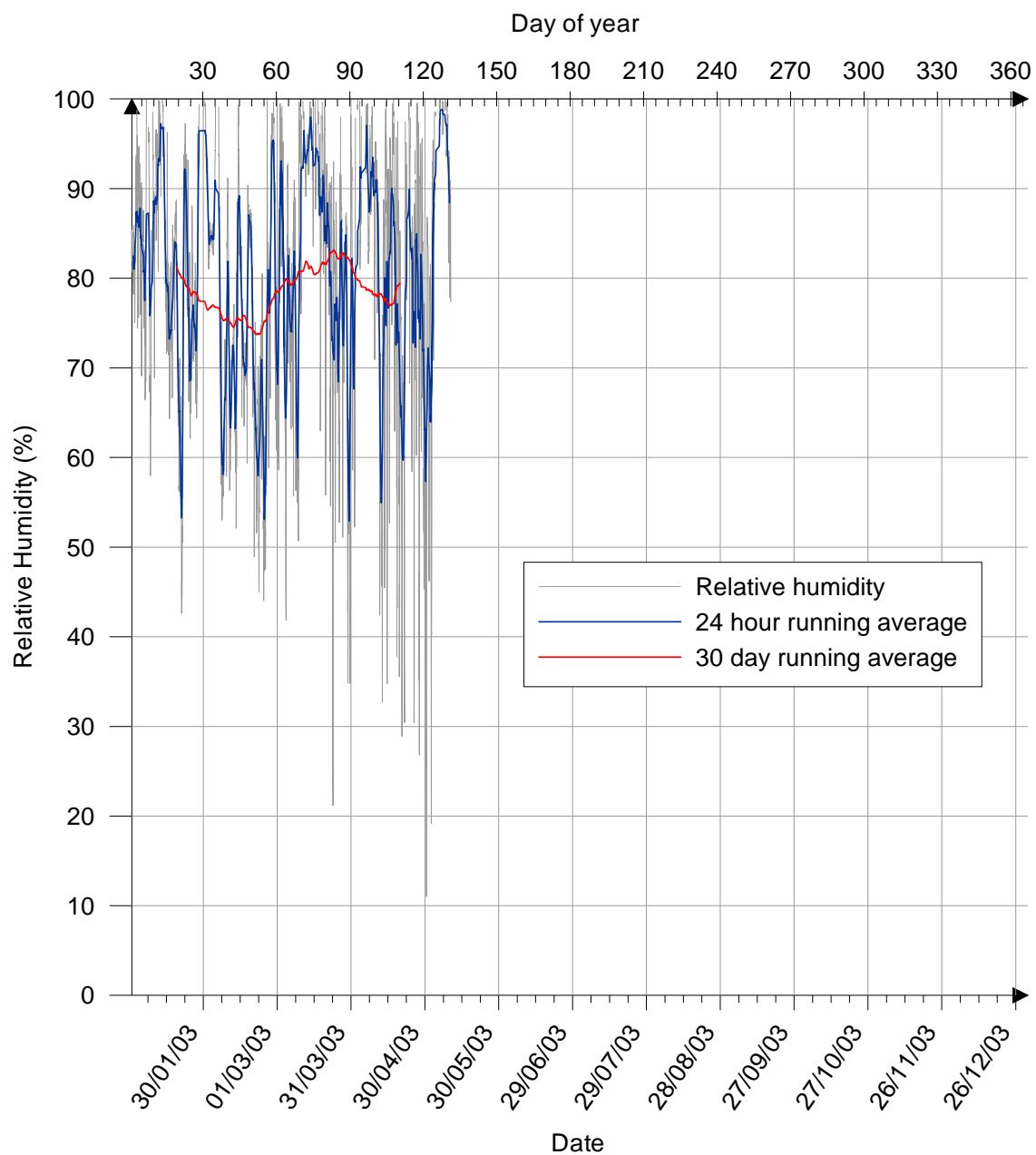
5.2 Qaqortoq stations

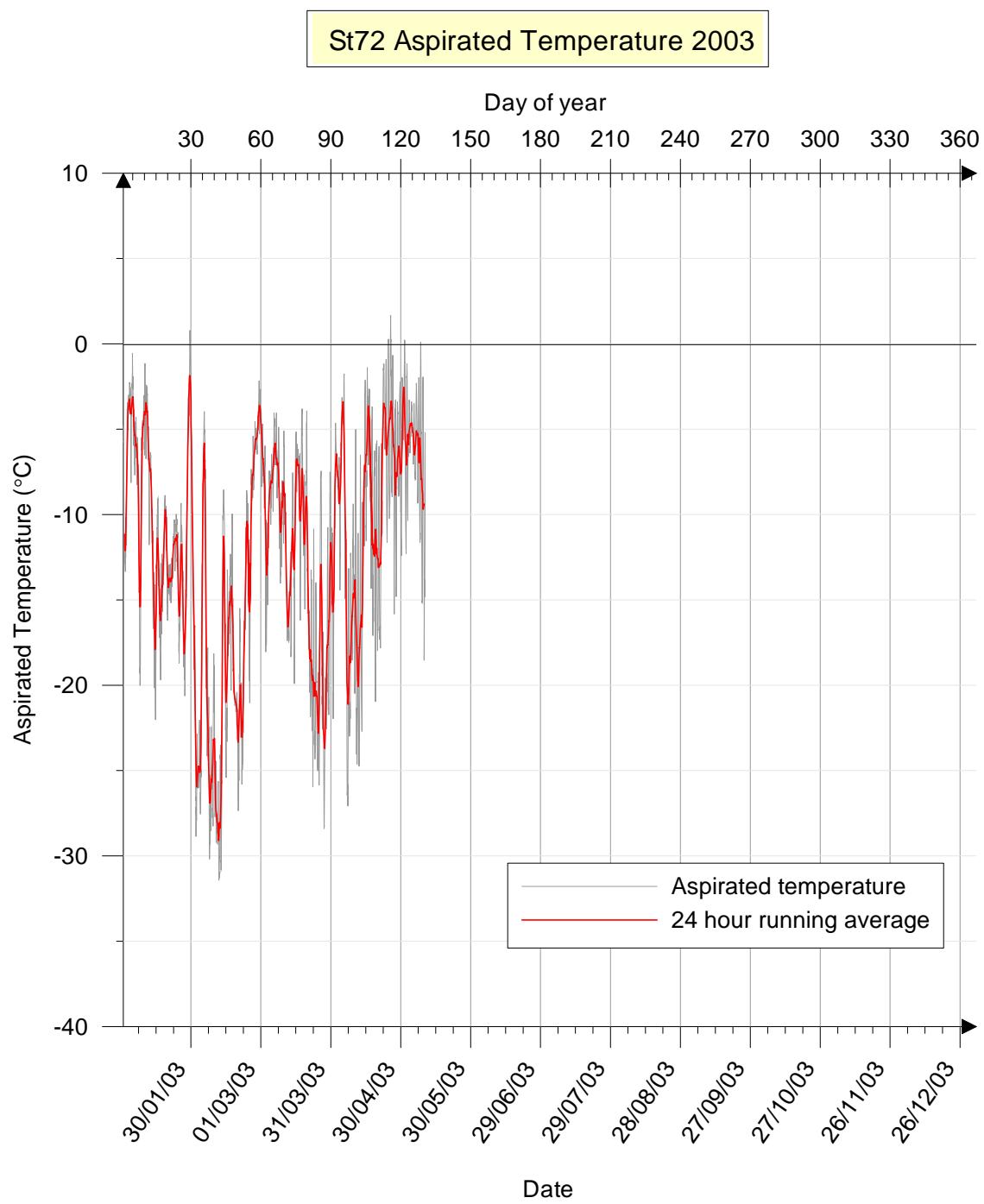
5.2.1 Qaqortoq stations in 2003

St72 Wind chart 2003 (Jan-May)

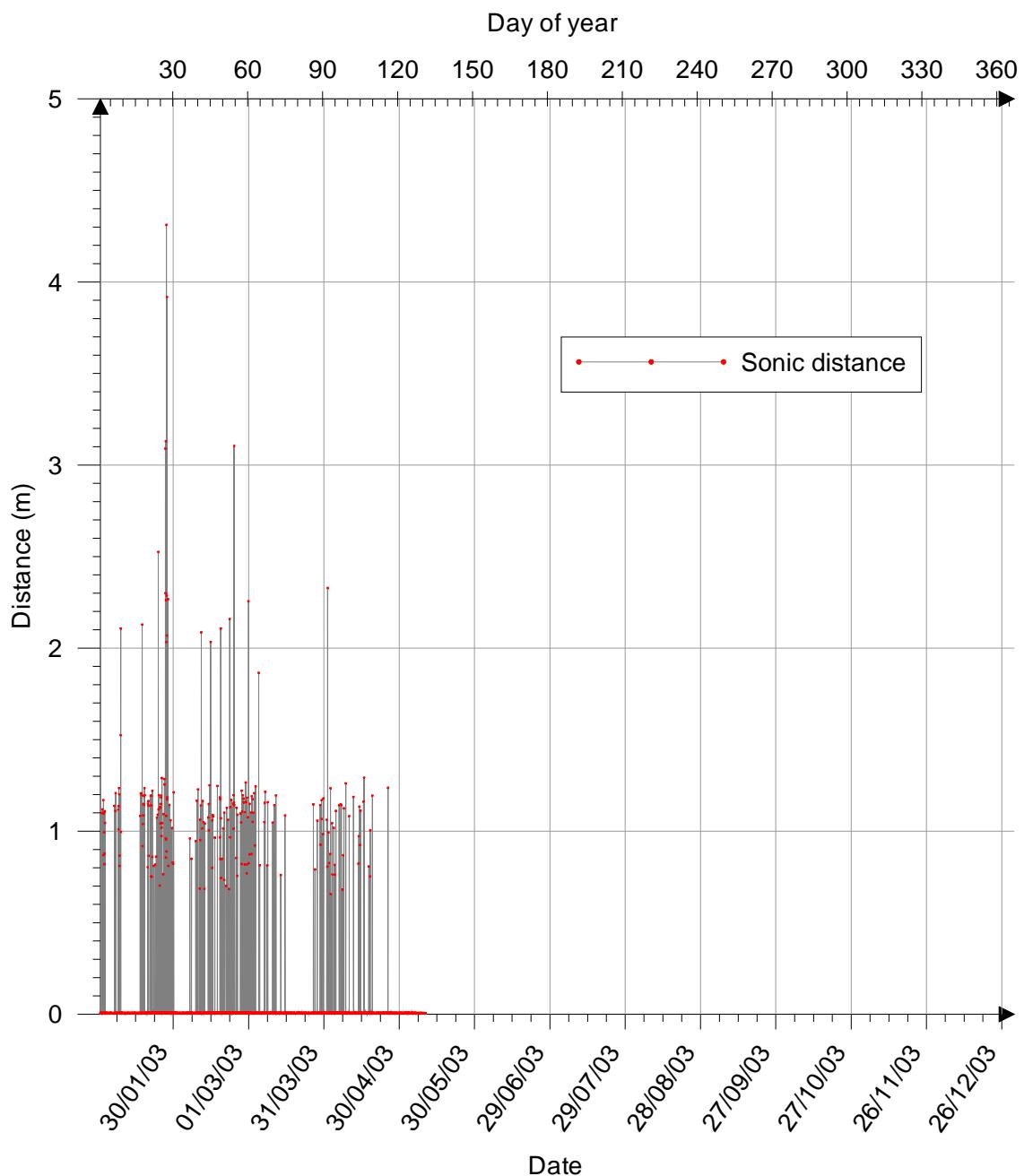


St72 Relative Humidity 2003

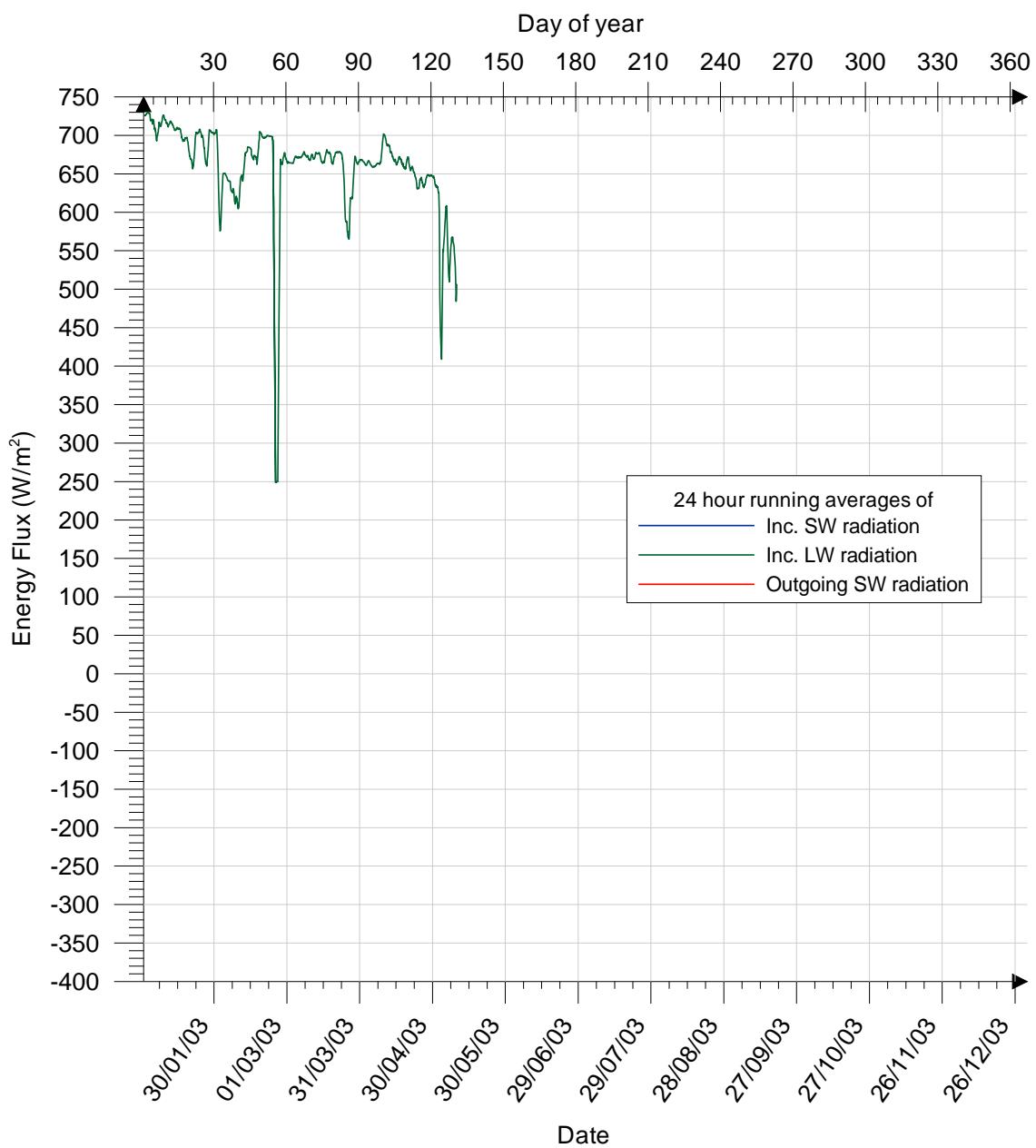




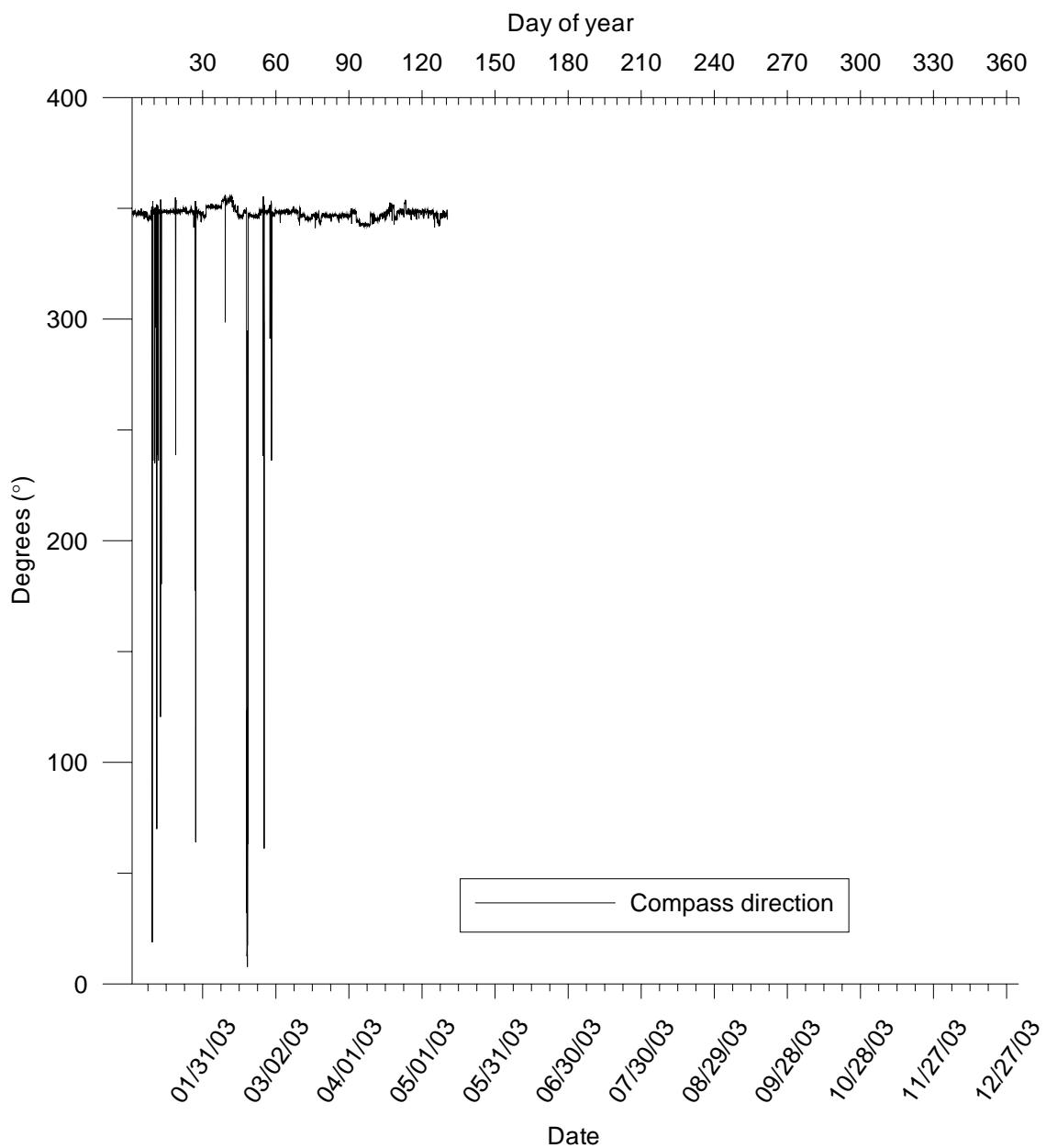
St72 Sonic Ranger 2003



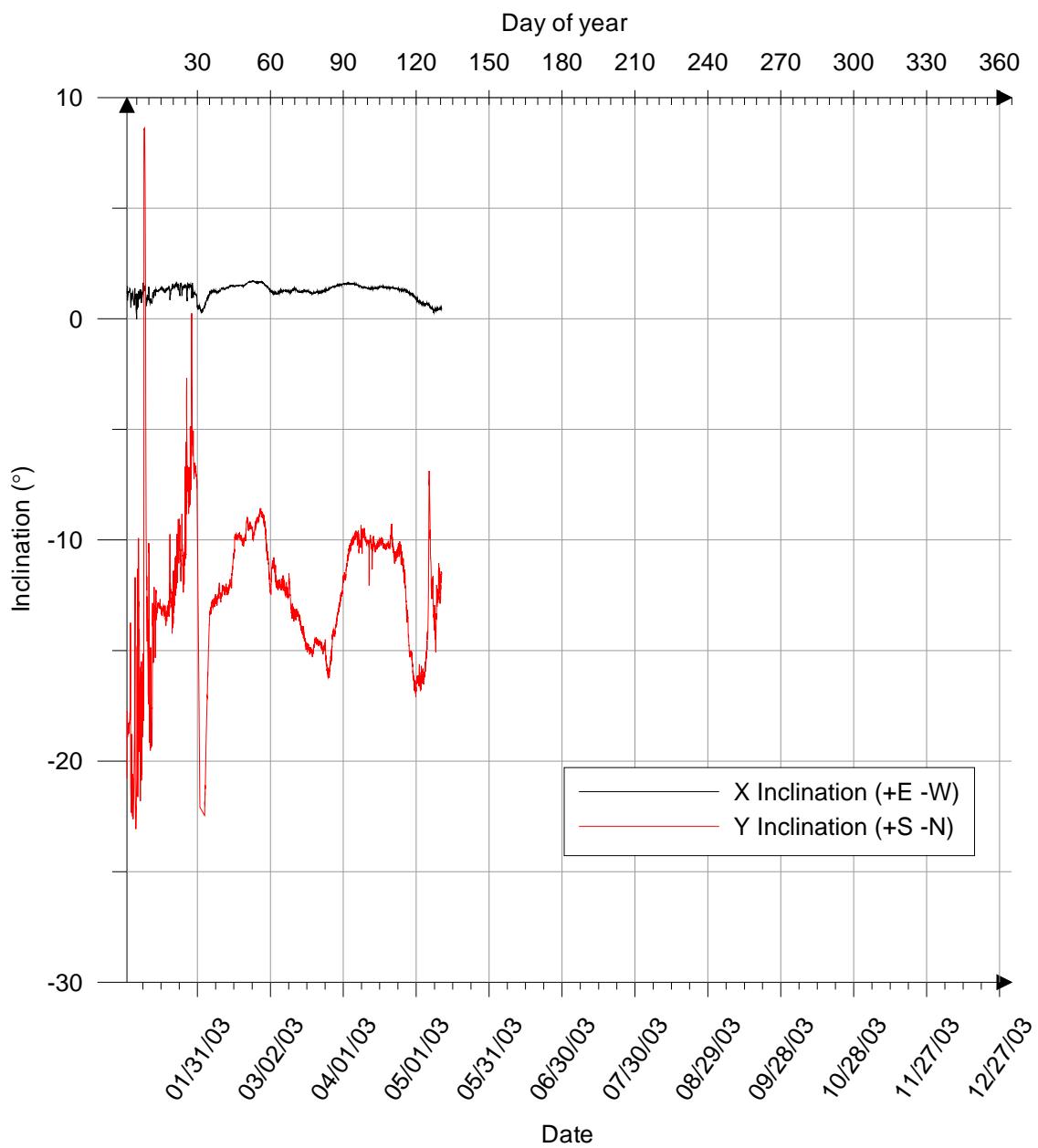
St72 Radiation 2003



St72 Compass Direction 2003

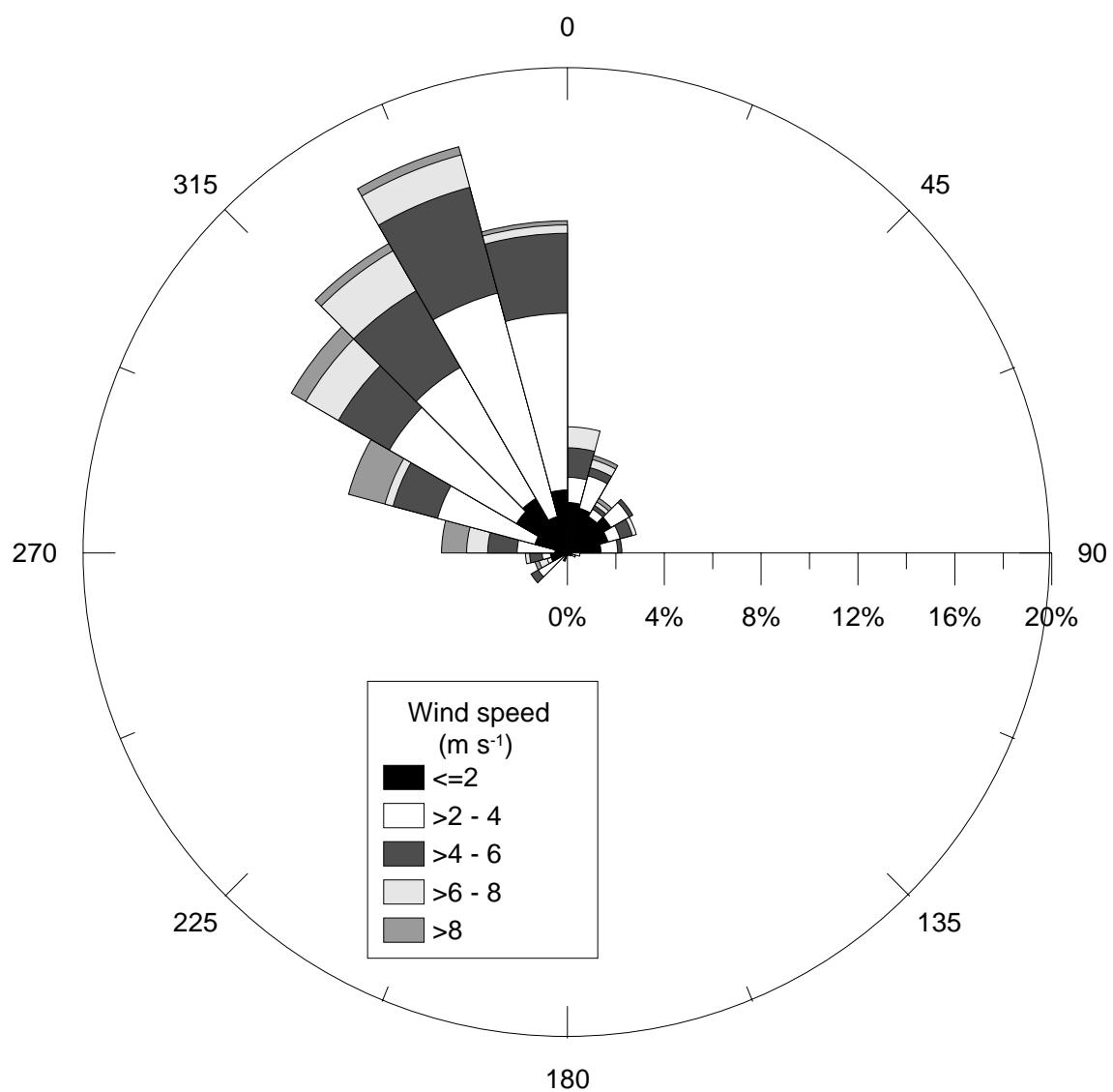


St72 Inclination 2003

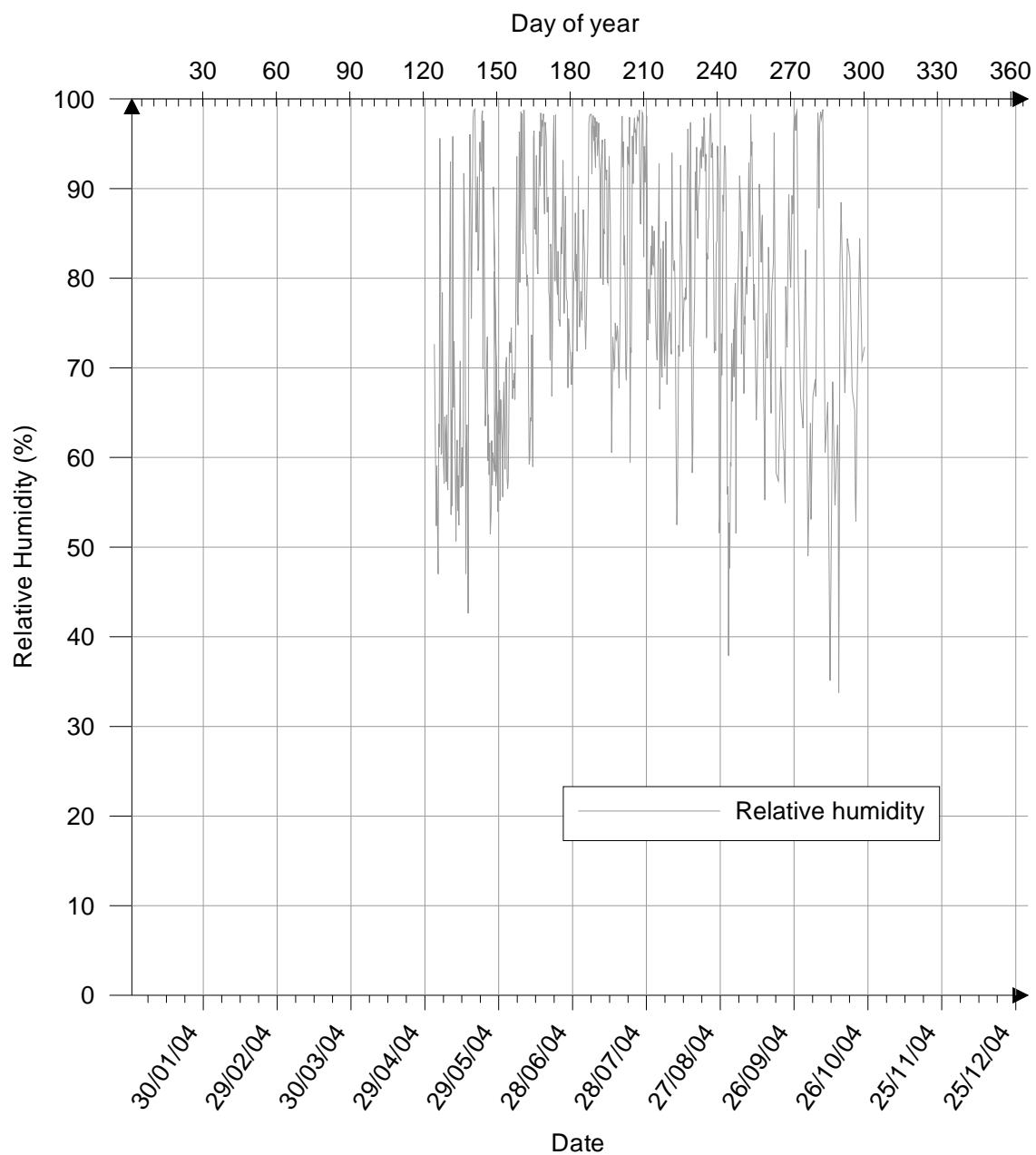


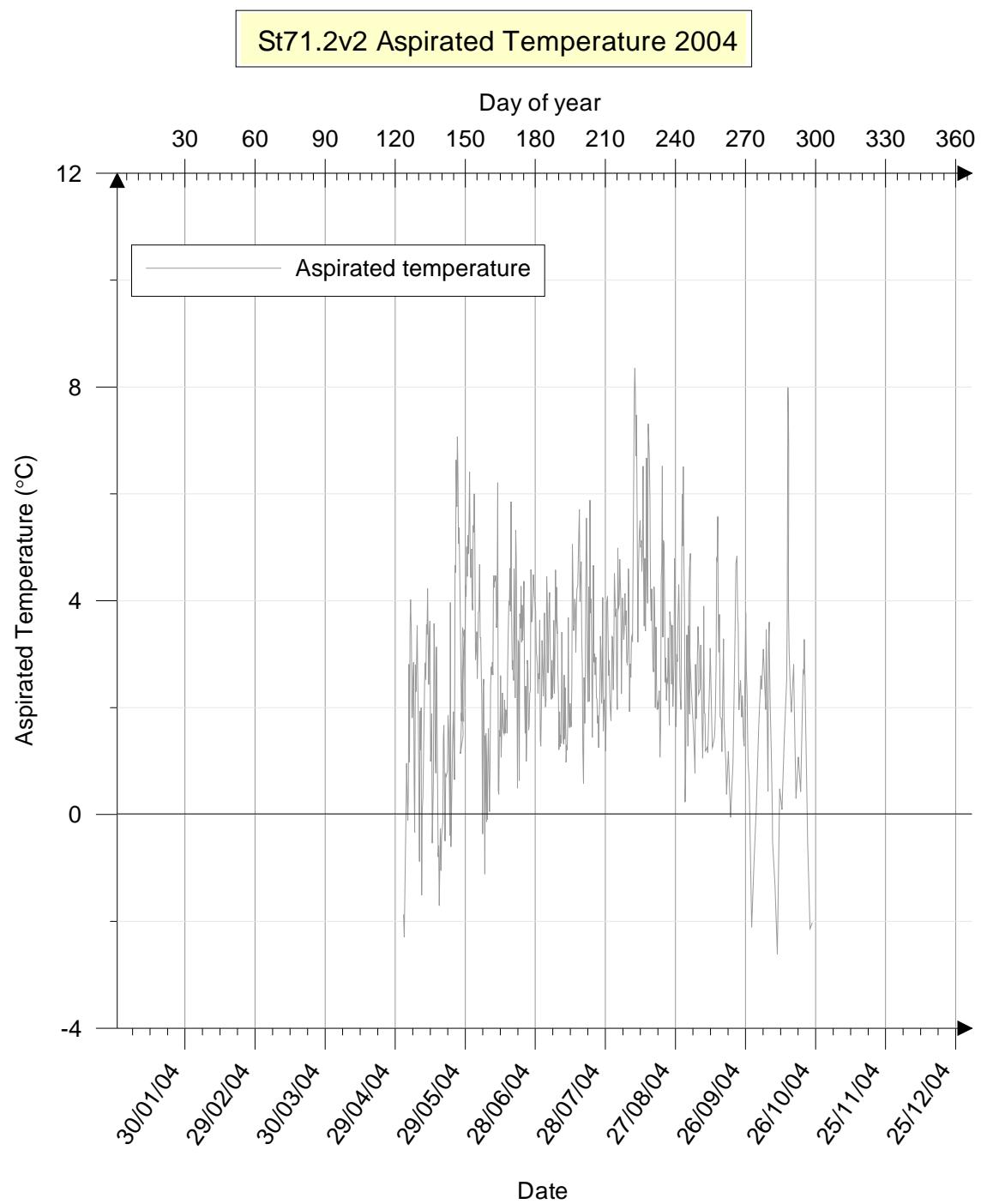
5.2.2 Qaqertoq stations in 2004

St71.2v2 Wind chart 2004 (May-Oct)

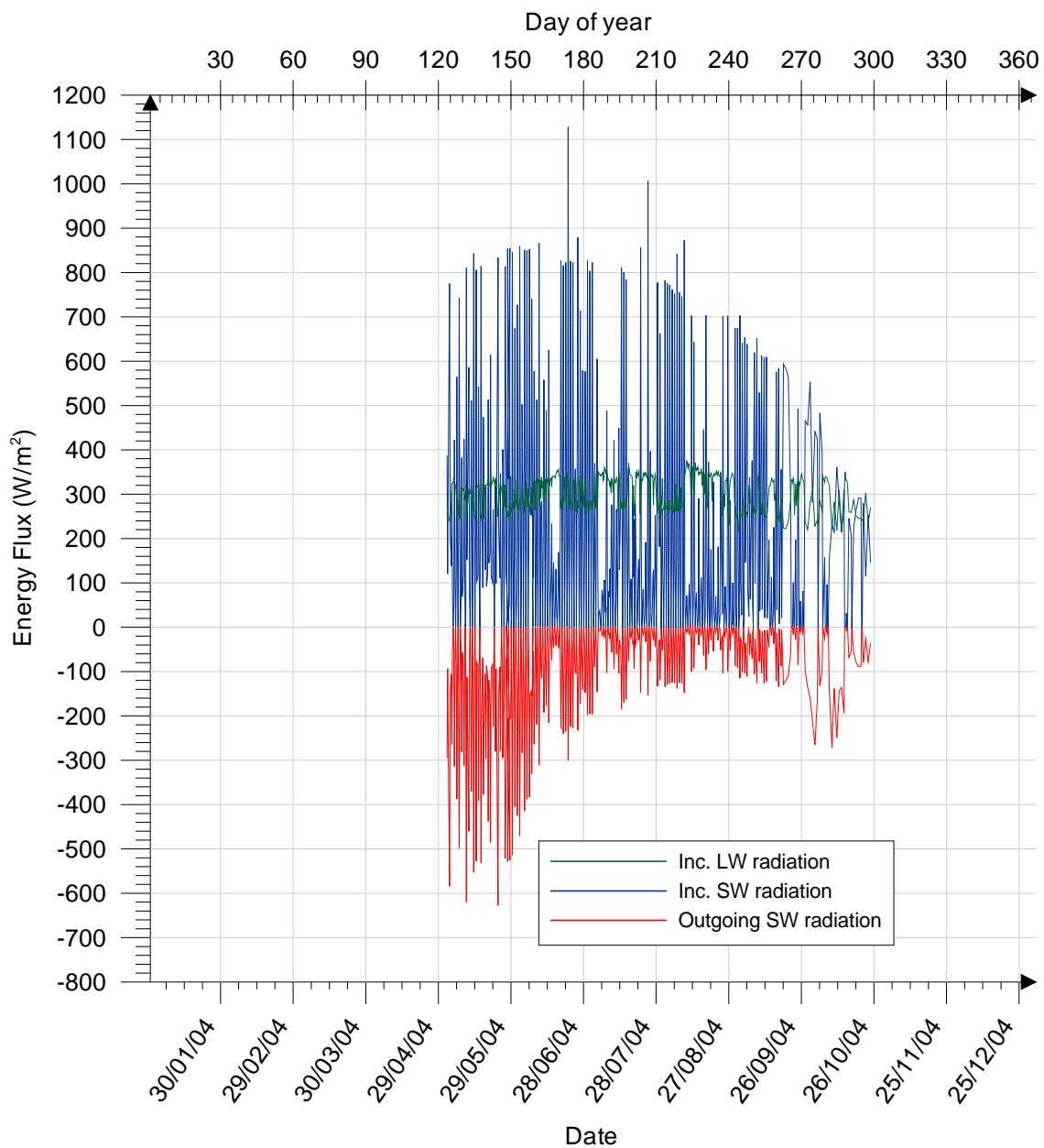


St71.2v2 Relative Humidity 2004

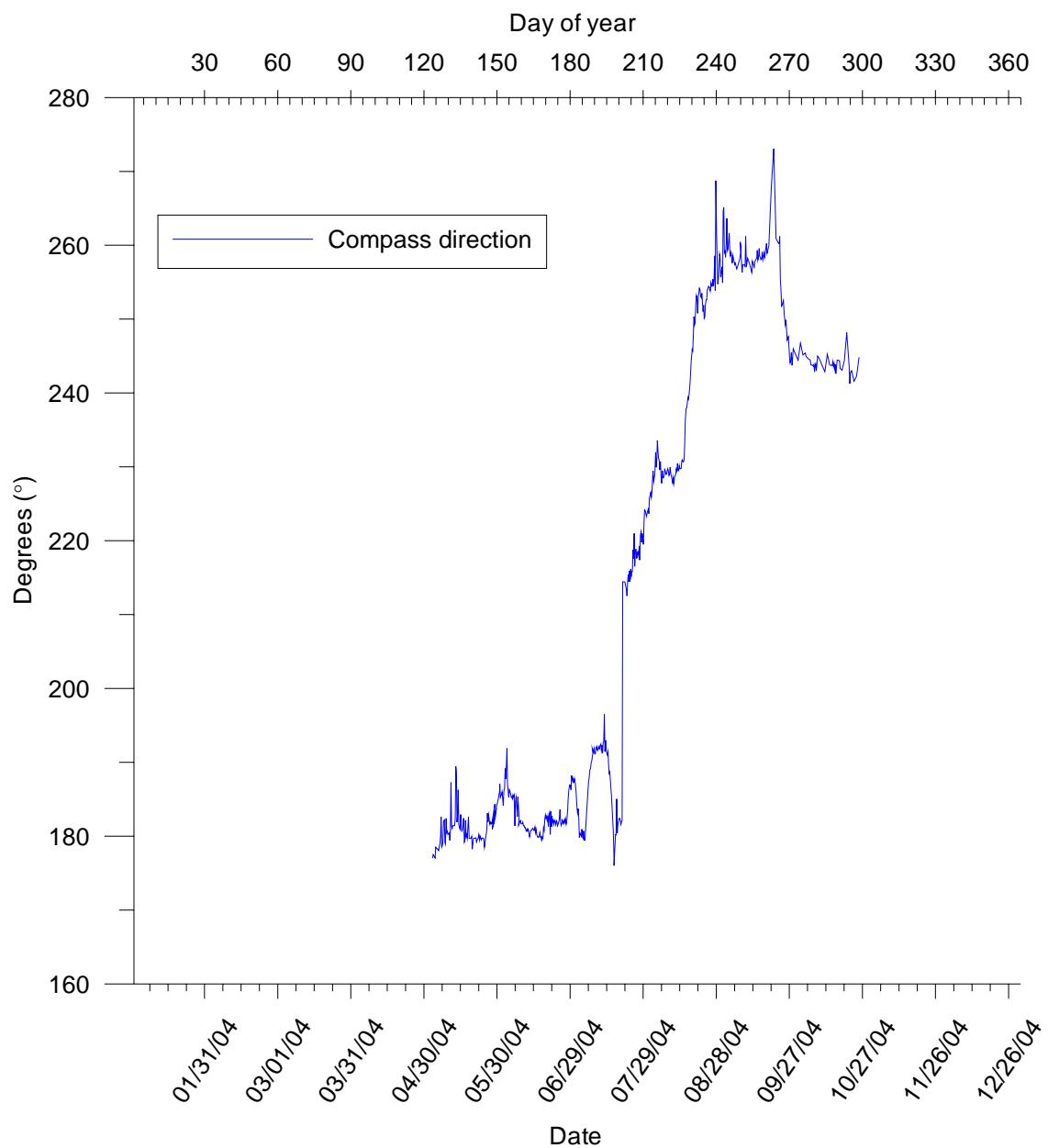


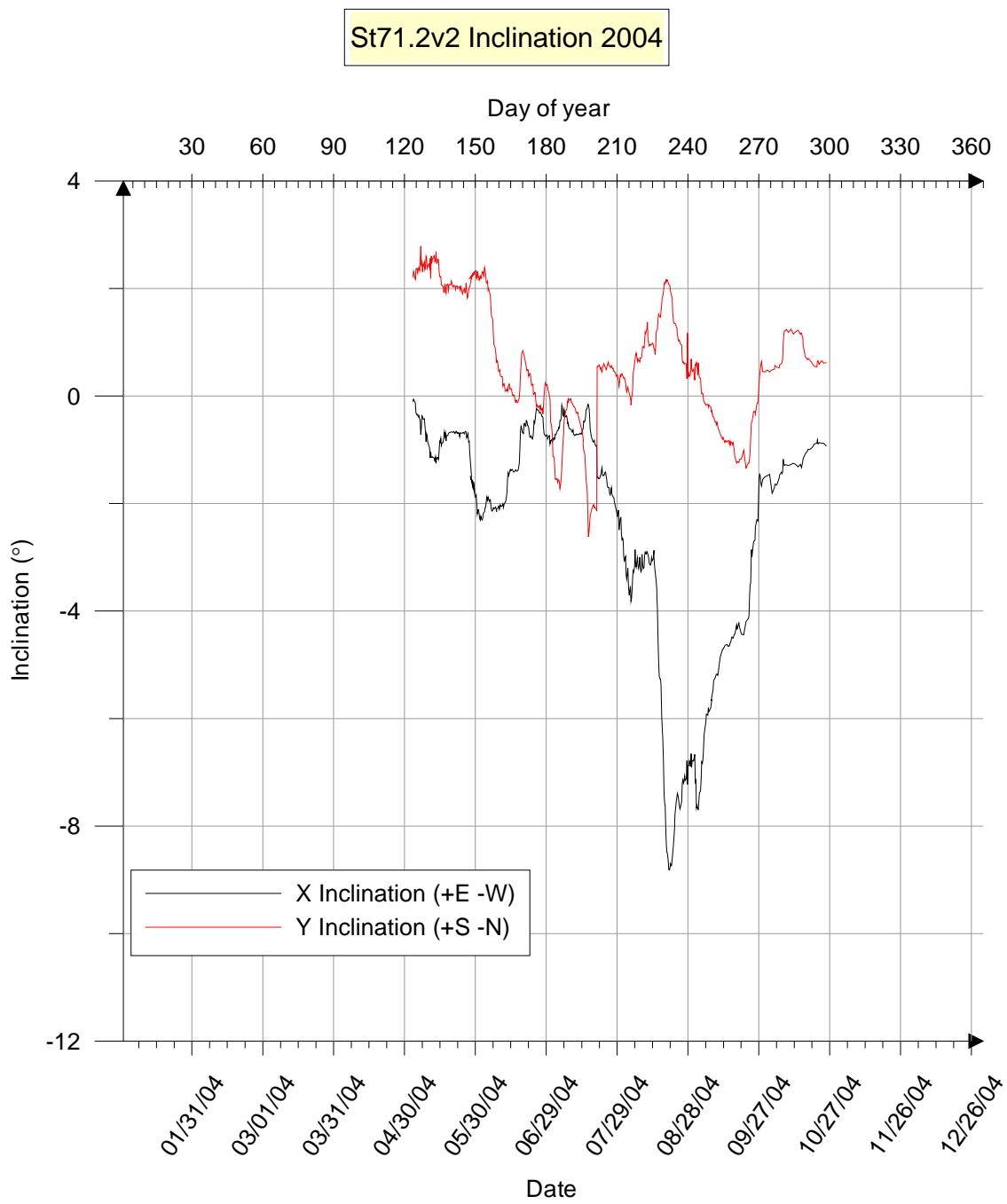


St71.2v2 Radiation 2004

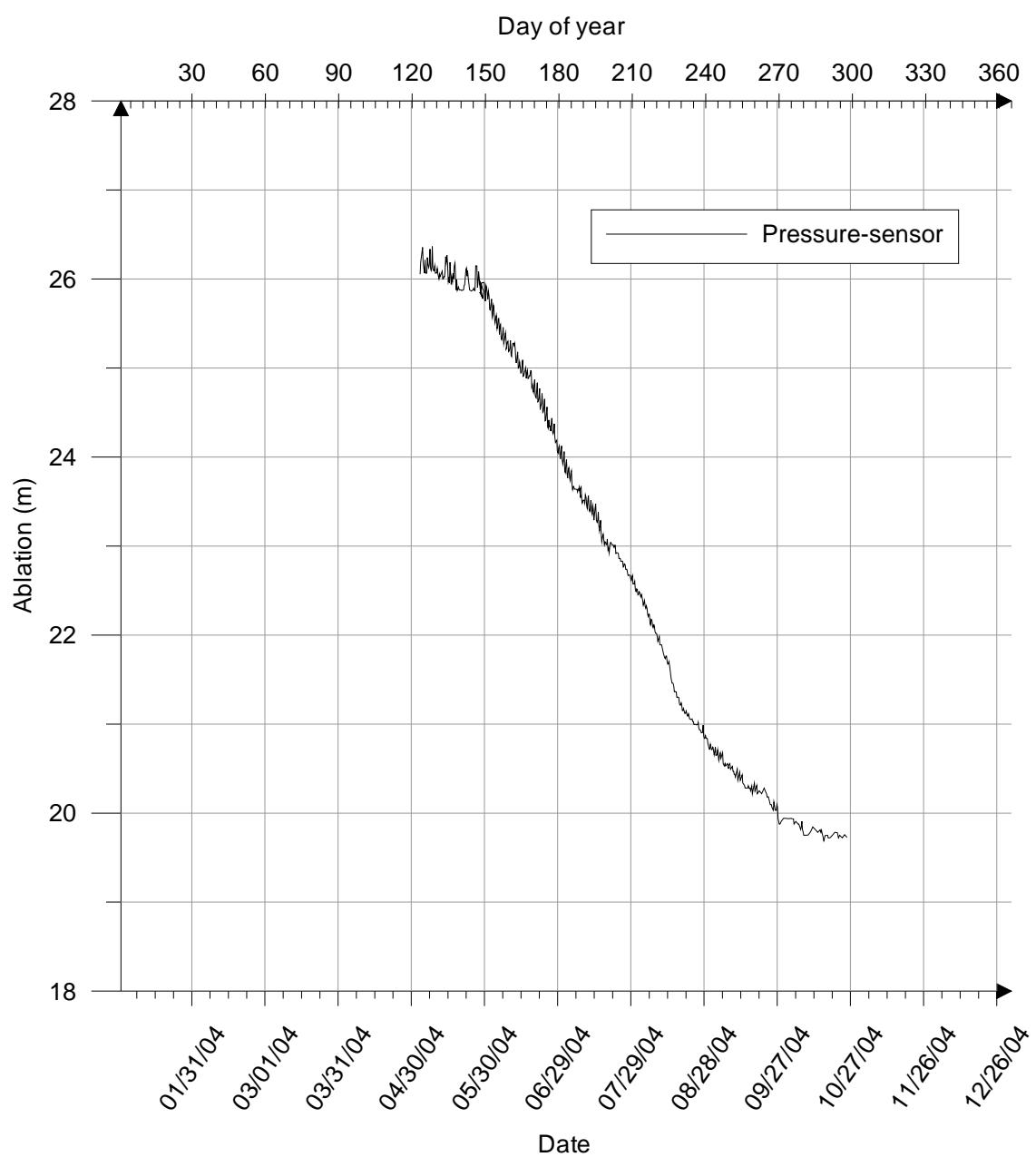


St71.2v2 Compass 2004

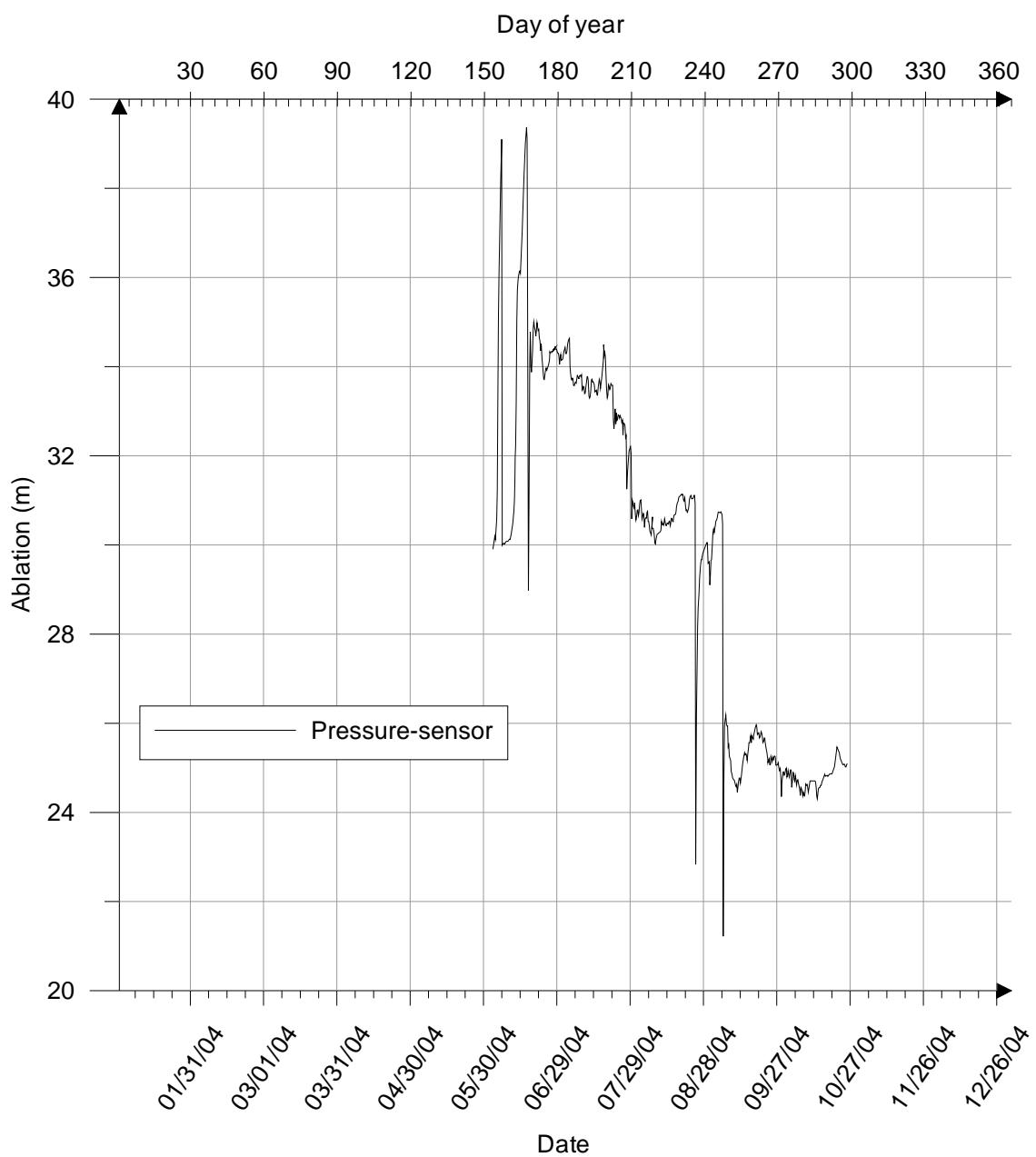




St71.2v2 Ablation 2004

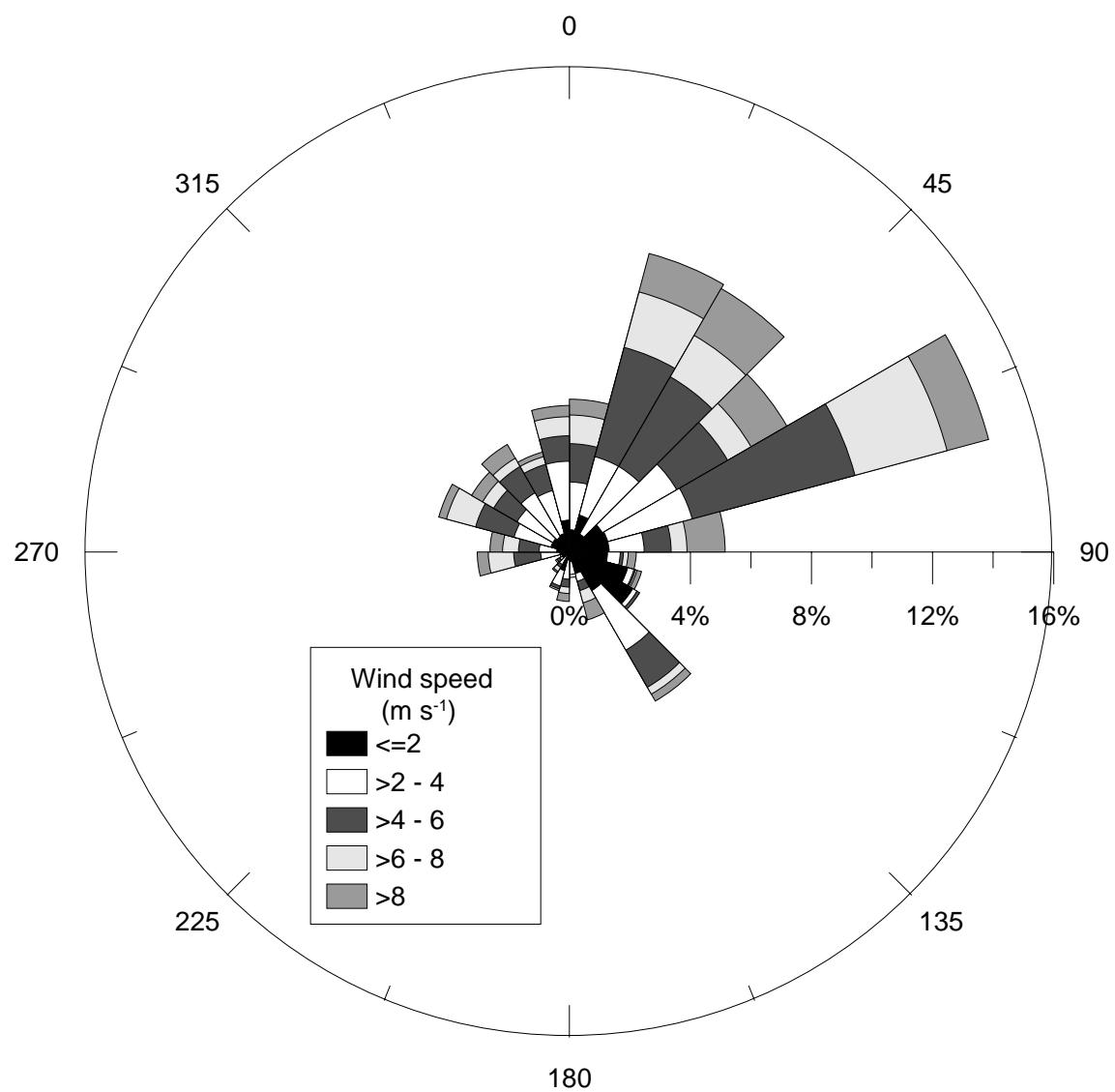


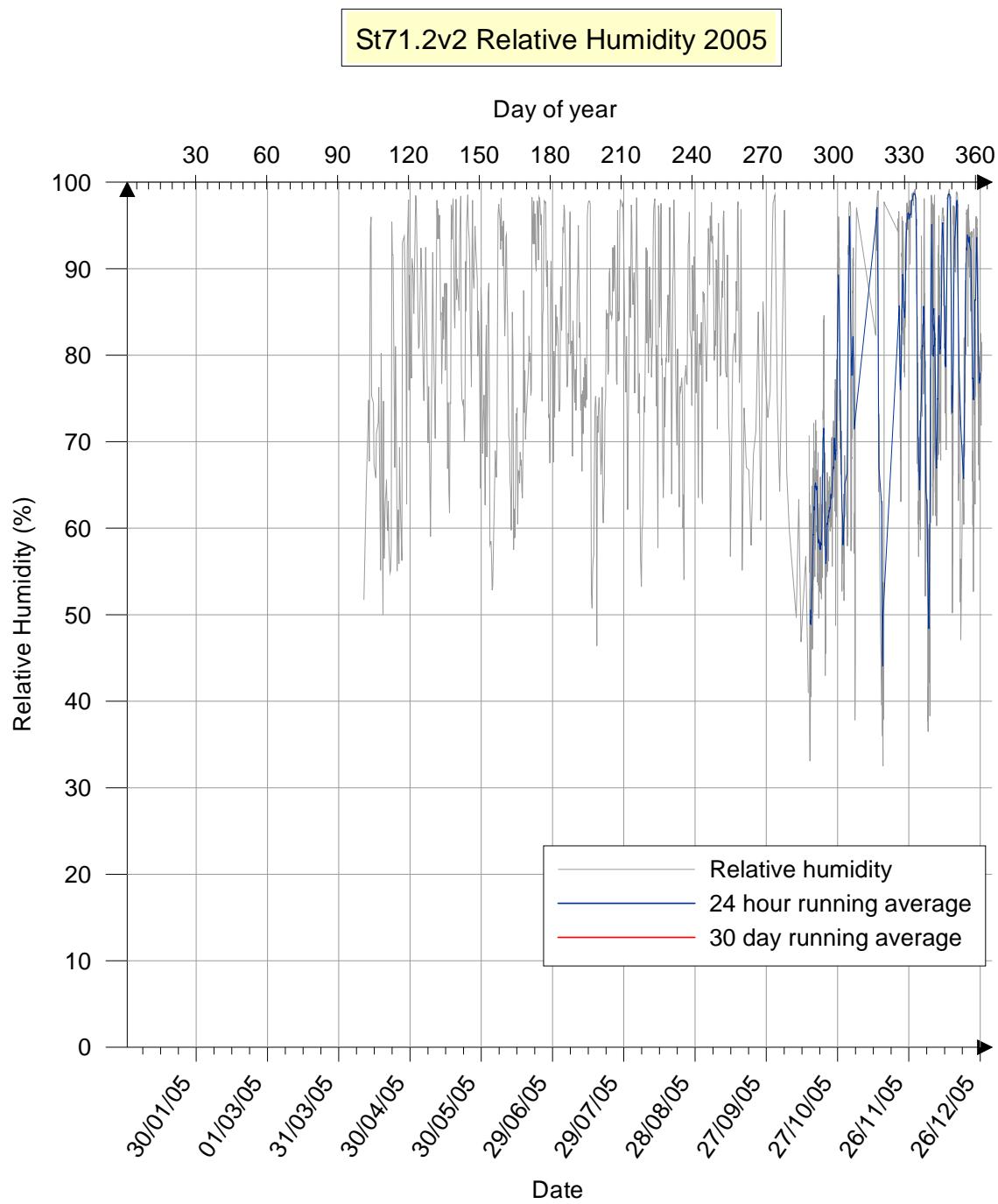
Station73 Ablation 2004

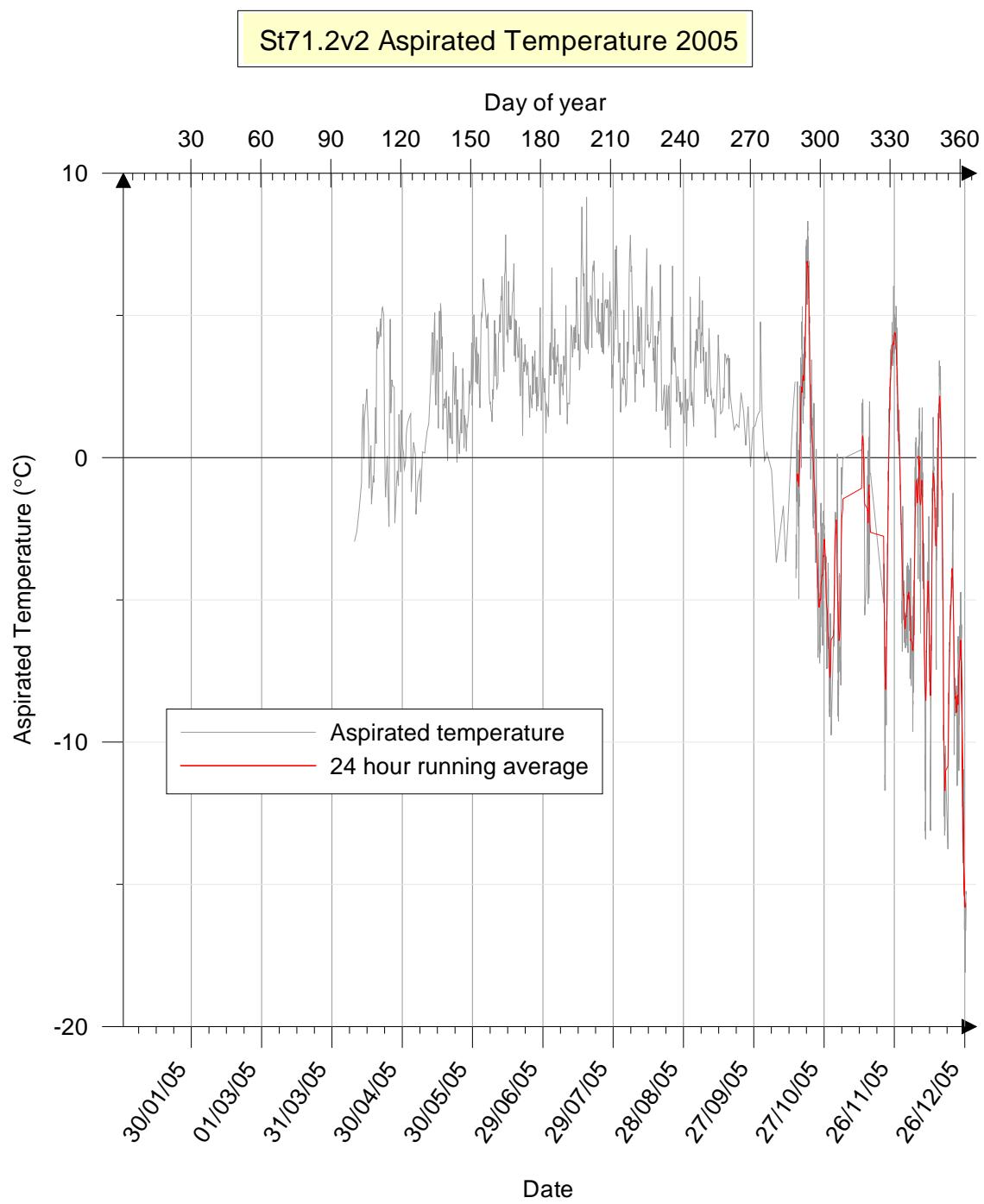


5.2.3 Qaqertoq stations in 2005

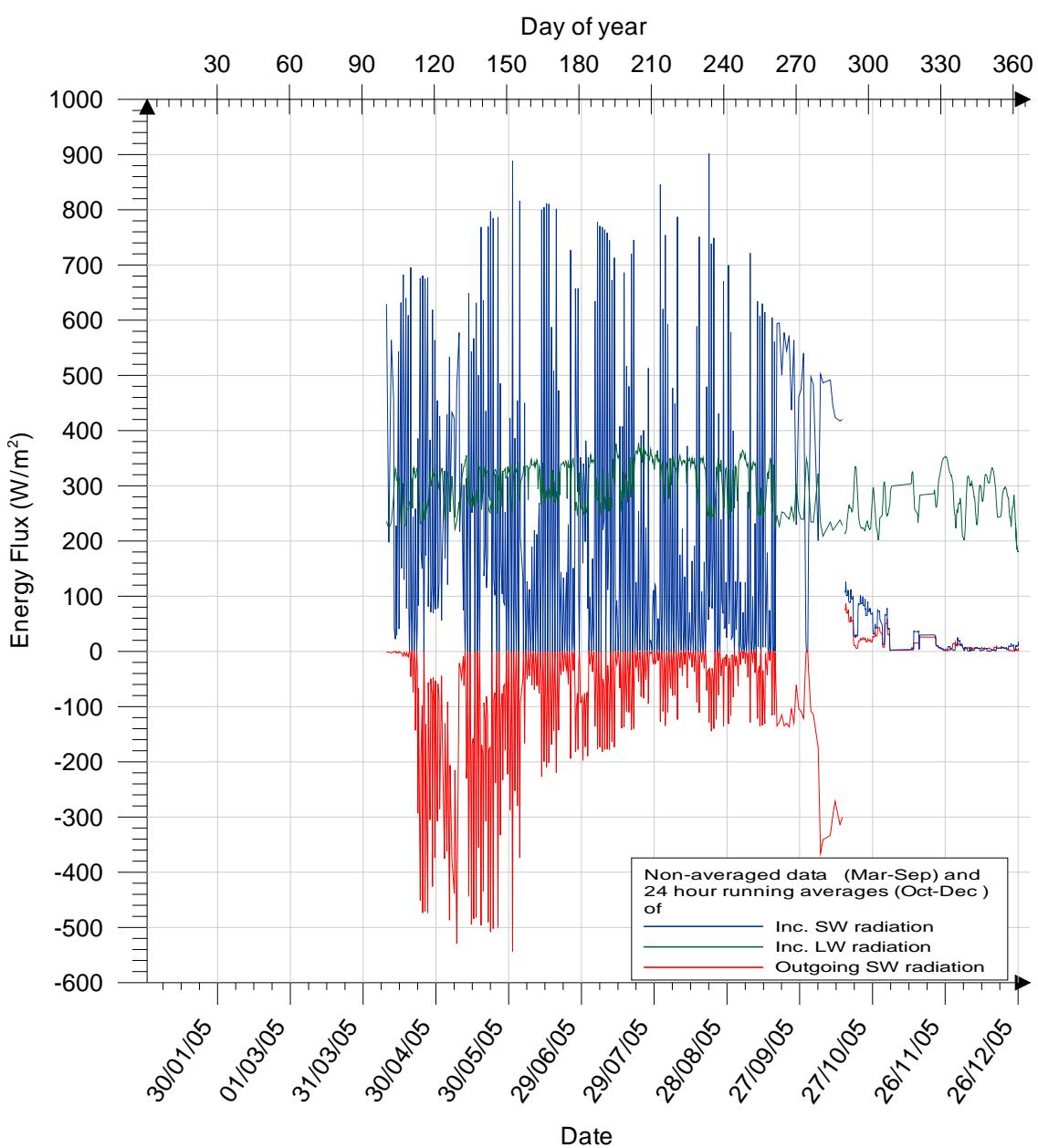
St71.2v2 Wind chart 2005 (Mar-Dec)



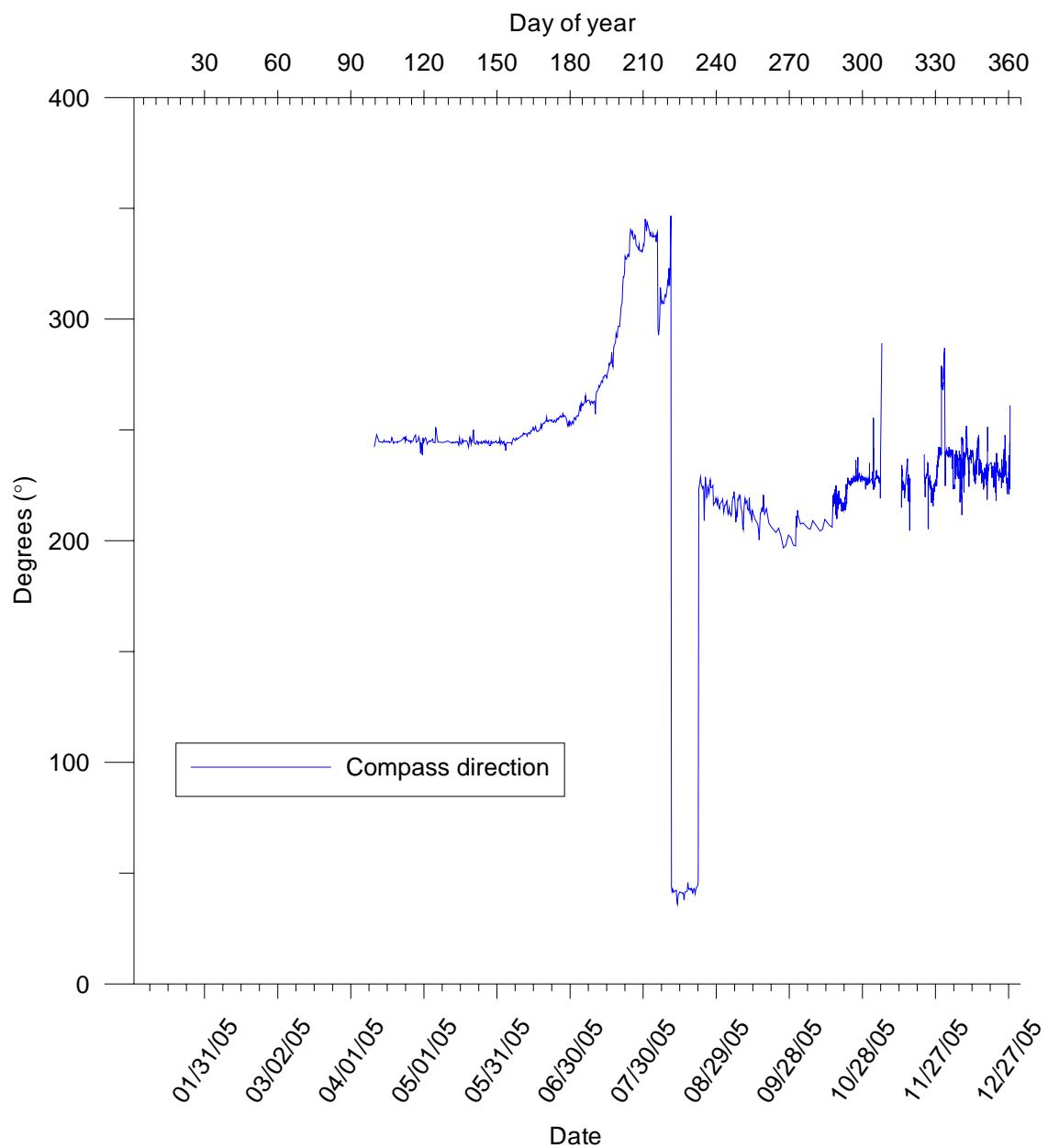




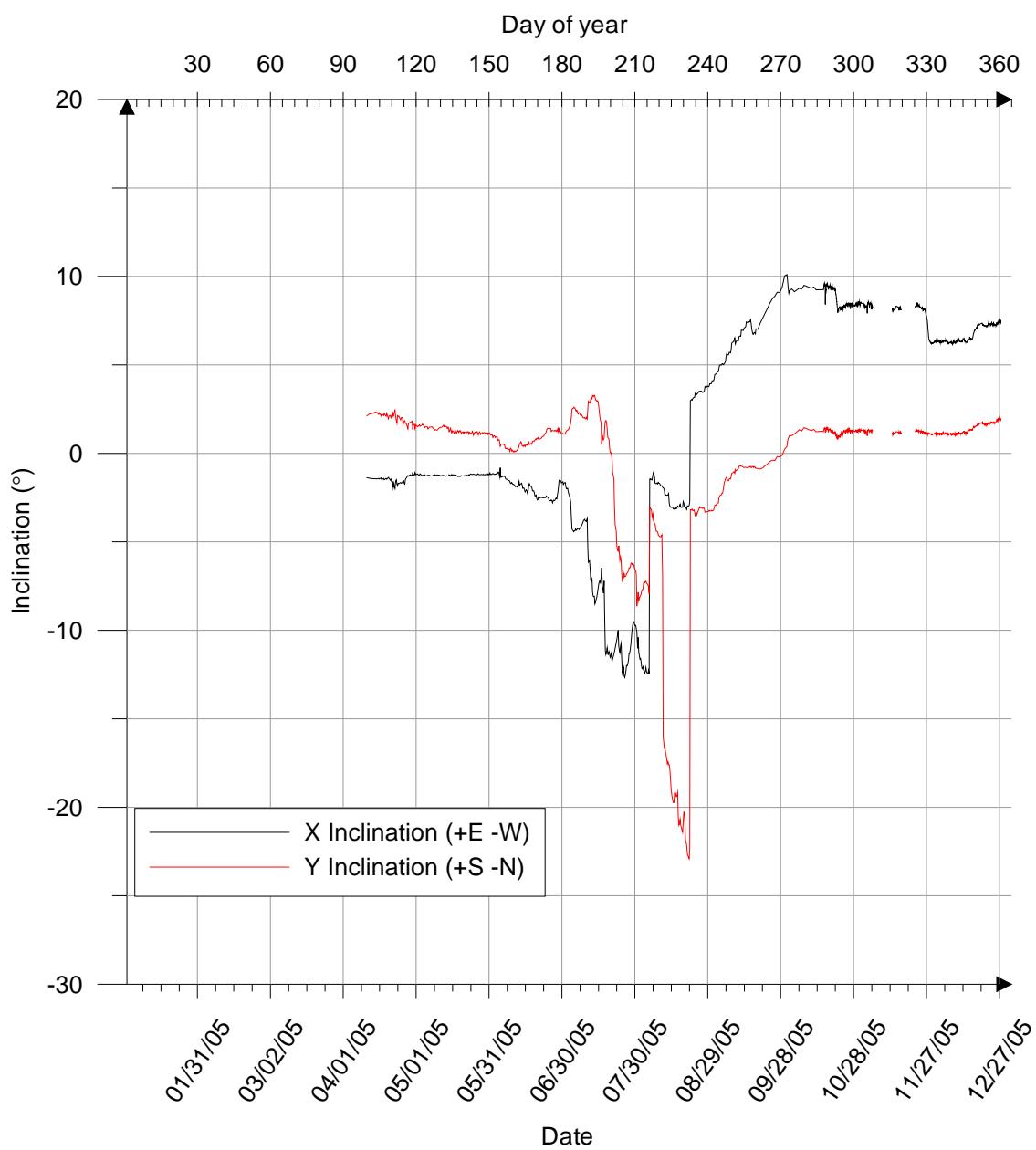
St71.2v2 Radiation 2005



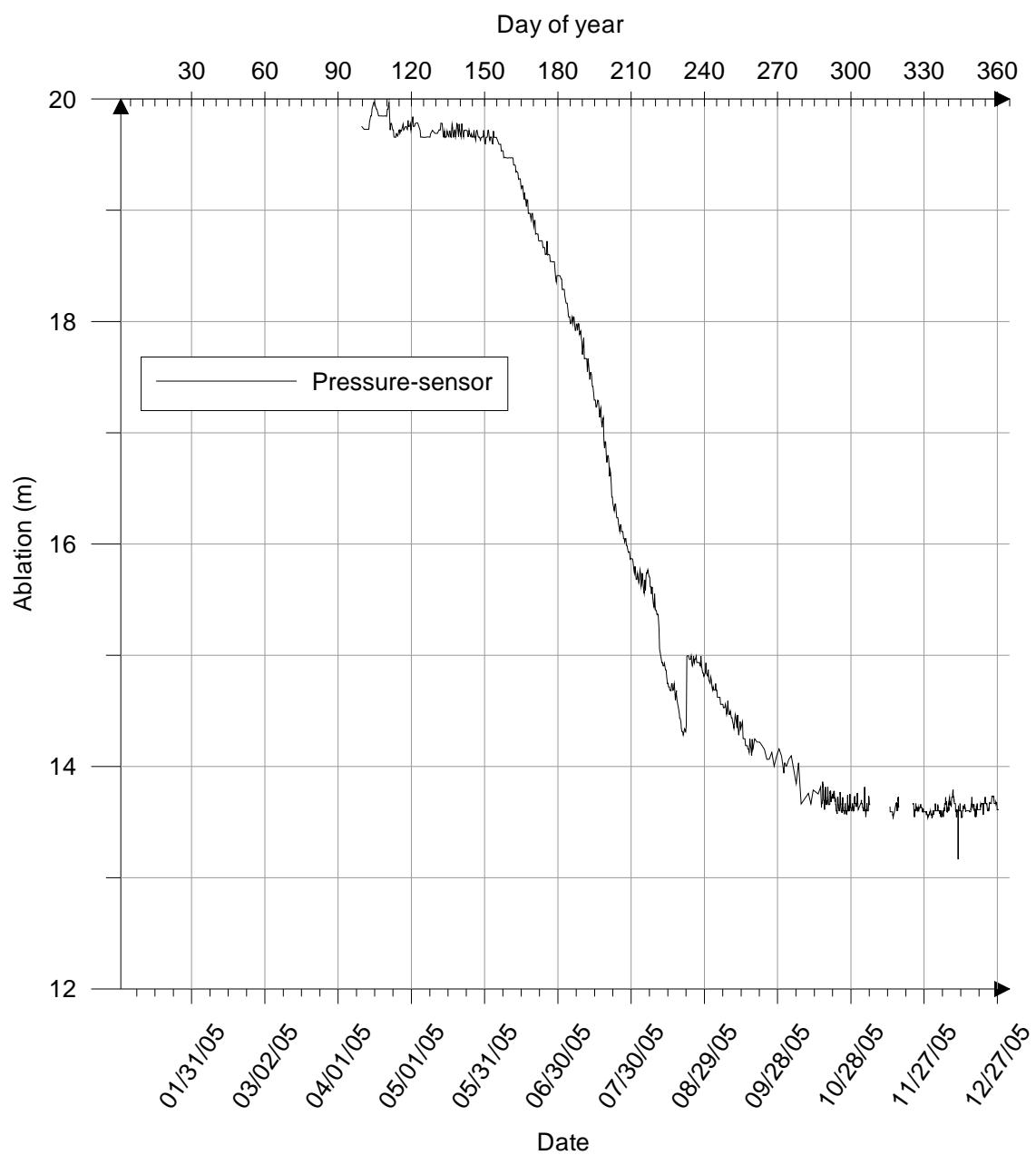
St71.2v2 Compass 2005



St71.2v2 Inclination 2005

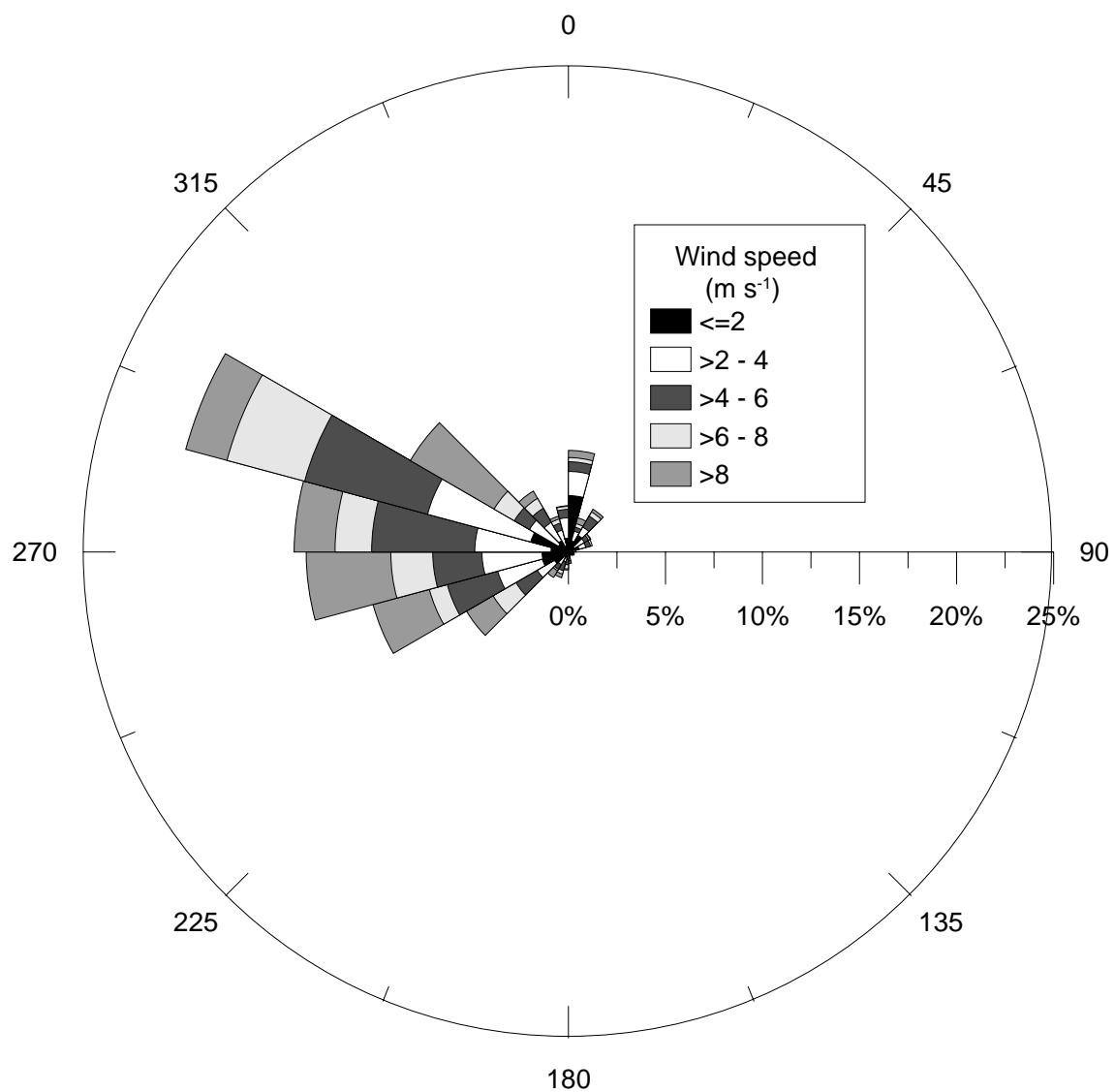


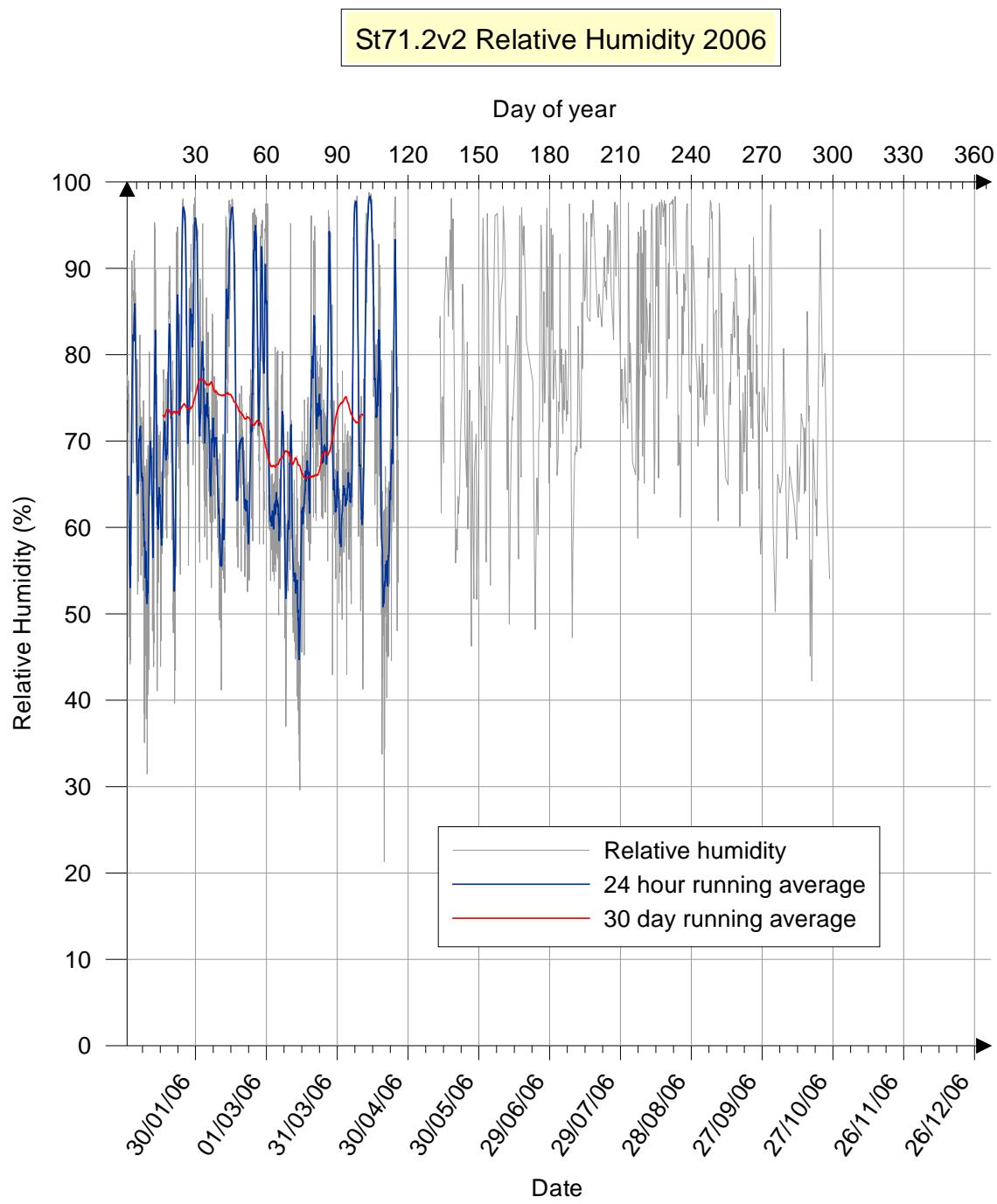
St71 Ablation 2005



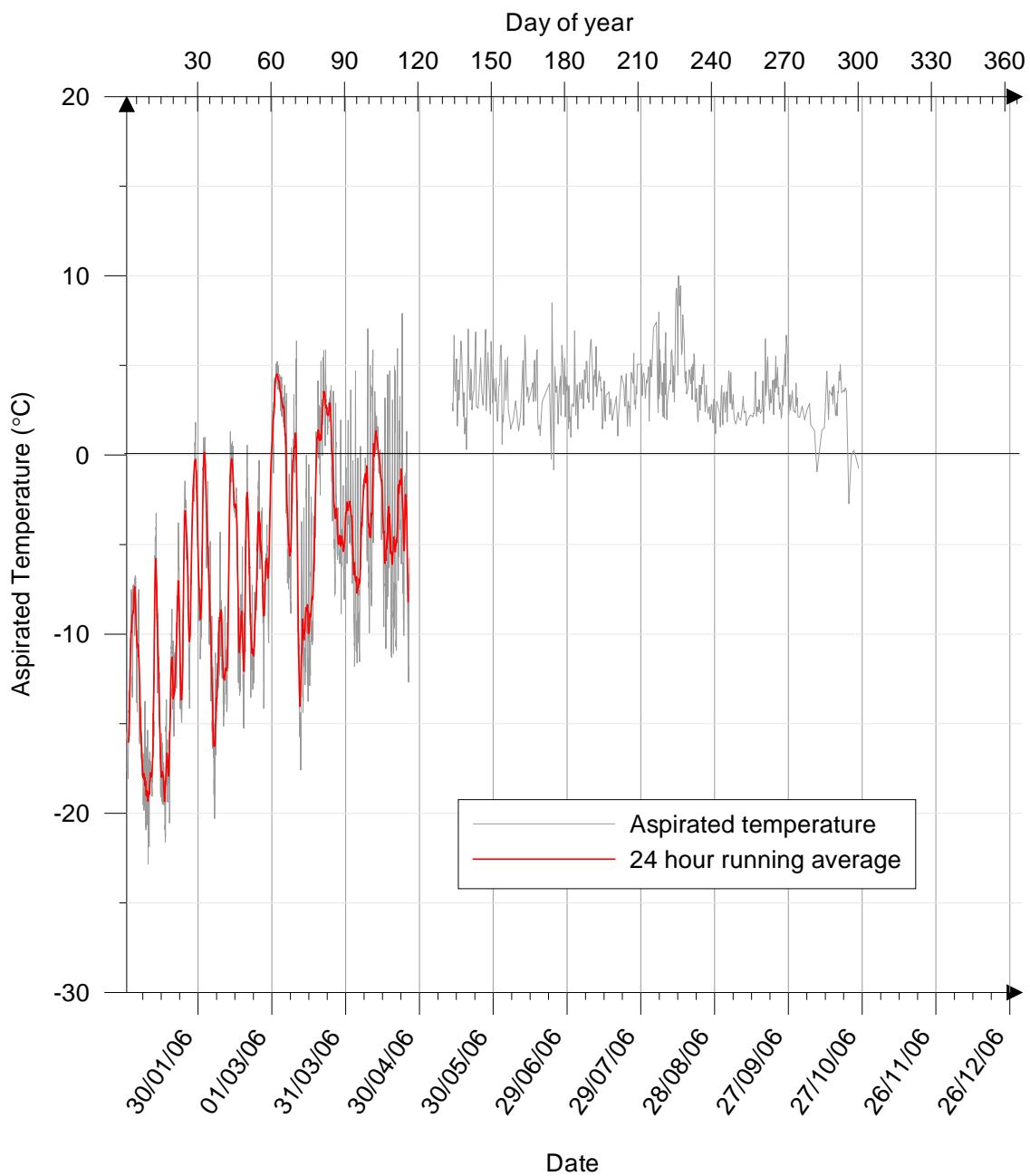
5.2.4 Qaqertoq stations in 2006

St71.2v2 Wind chart 2006 (Jan-May, May-Oct)

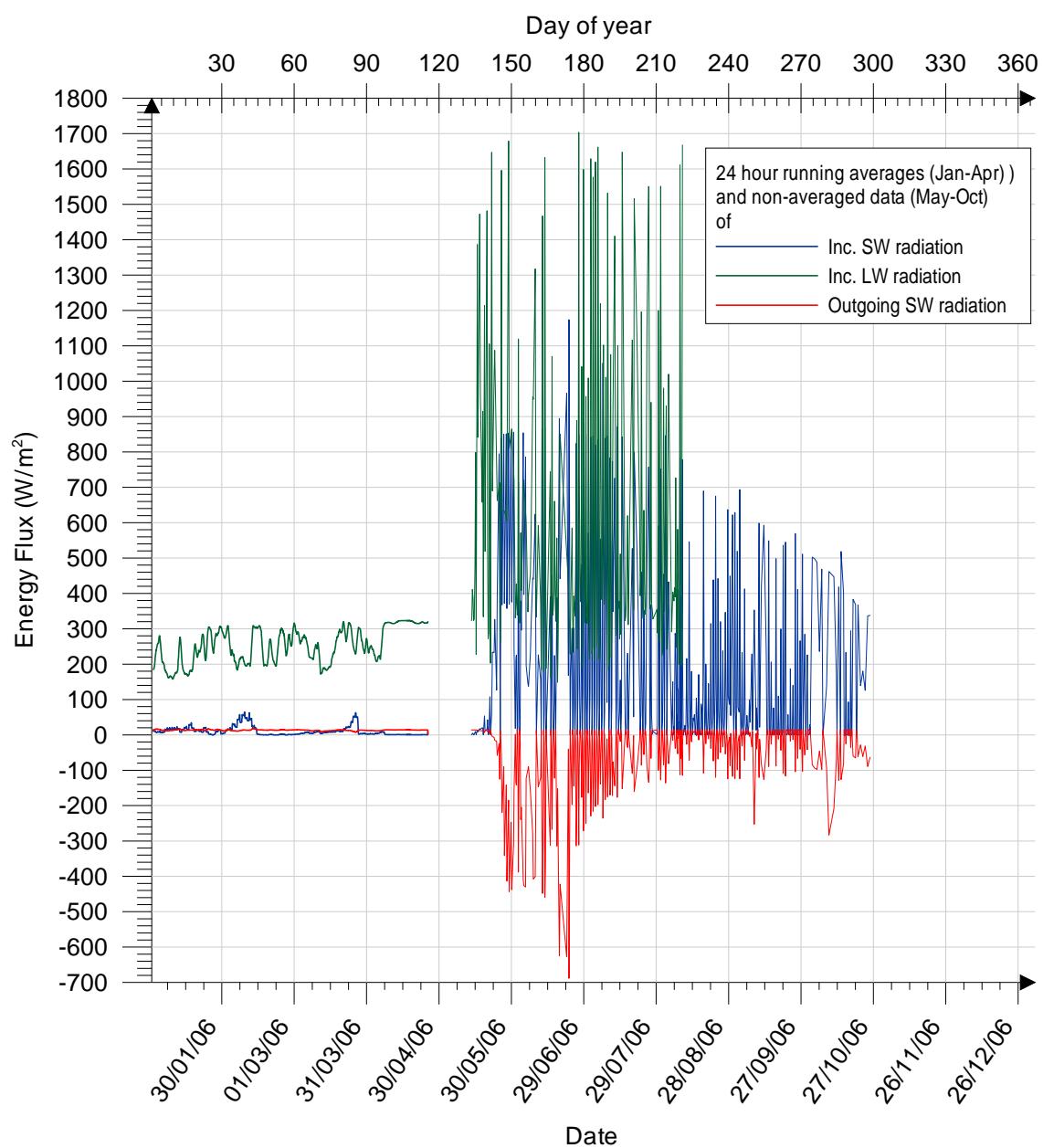




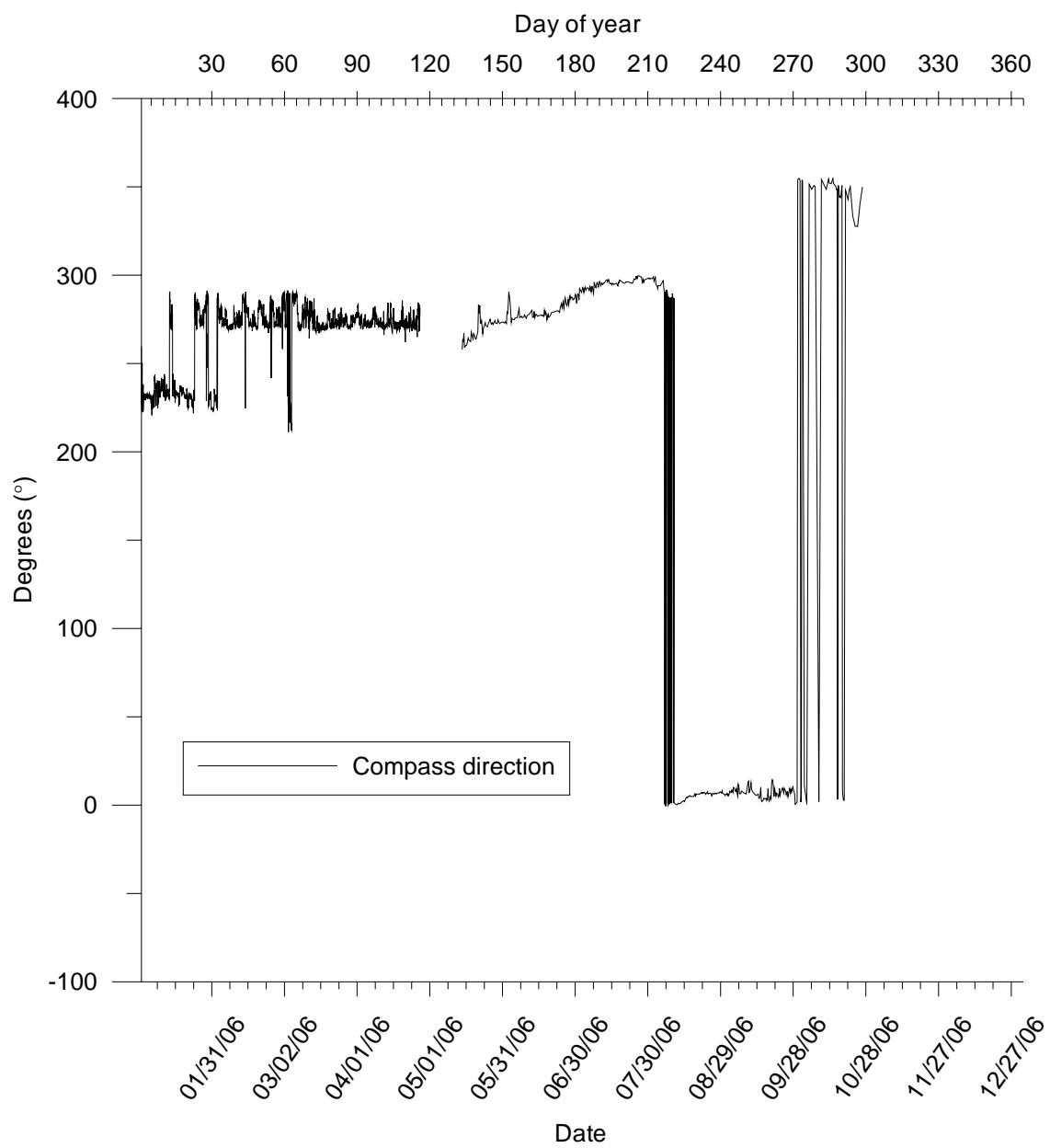
St71.2v2 Aspirated Temperature 2006



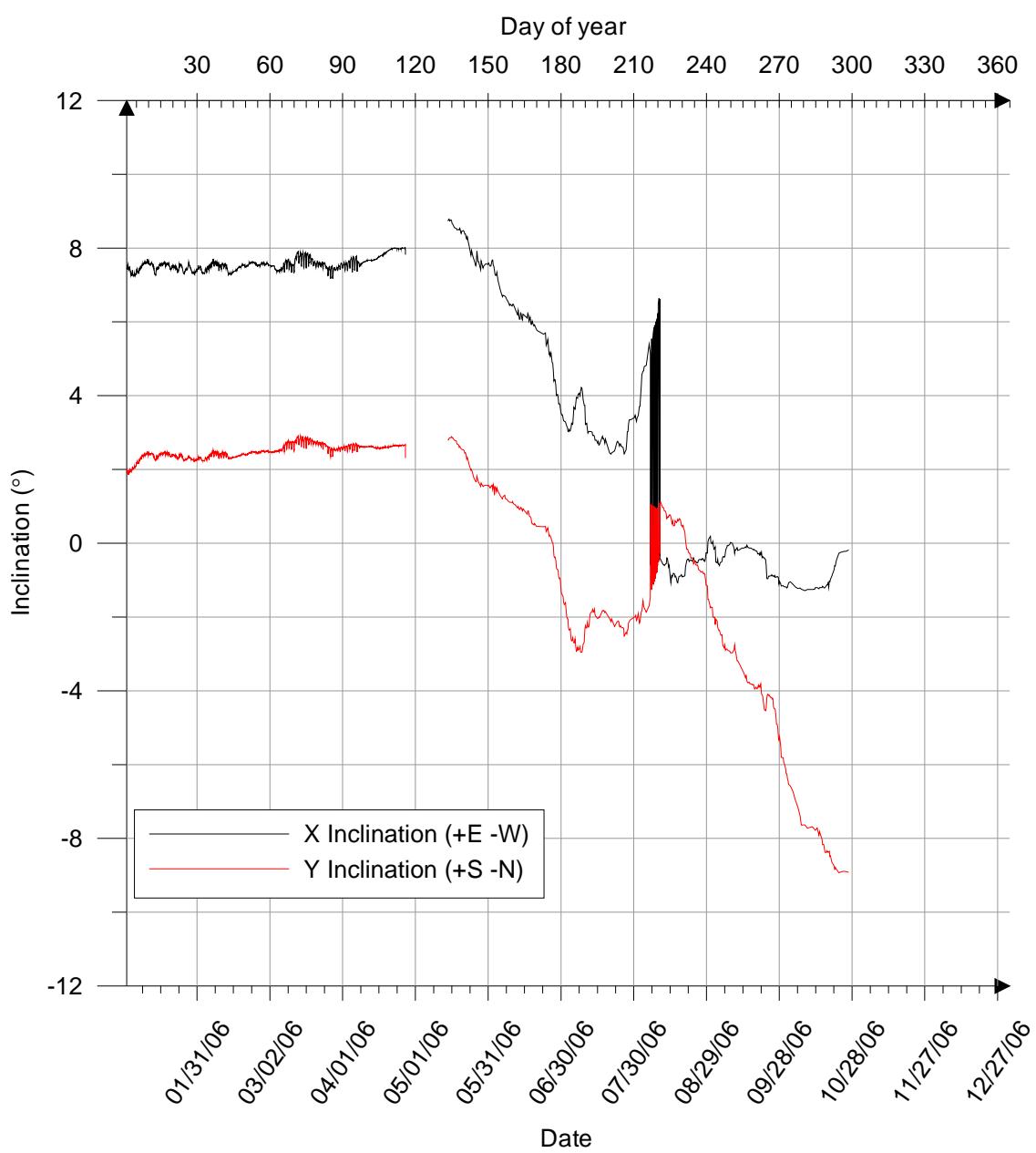
St71.2v2 Radiation 2006



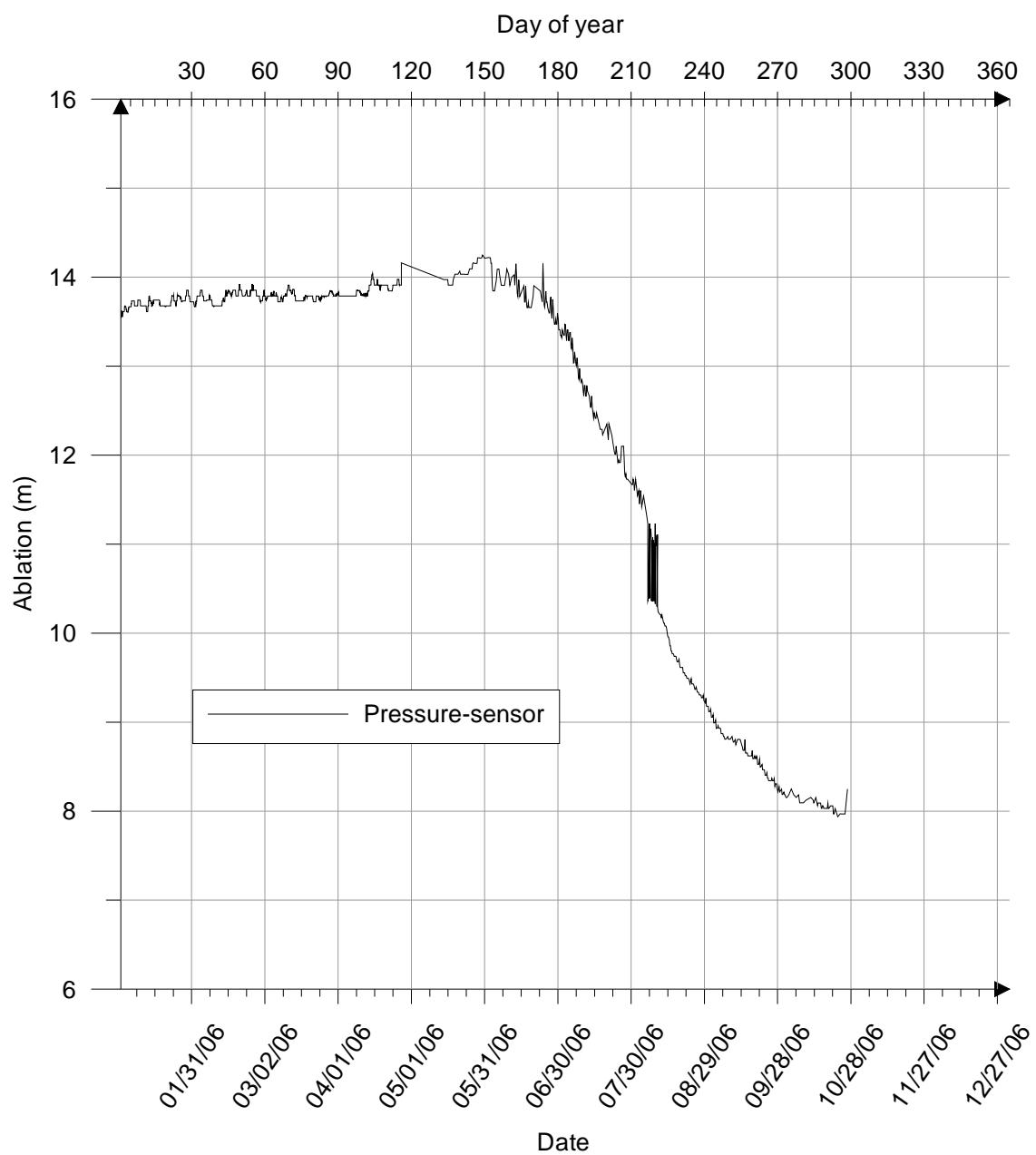
St71.2v2 Compass 2006



St71.2v2 Inclination 2006



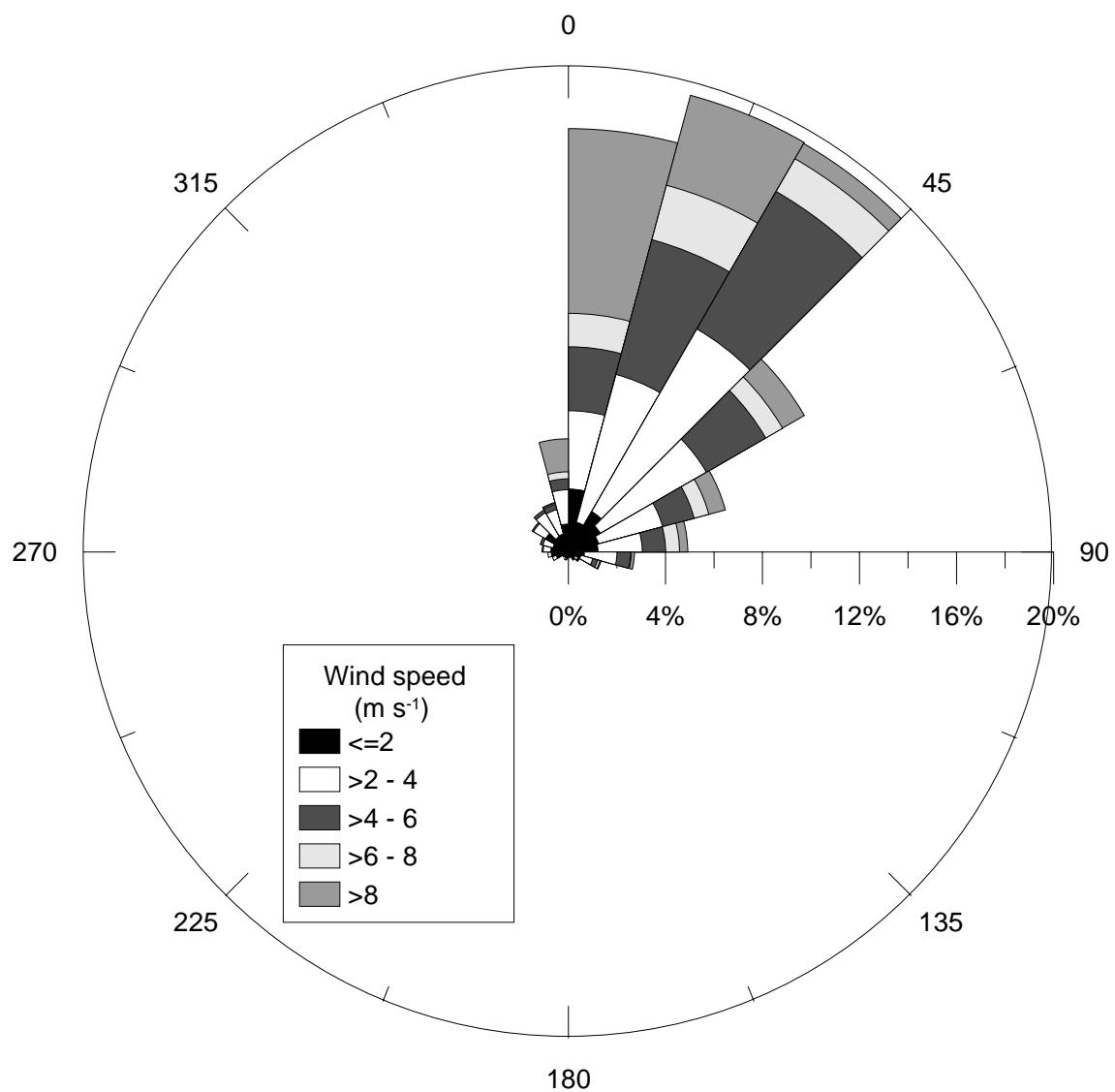
St71.2v2 Ablation 2006

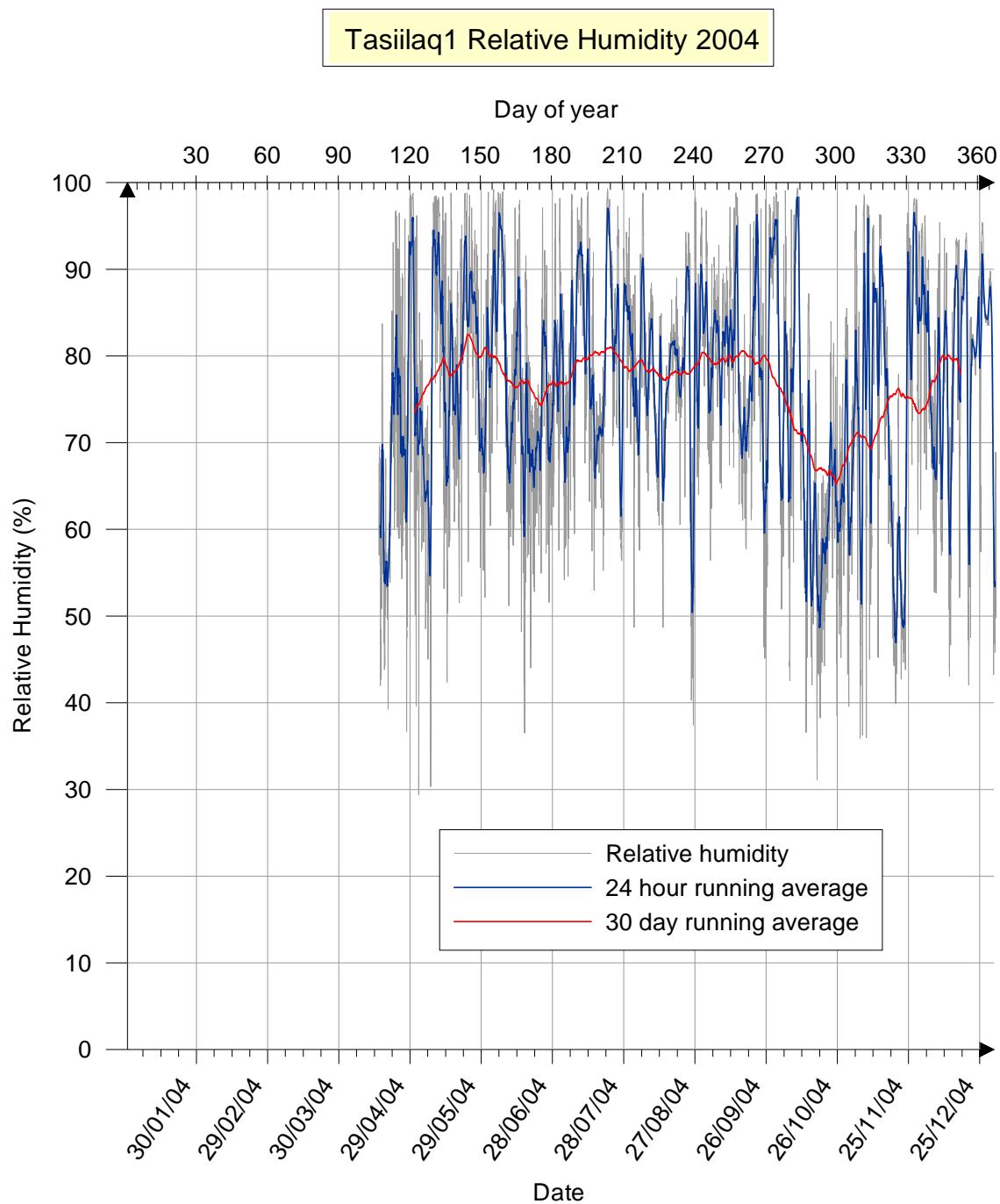


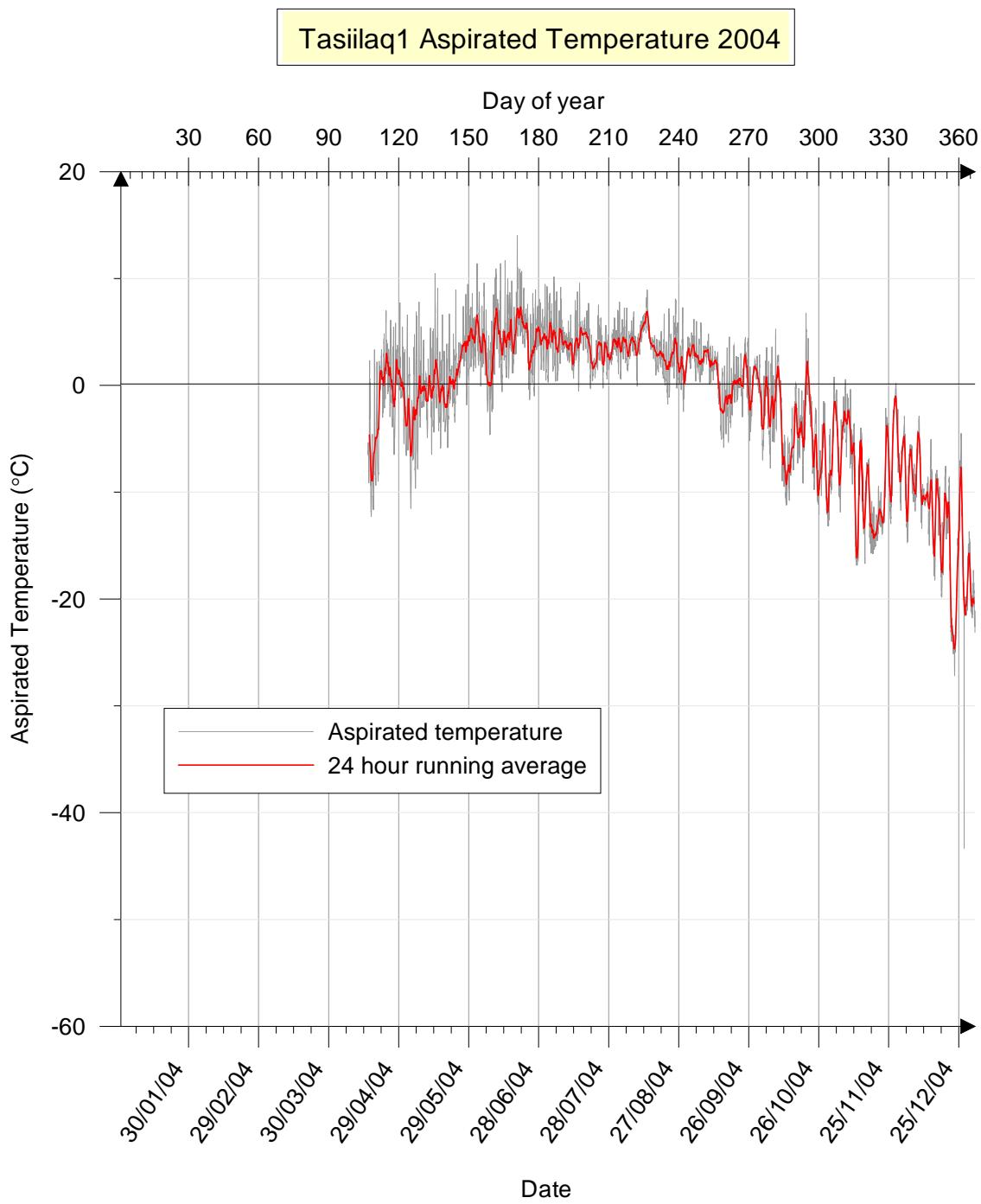
5.3 Tasiilaq stations

5.3.1 Tasiilaq stations in 2004

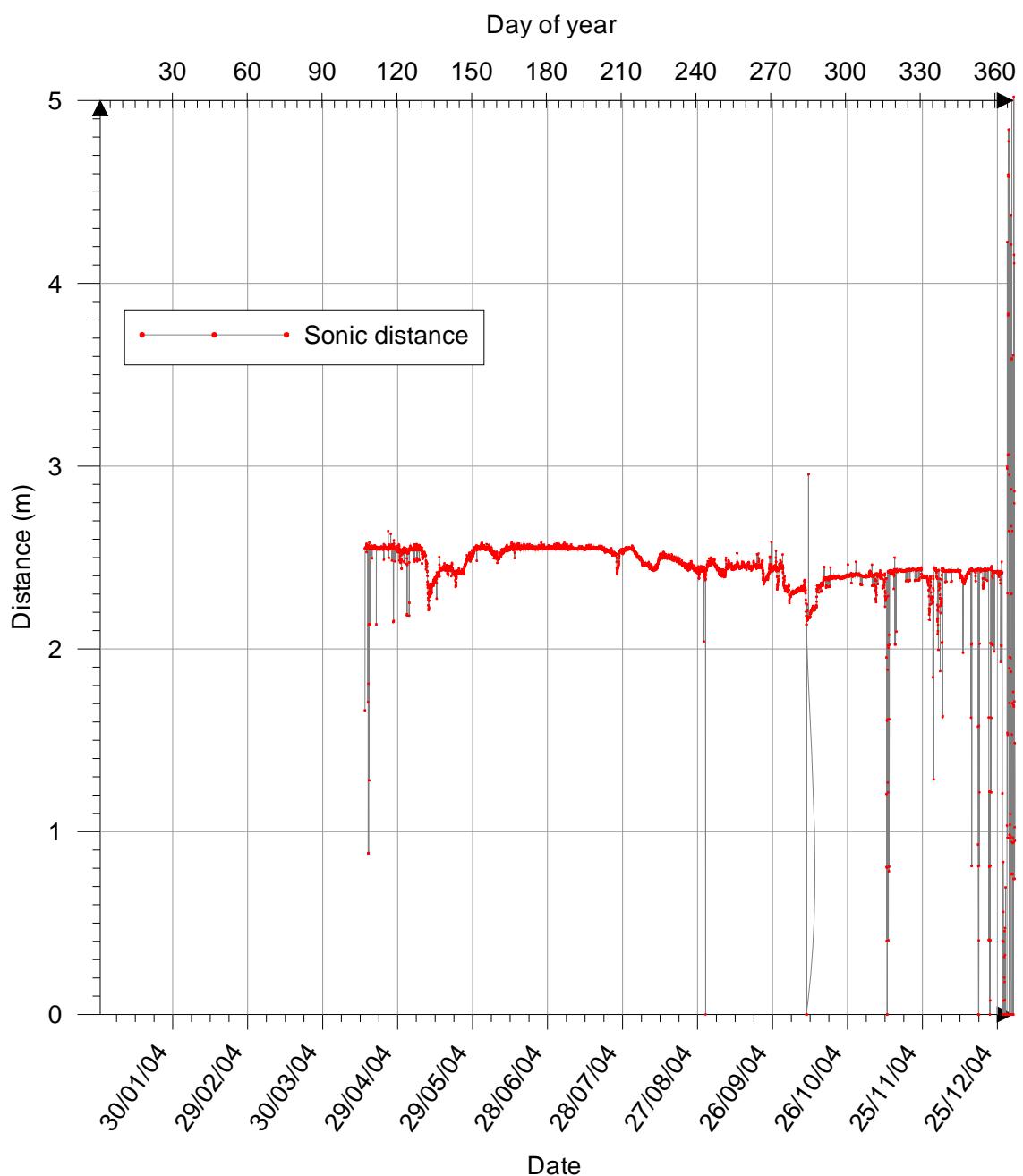
Tasiilaq1 Wind chart 2004 (May-Dec)



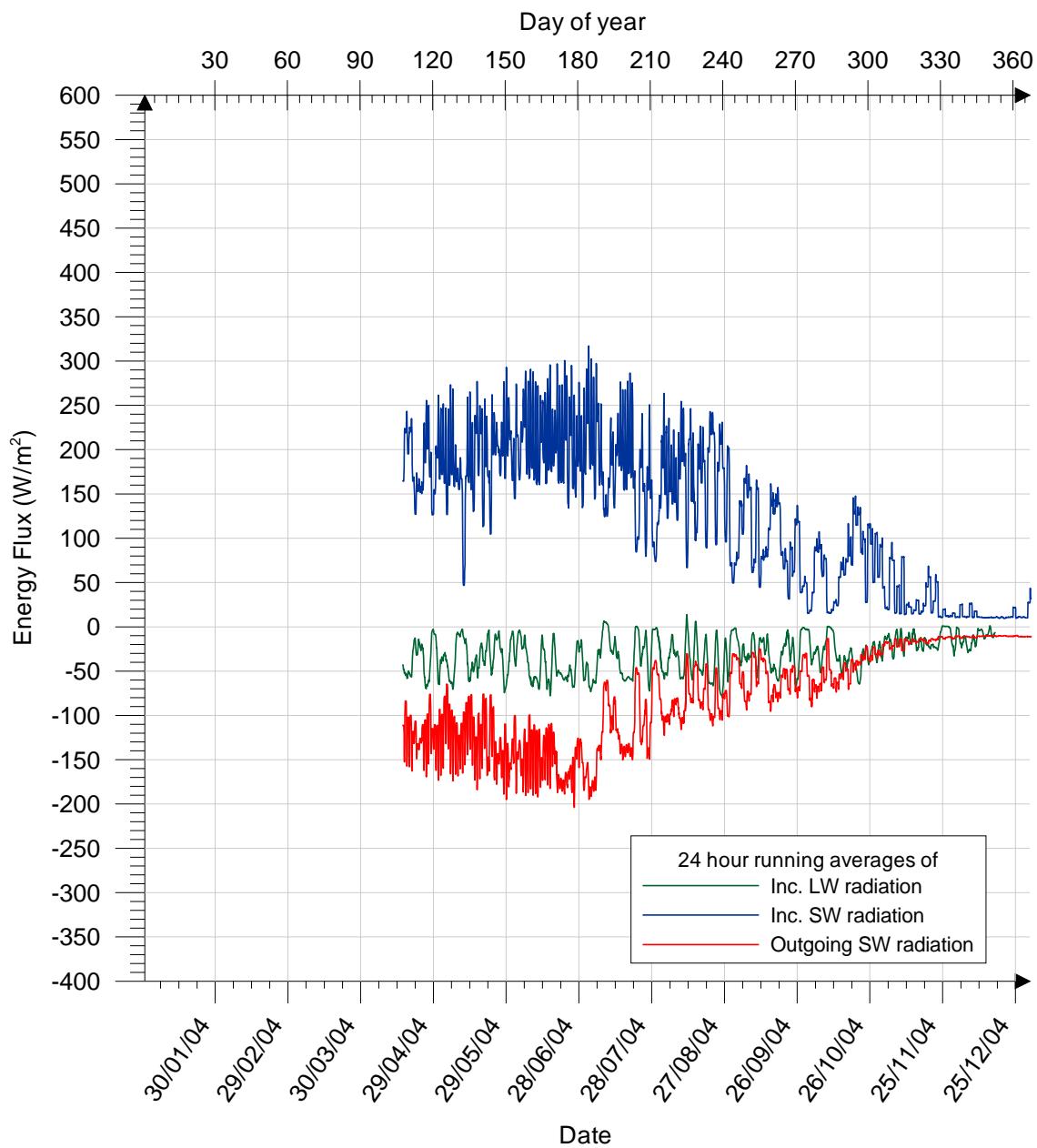




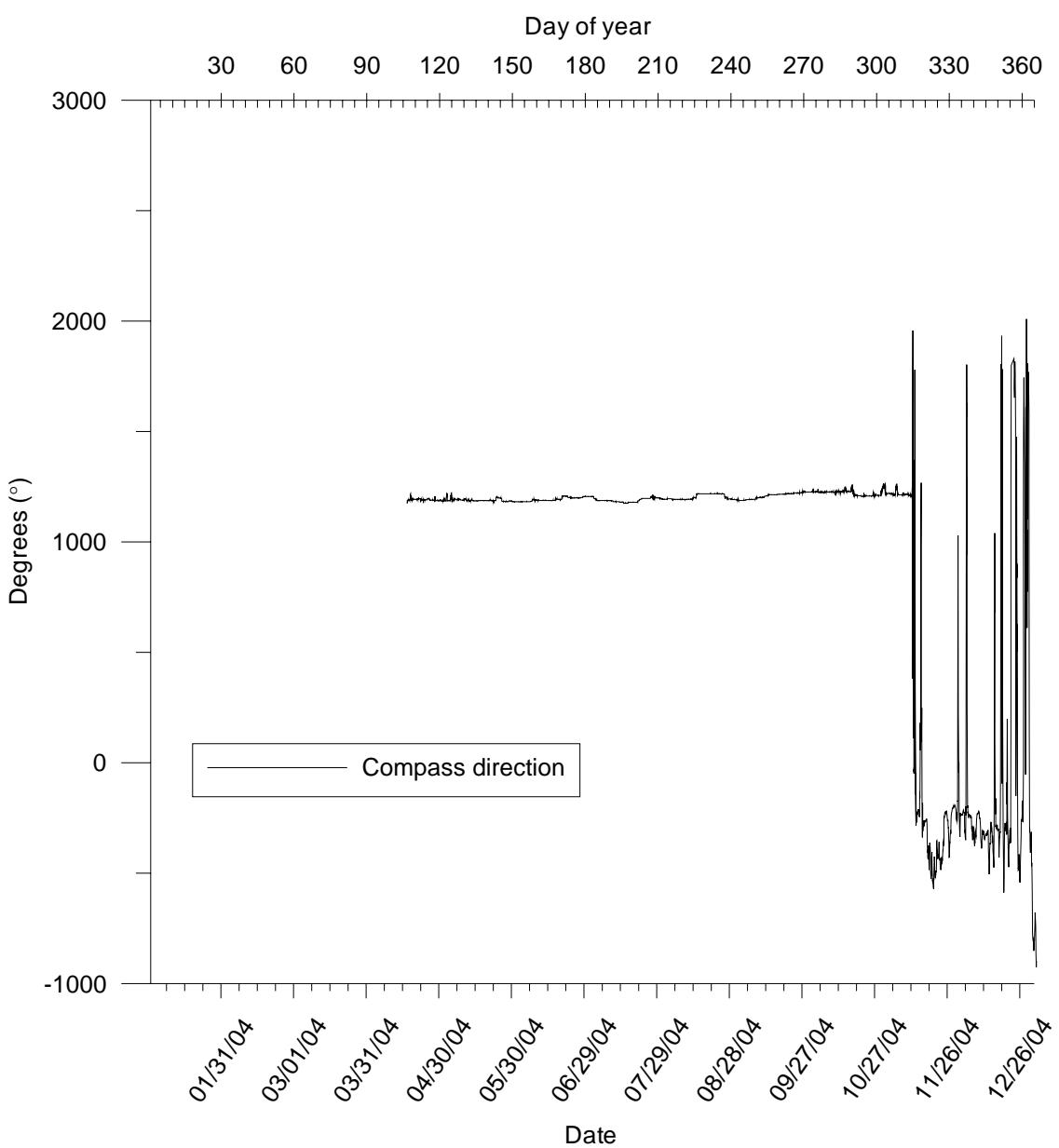
Tasiilaq1 Sonic Ranger 2004



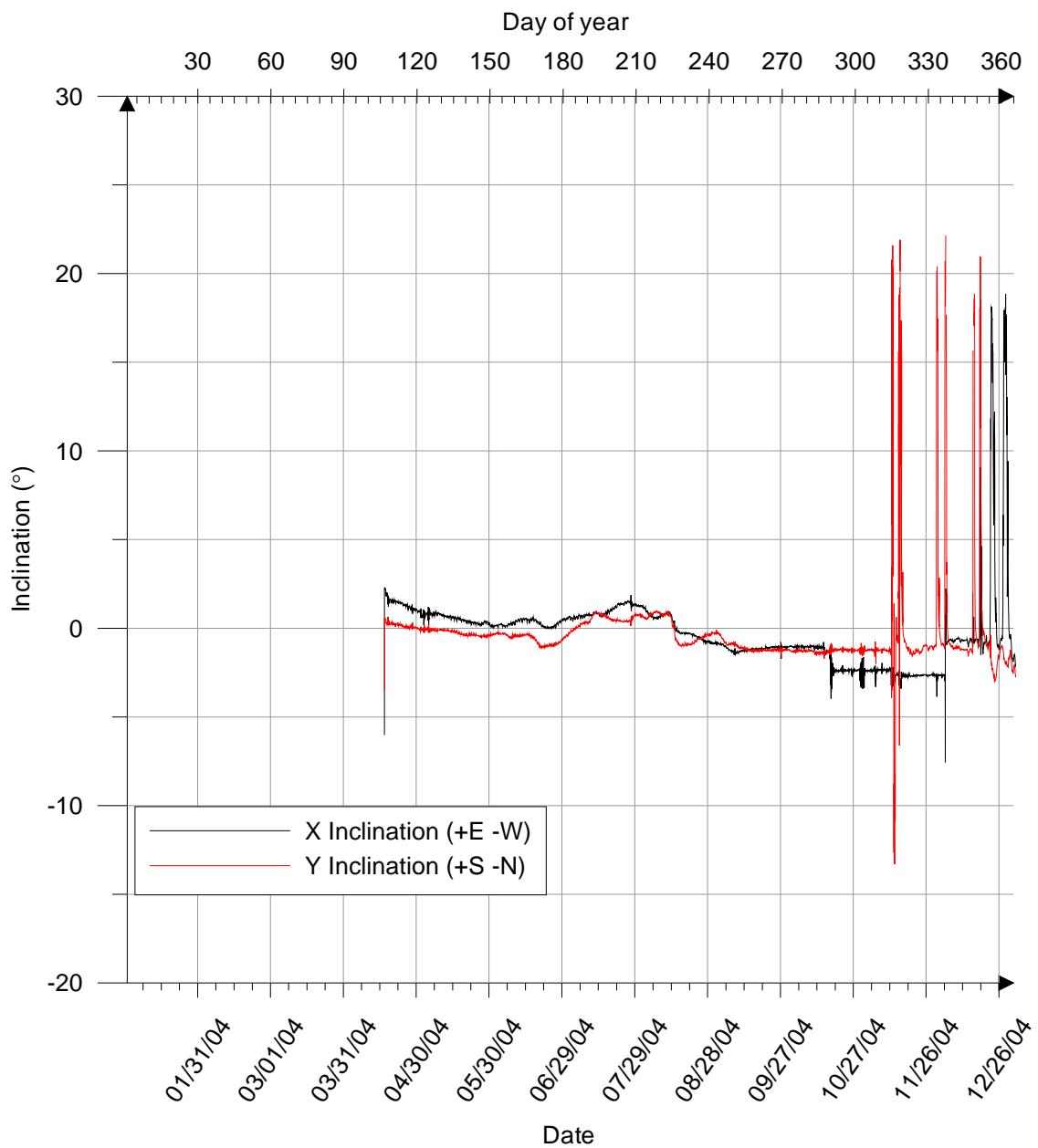
Tasiilaq1 Radiation 2004



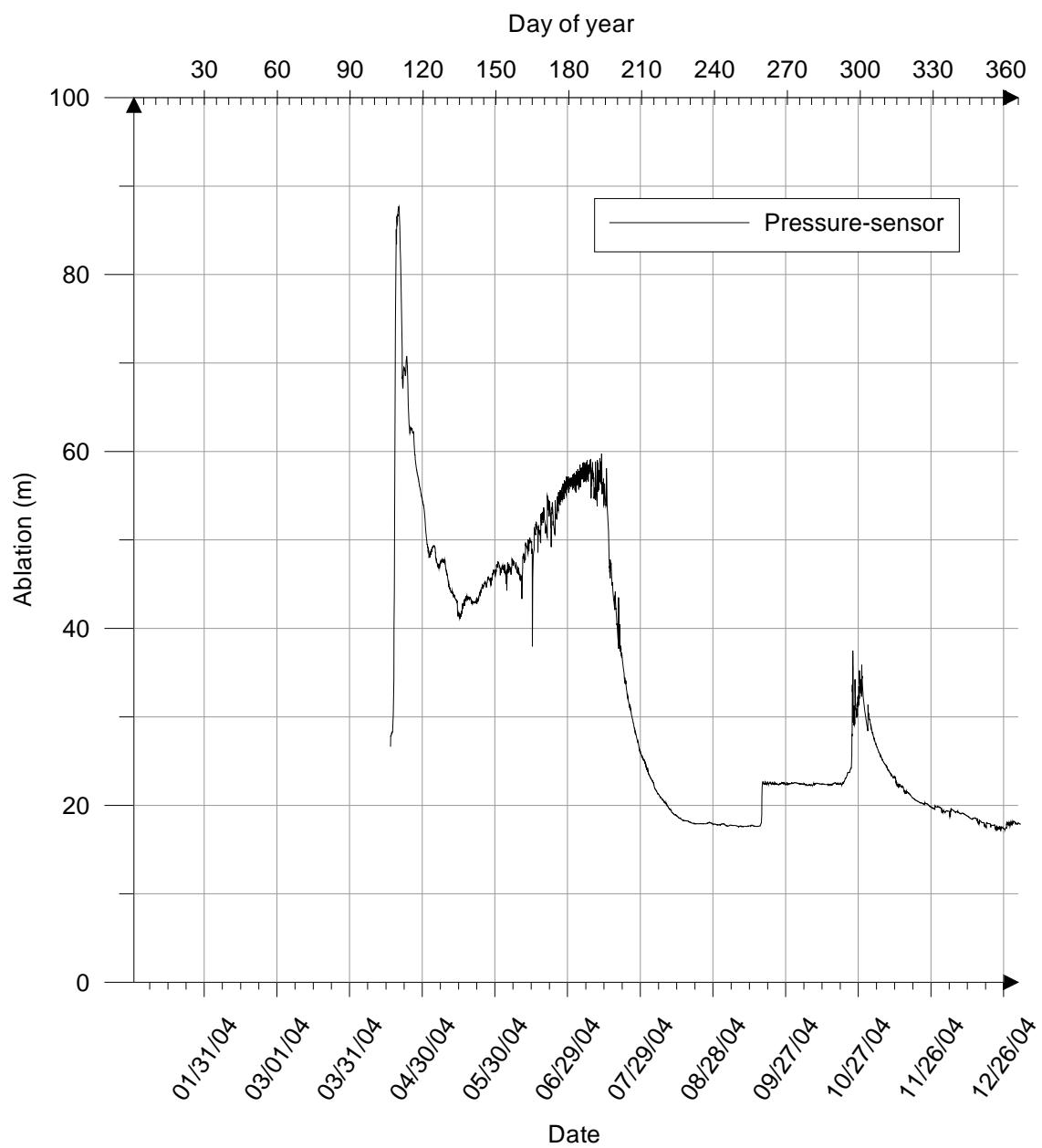
Tasiilaq1 Compass Direction 2004



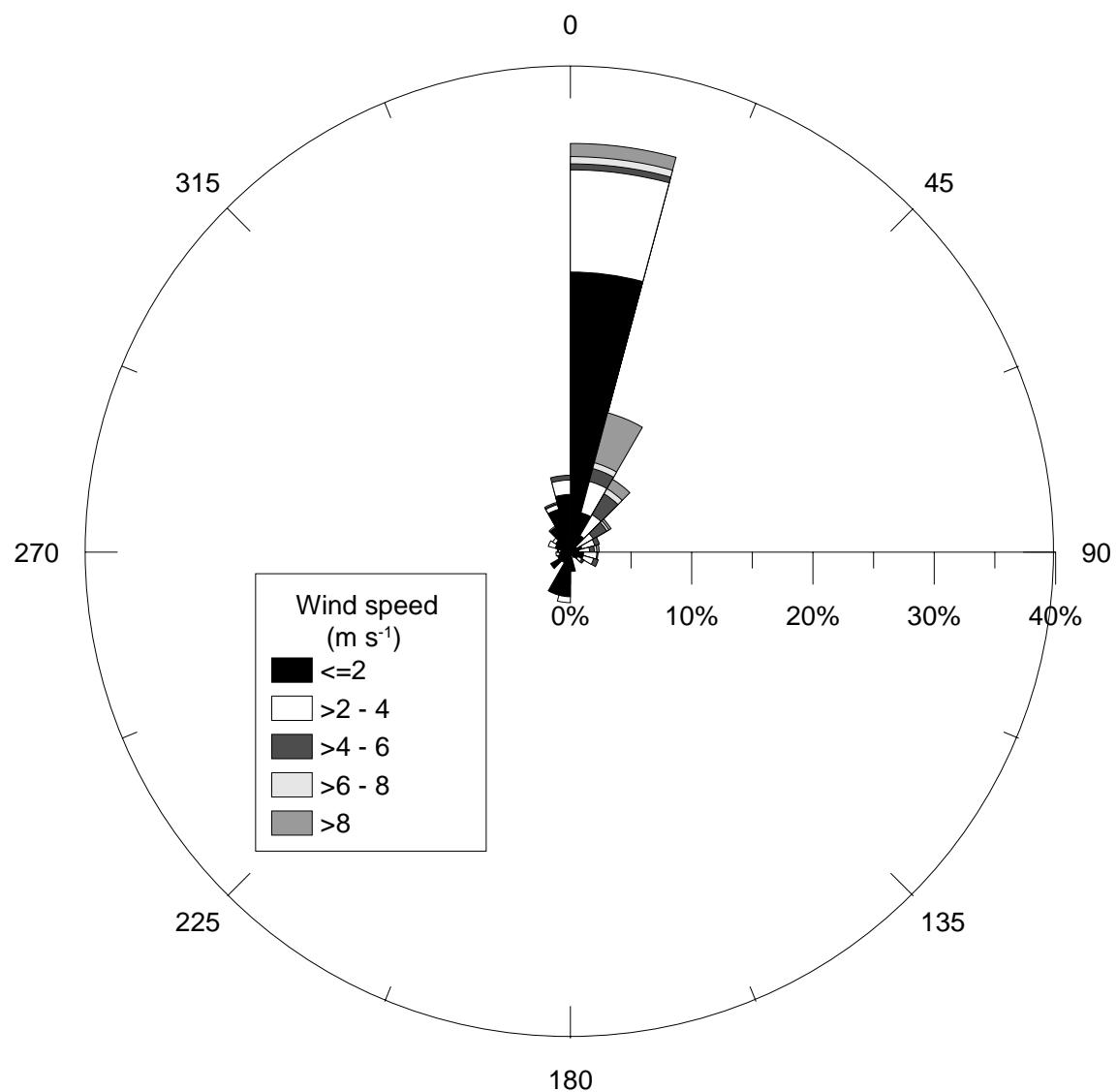
Tasiilaq1 Inclination 2004

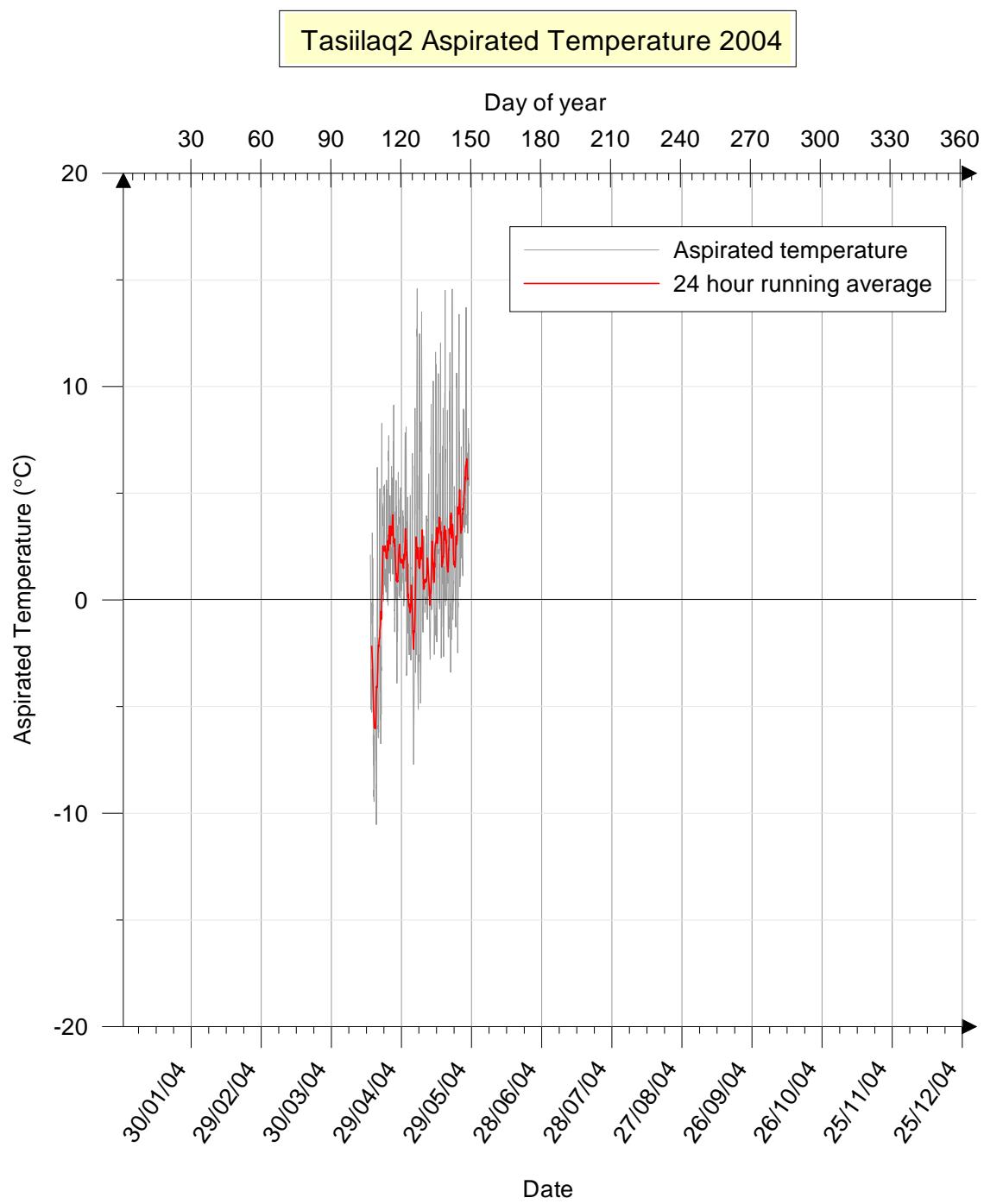


Tasiilaq1 Ablation 2004

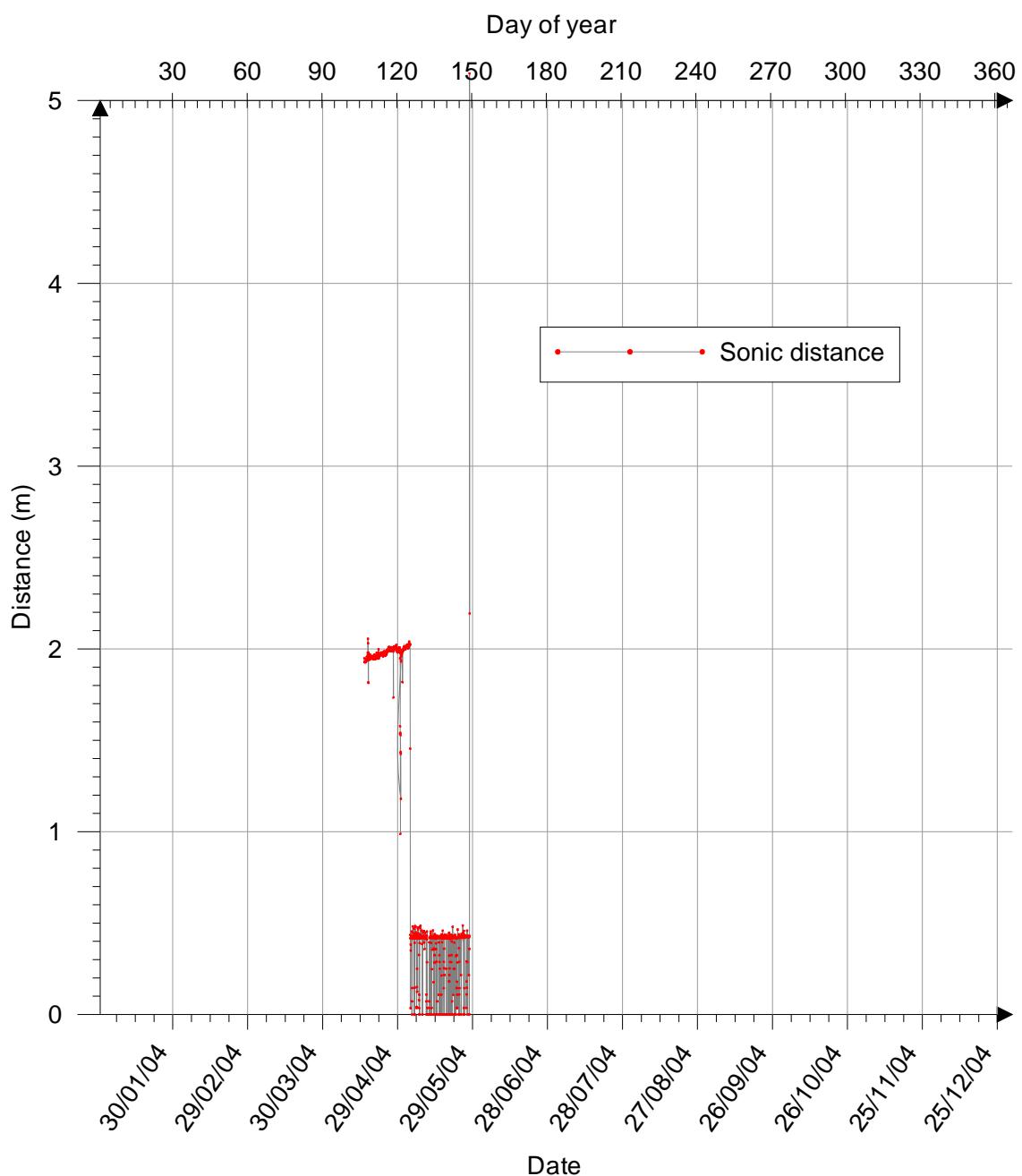


Tasiilaq2 Wind chart 2004 (Apr-May)

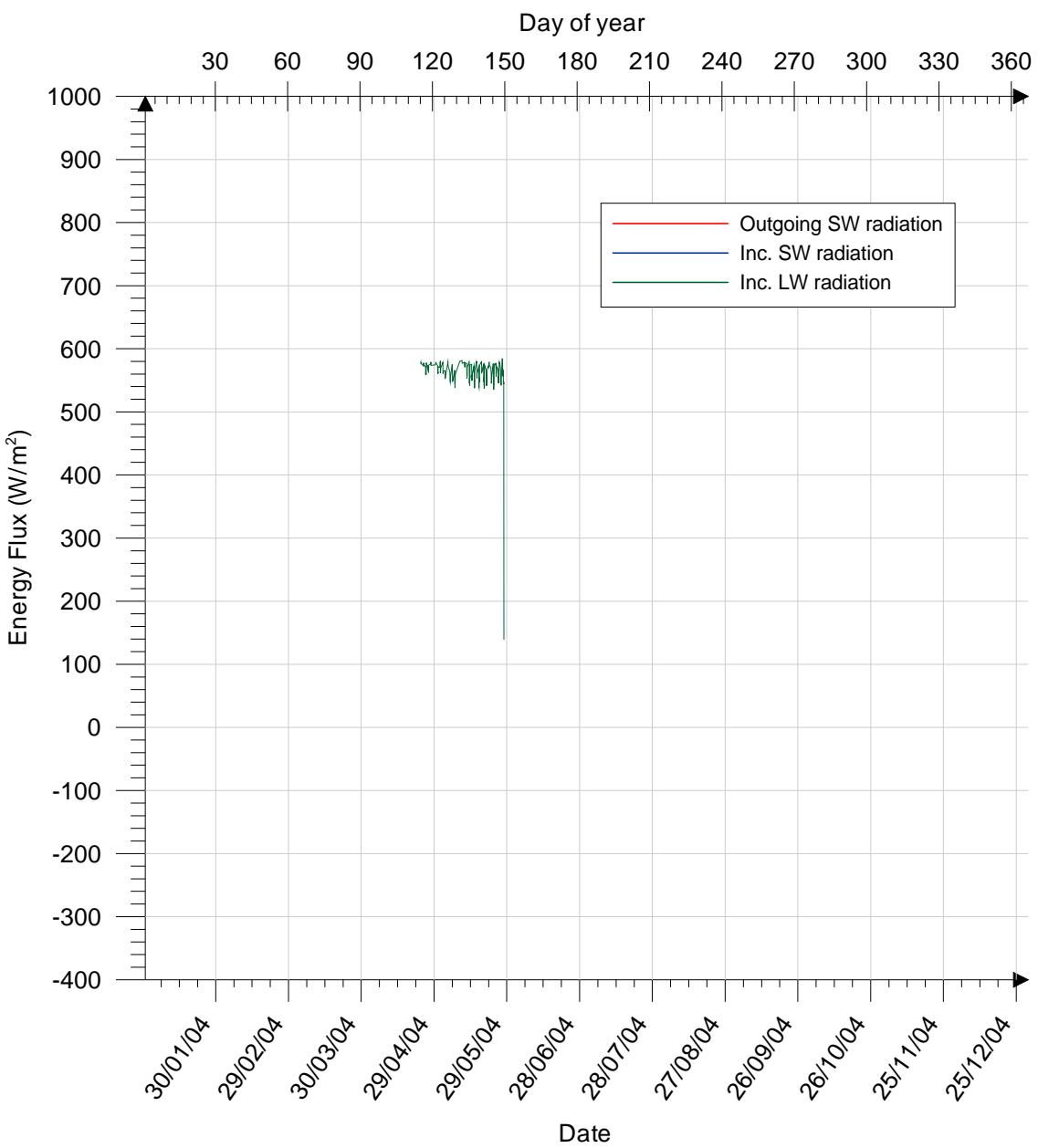




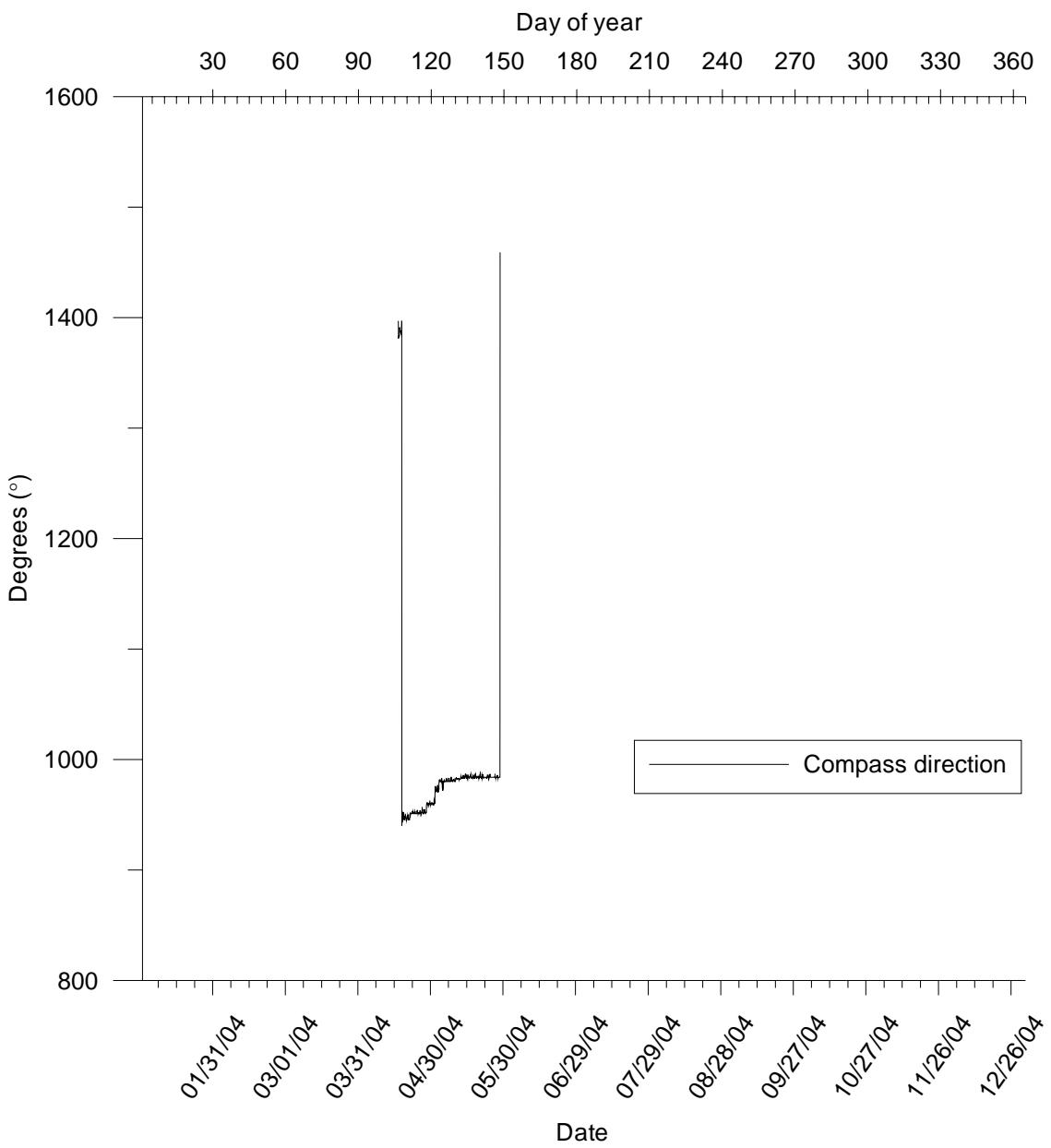
Tasiilaq2 Sonic Ranger 2004



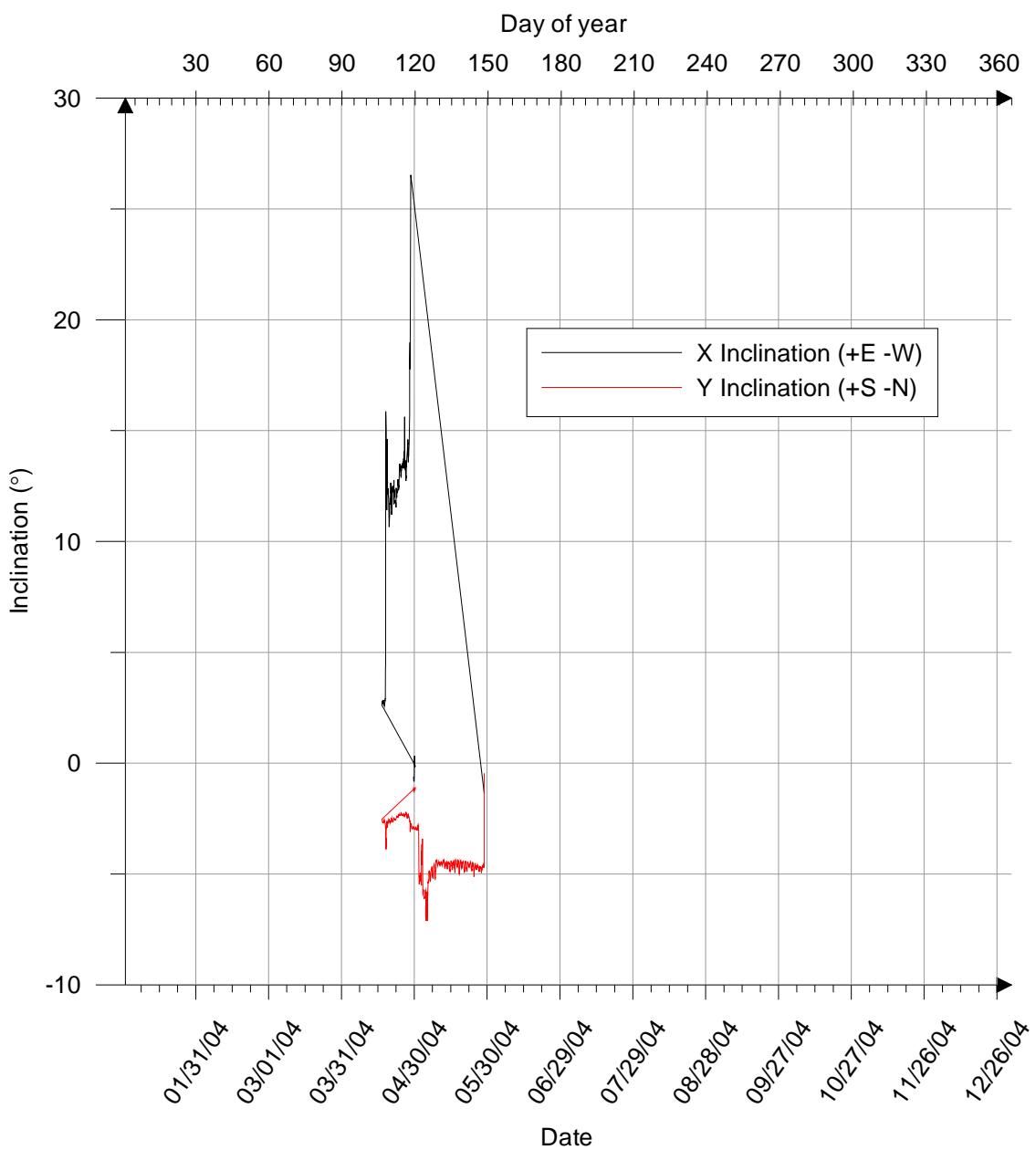
Tasiilaq2 Radiation 2004



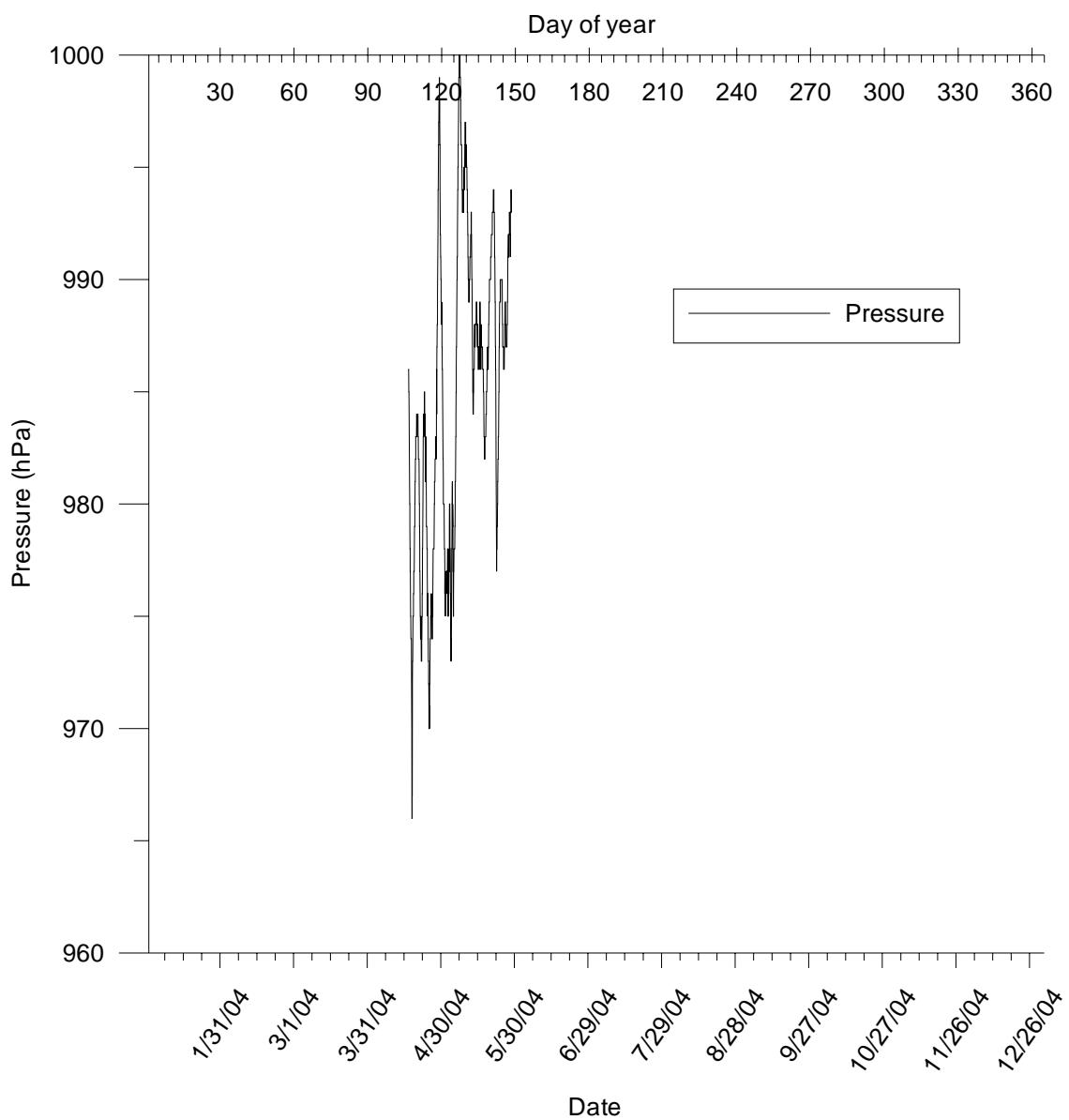
Tasiilaq2 Compass Direction 2004



Tasiilaq2 Inclination 2004

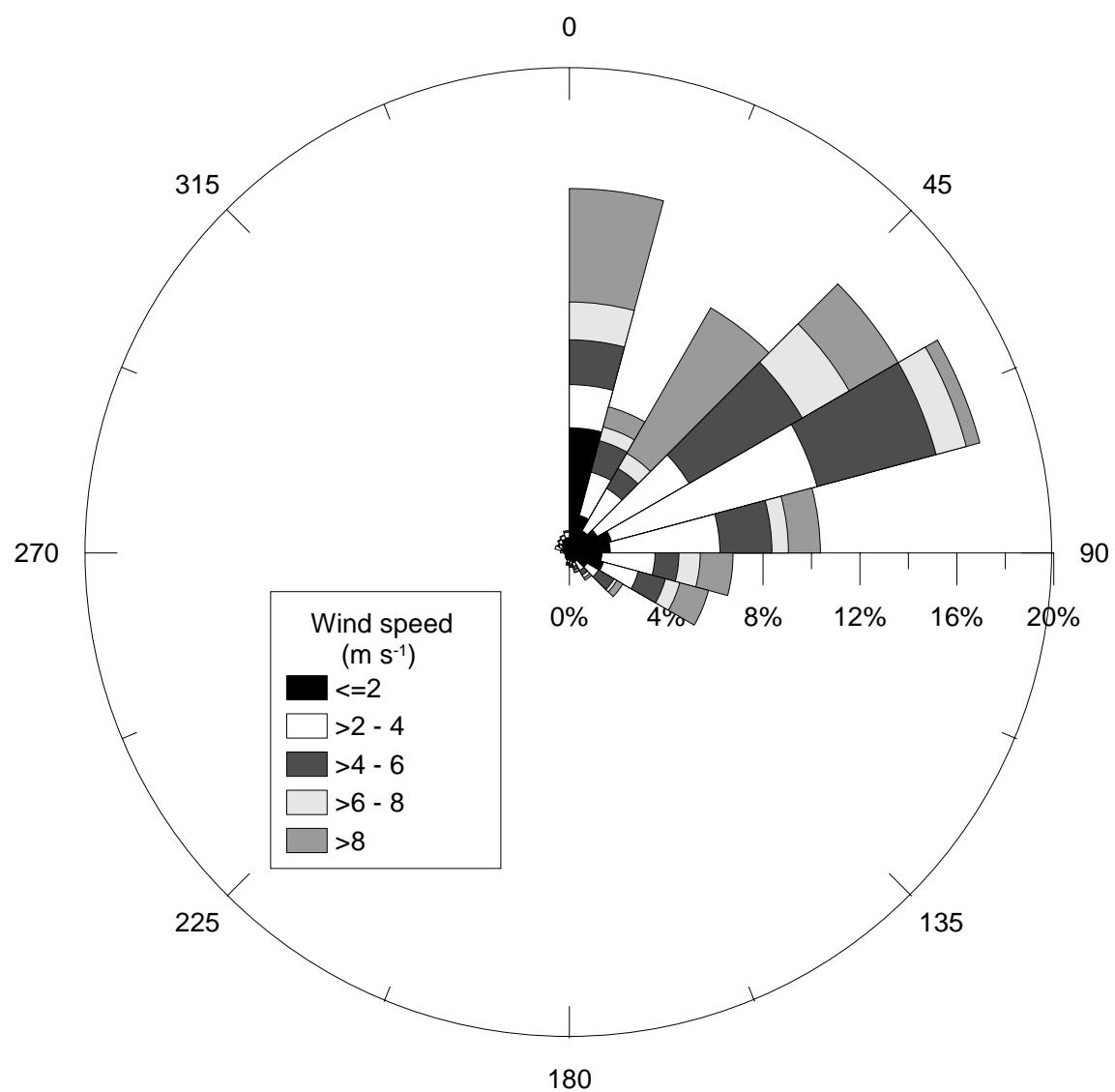


Tasiilaq2 Barometer 2004

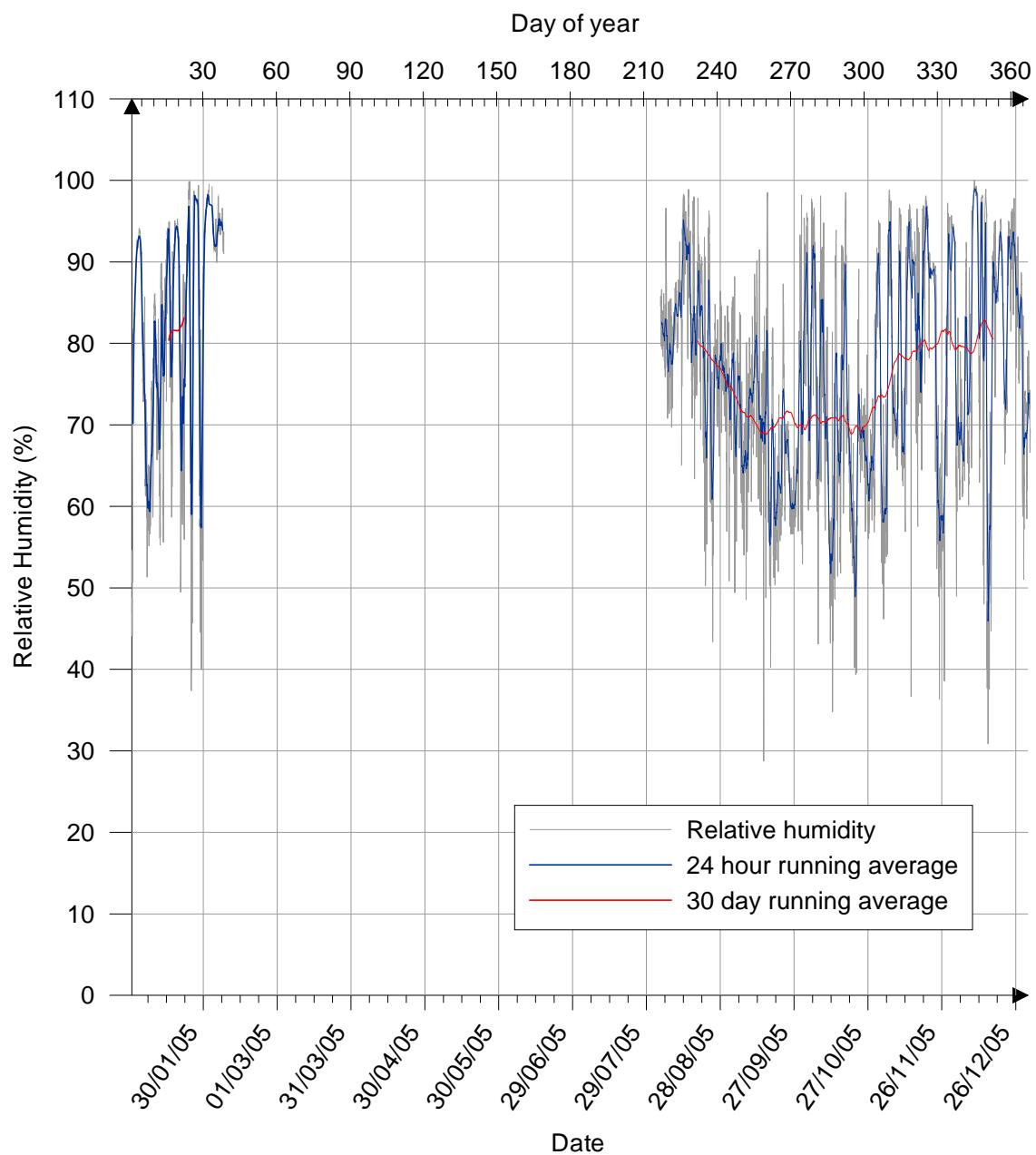


5.3.2 Tasiilaq stations in 2005

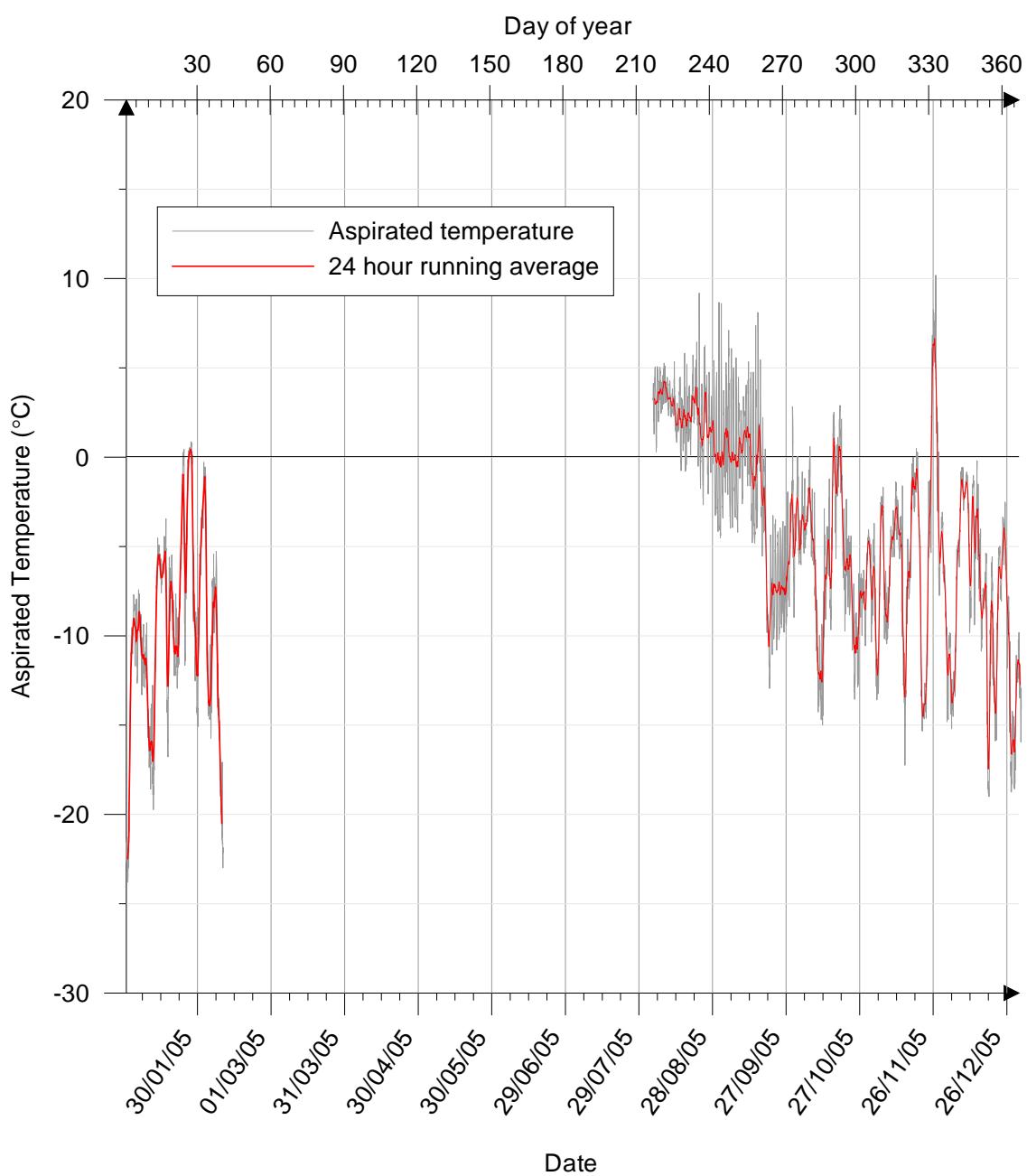
Tasiilaq1 Wind chart 2005 (Jan-Feb, Aug-Dec)



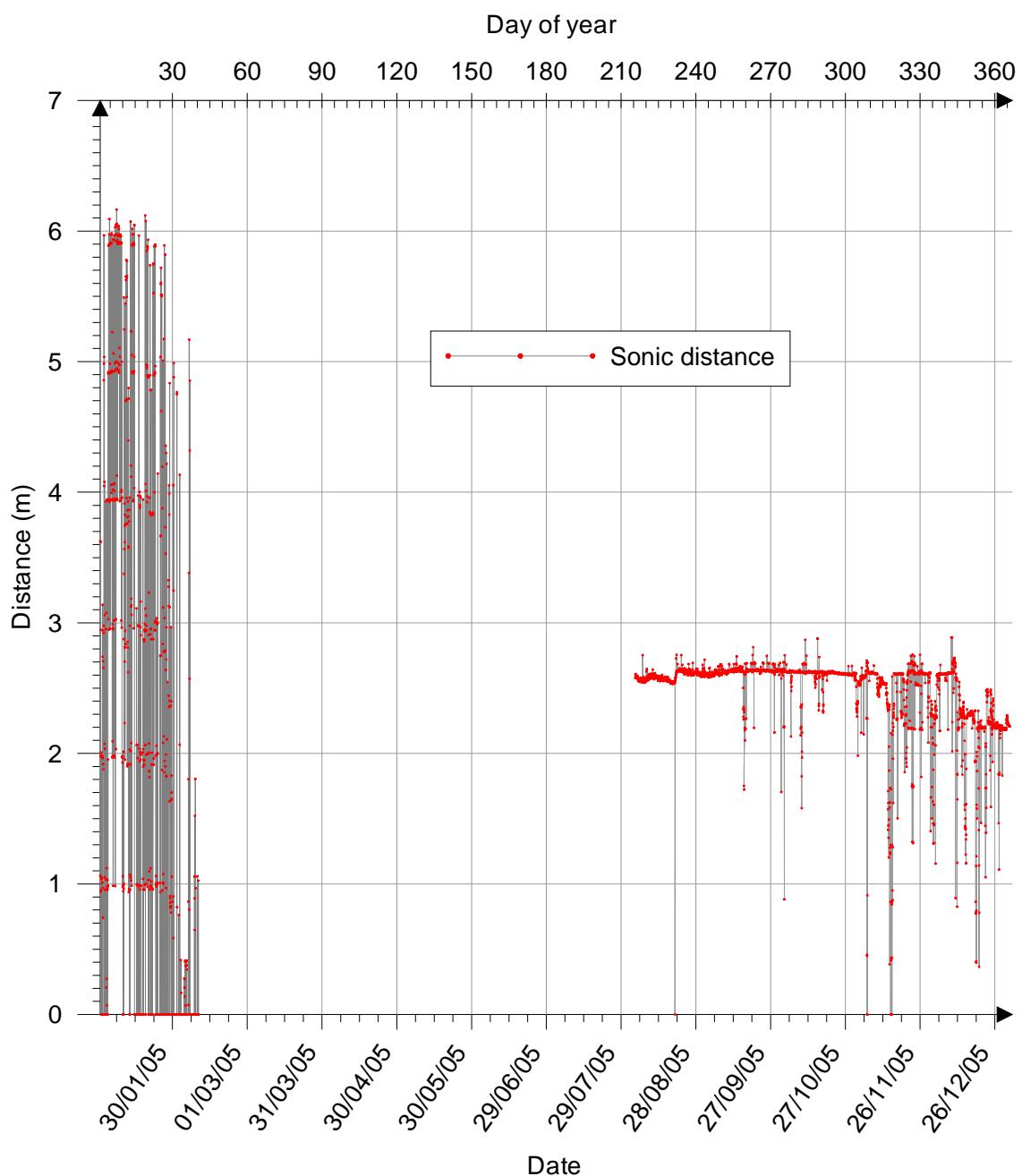
Tasiilaq1 Relative Humidity 2005



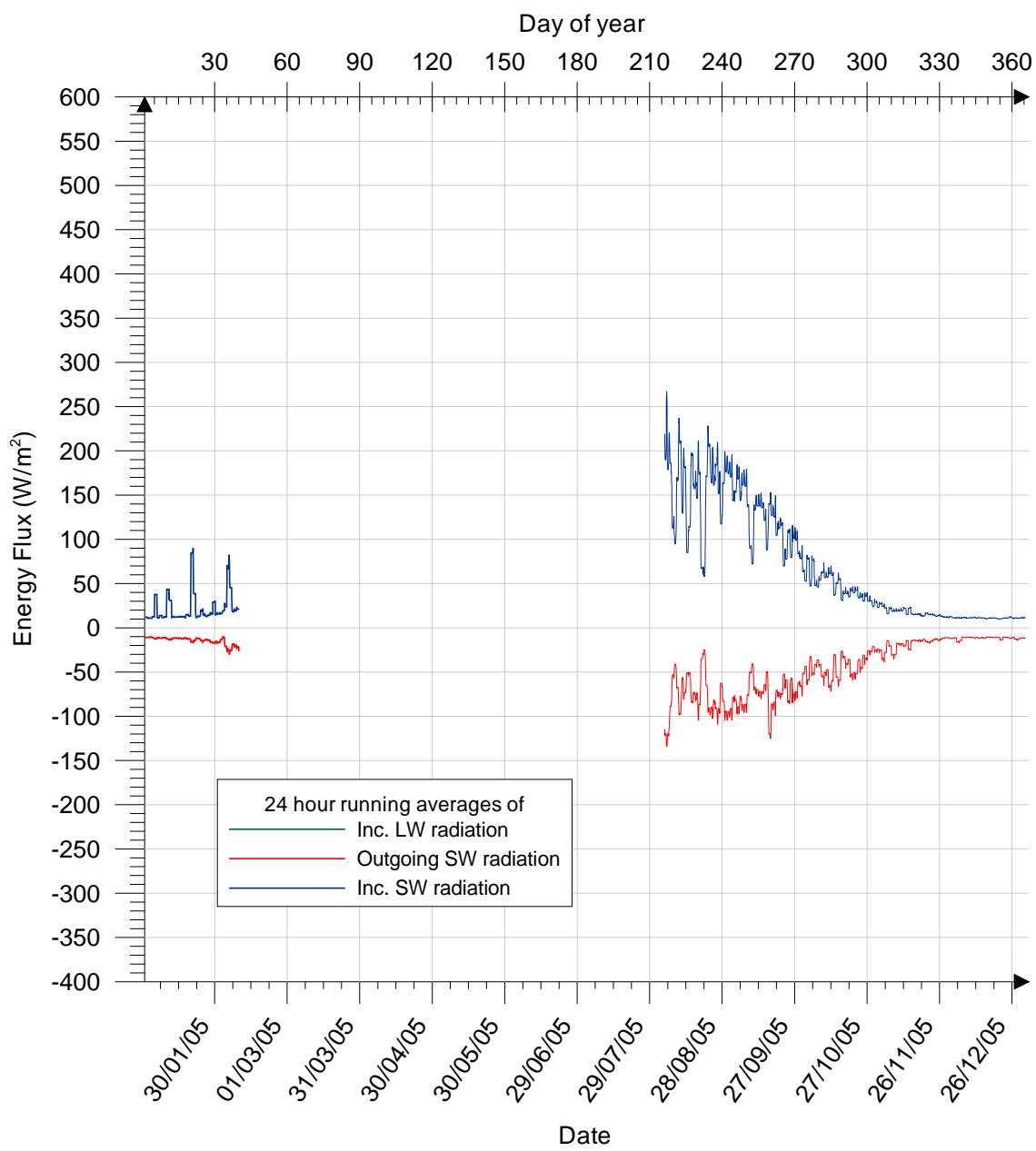
Tasiilaq1 Aspirated Temperature 2005



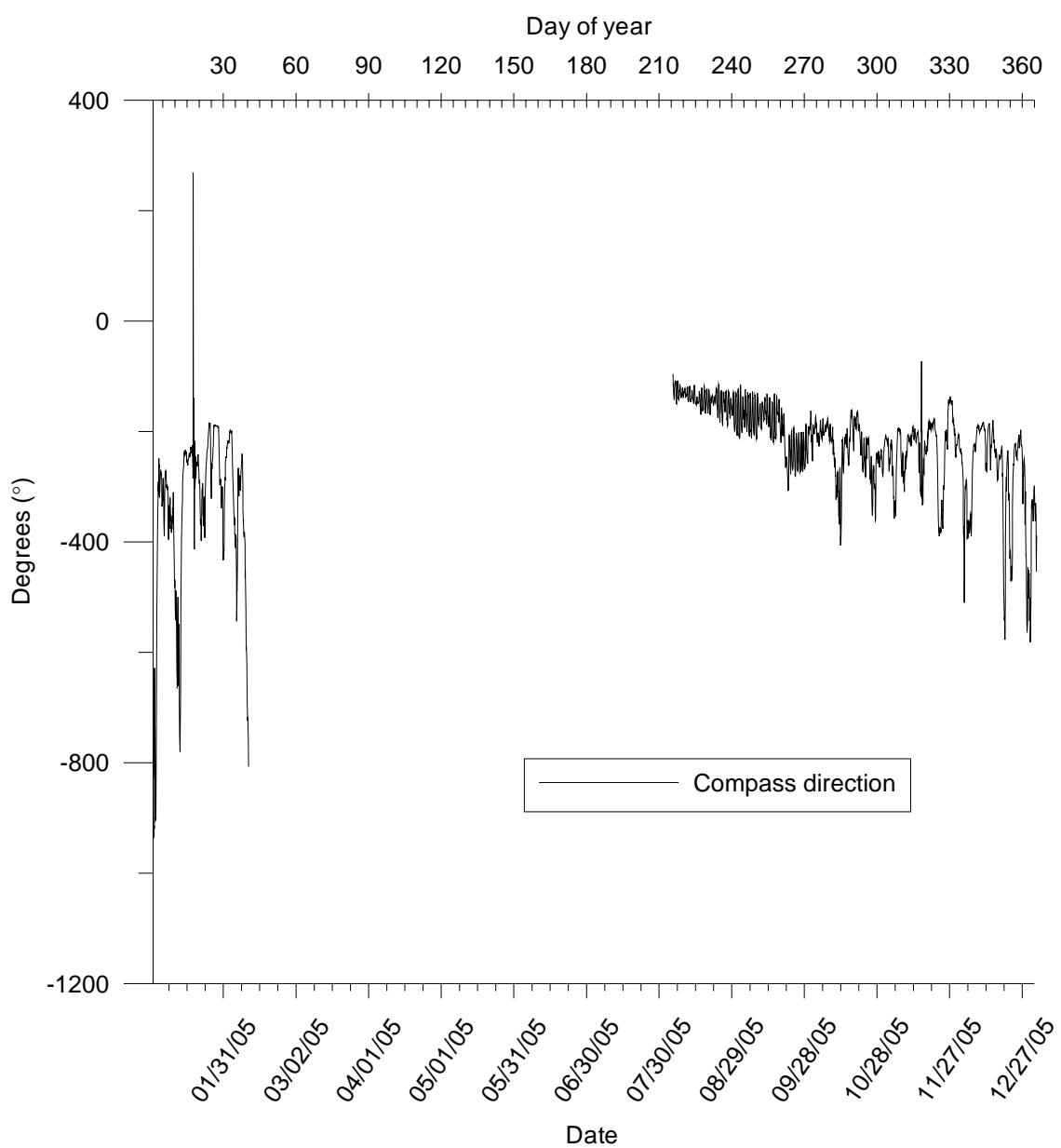
Tasiilaq1 Sonic Ranger 2005



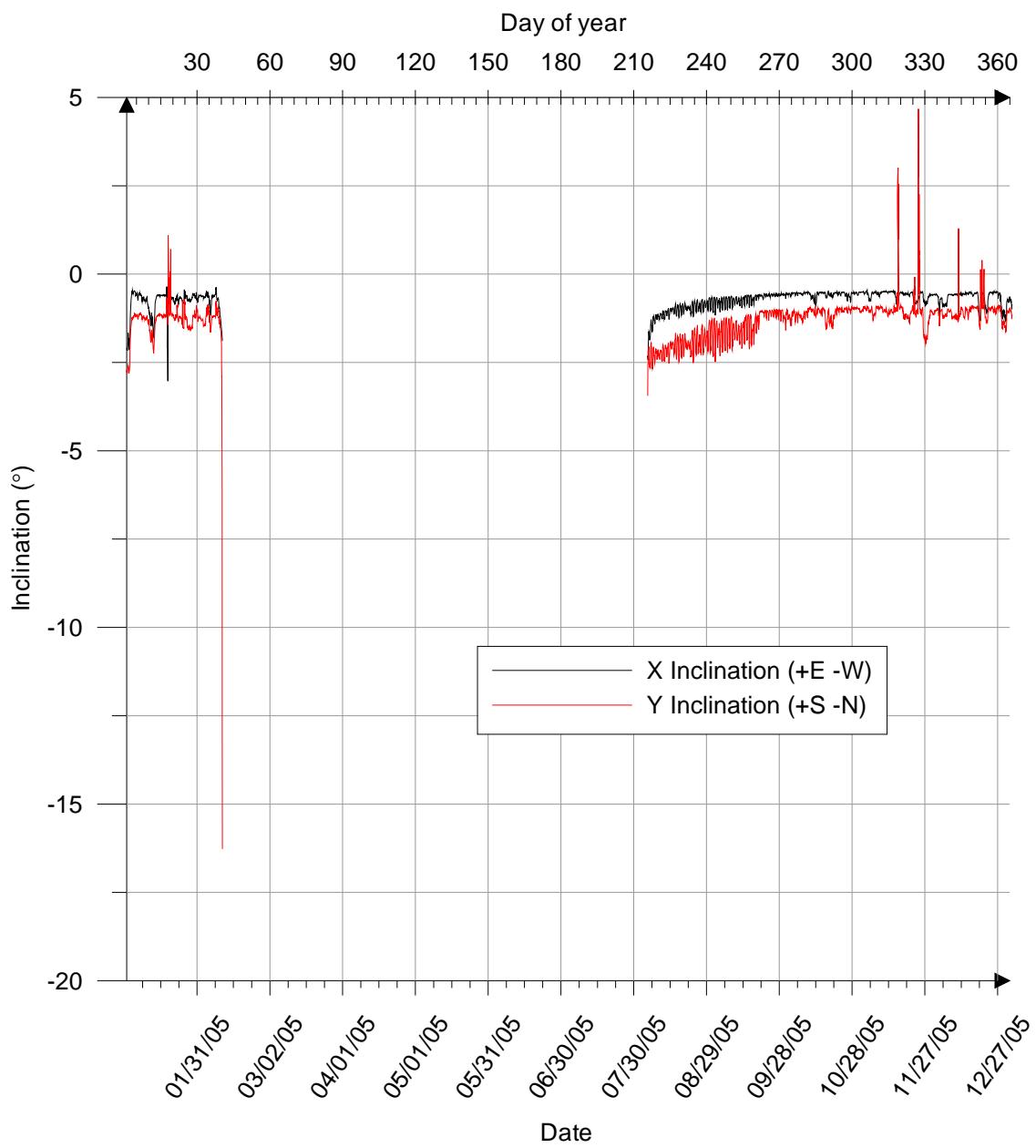
Tasiilaq1 Radiation 2005



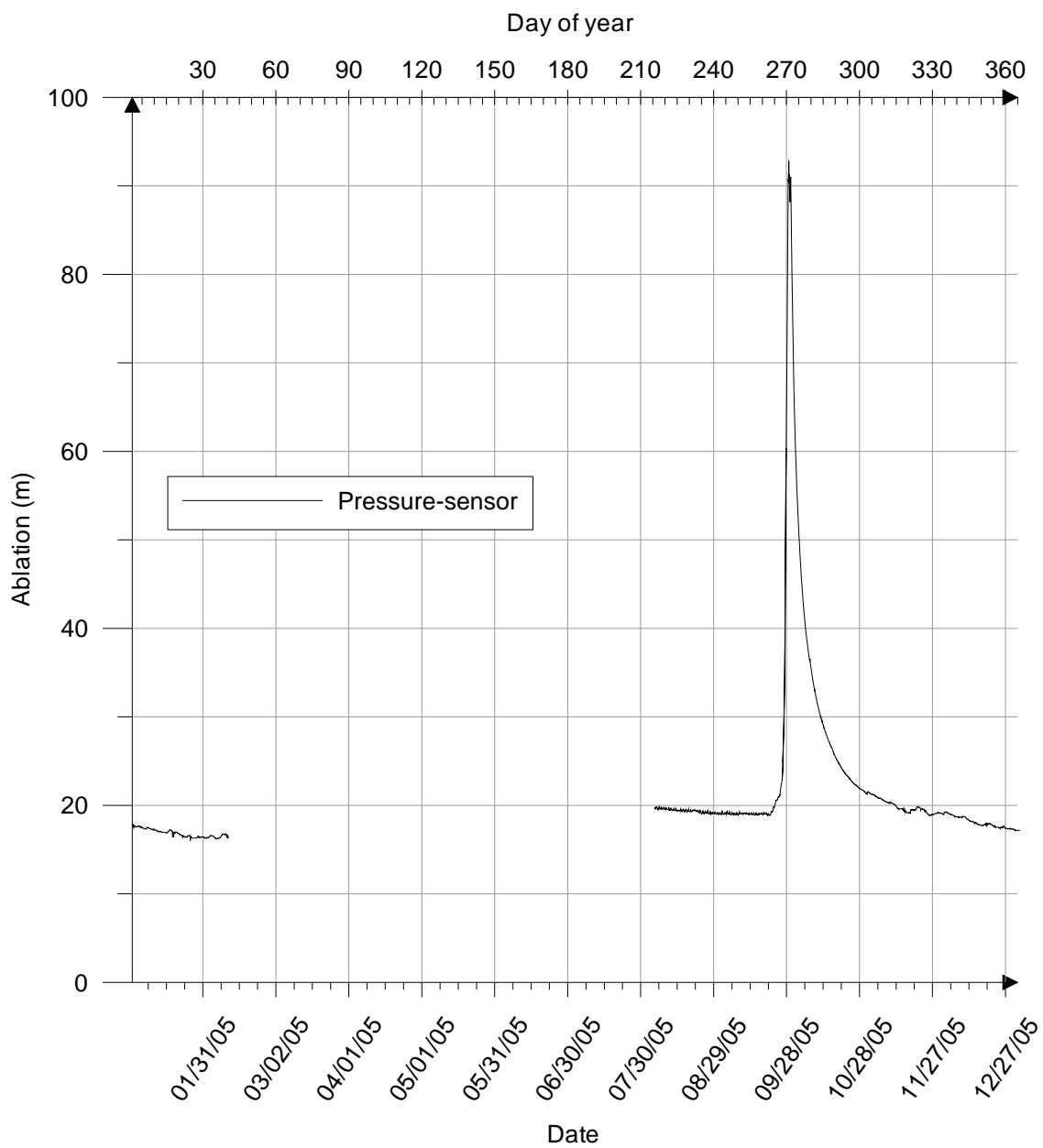
Tasiilaq1 Compass 2005



Tasiilaq1 Inclination 2005

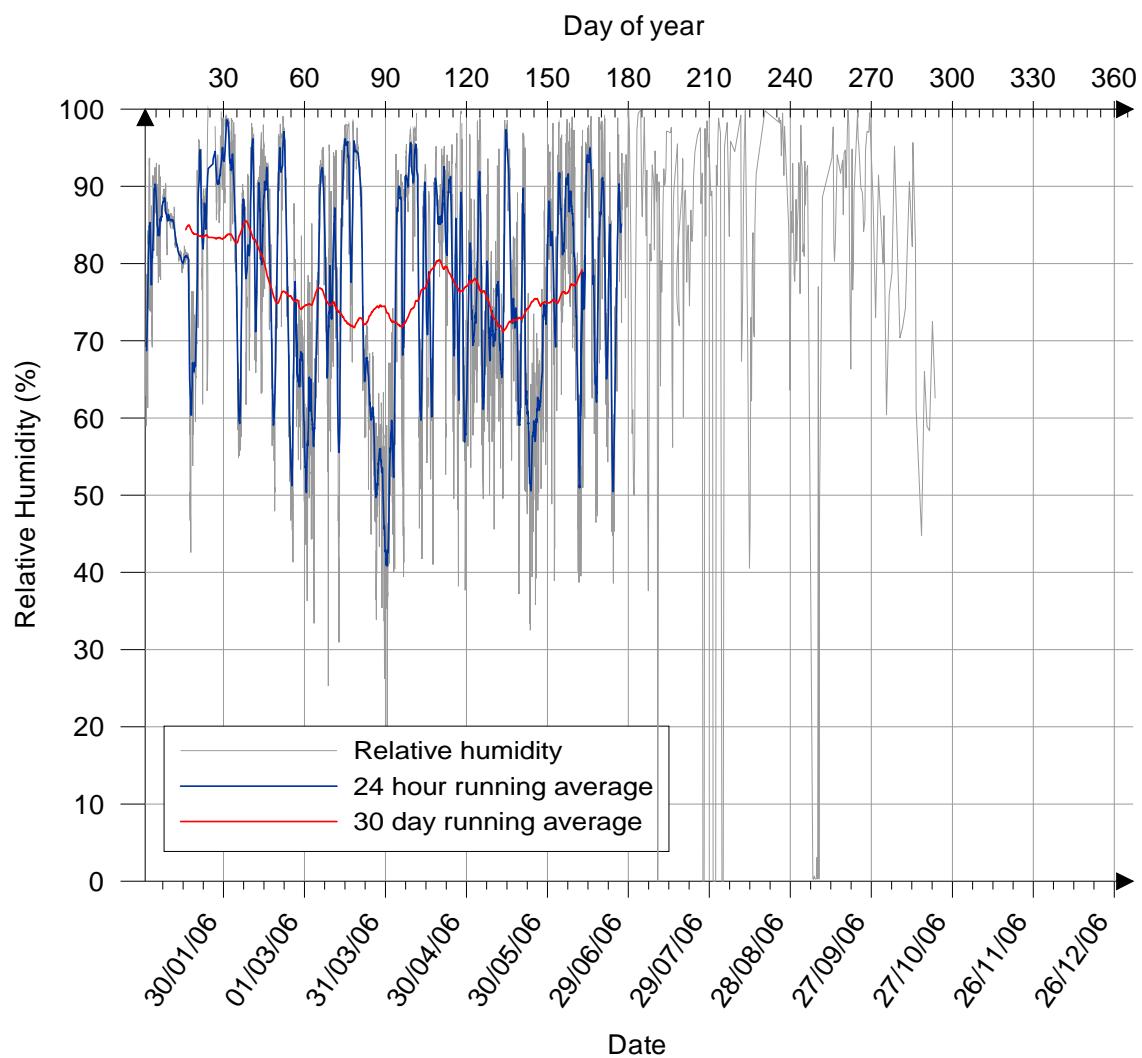


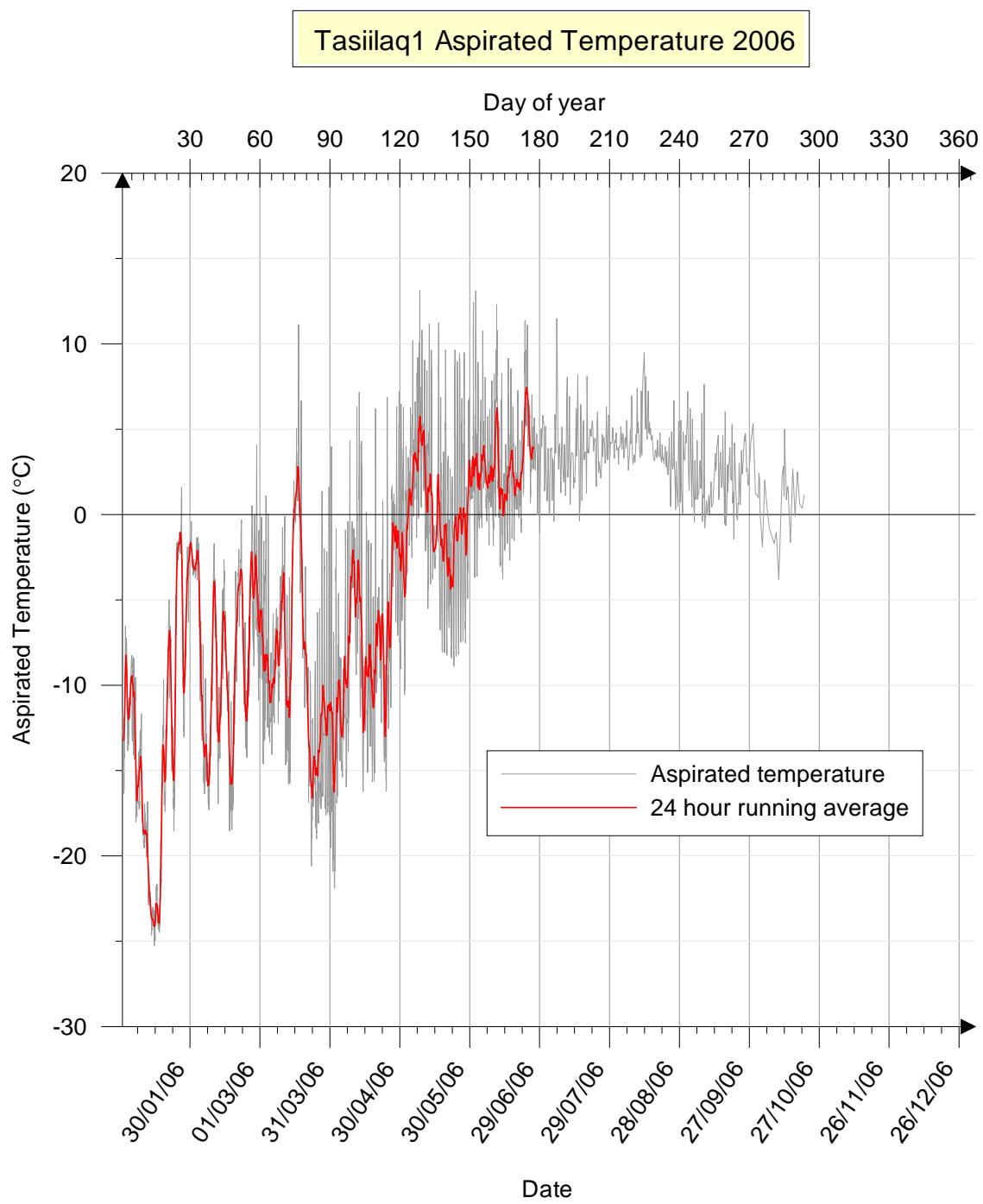
Tasiilaq1 Ablation 2005



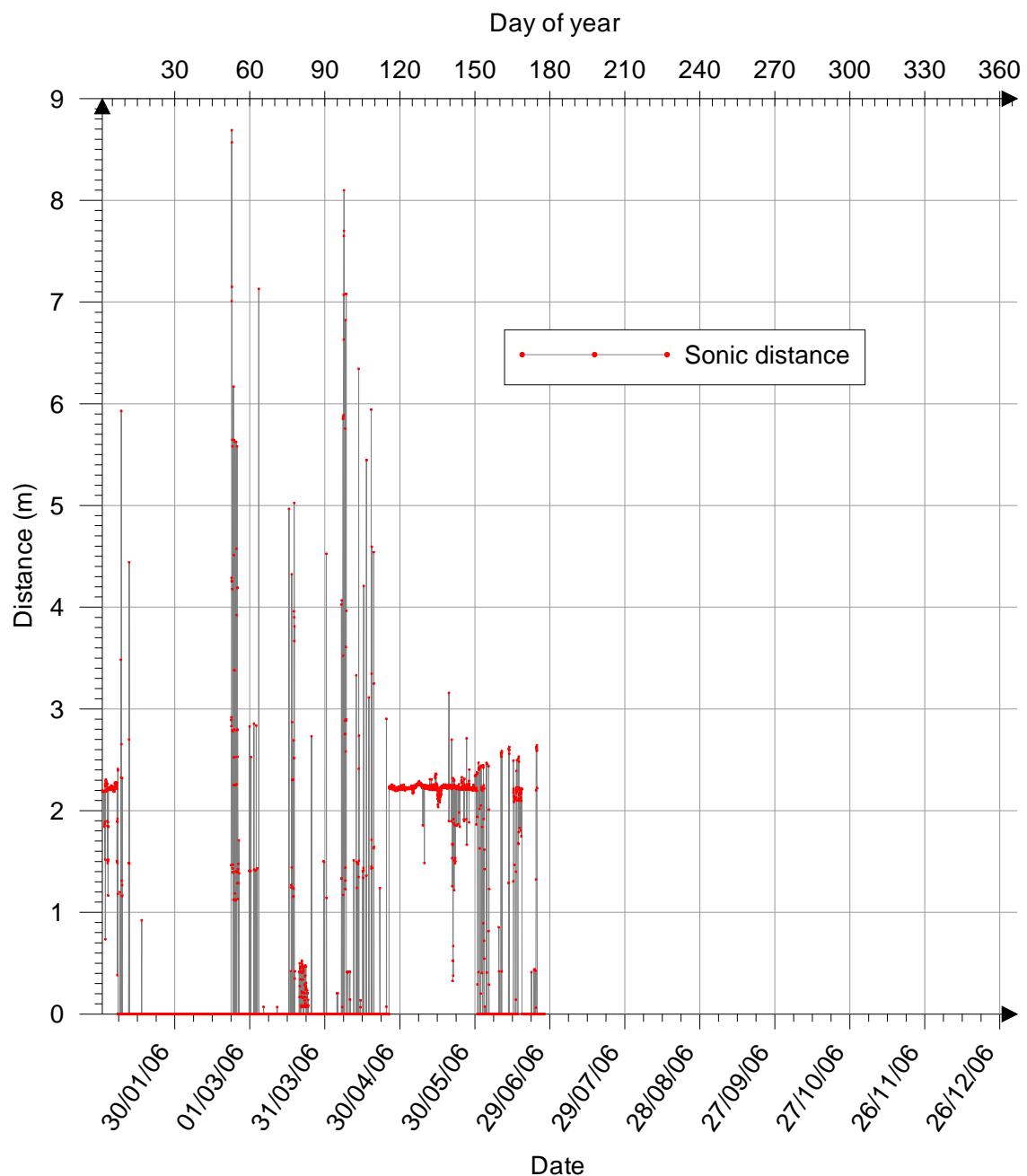
5.3.3 Tasiilaq stations in 2006

Tasiilaq1 Relative Humidity 2006

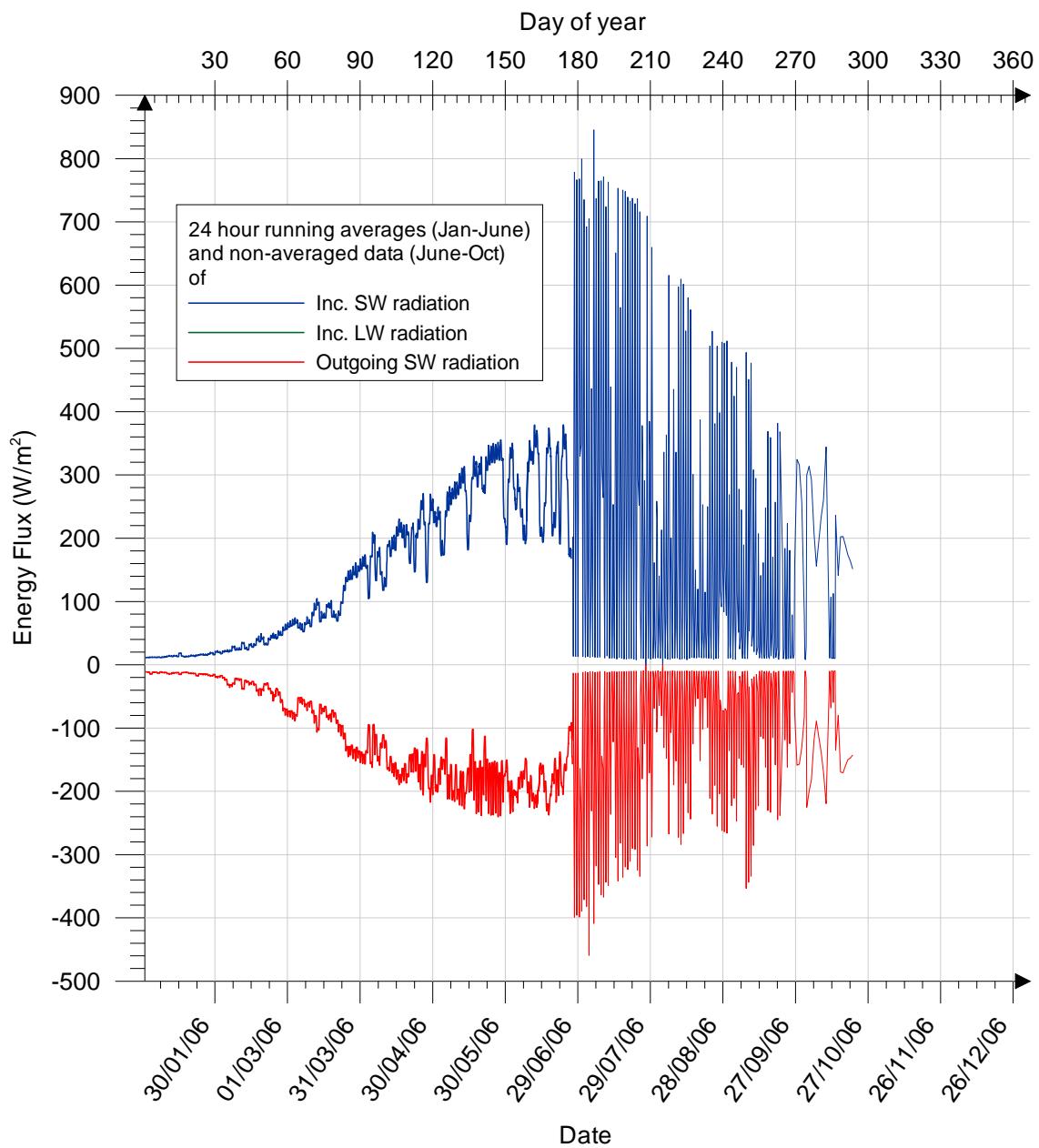




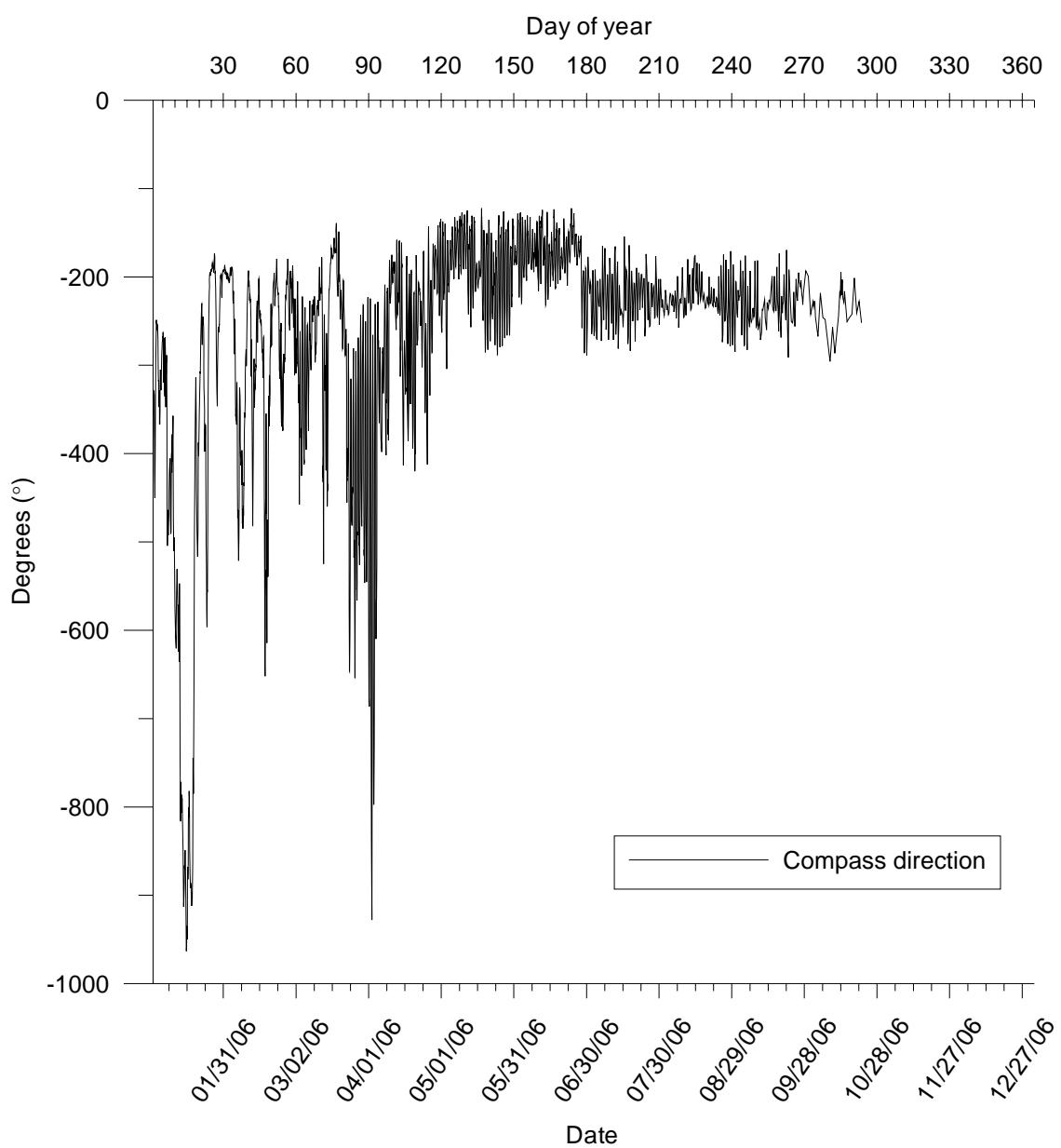
Tasiilaq1 Sonic Ranger 2006



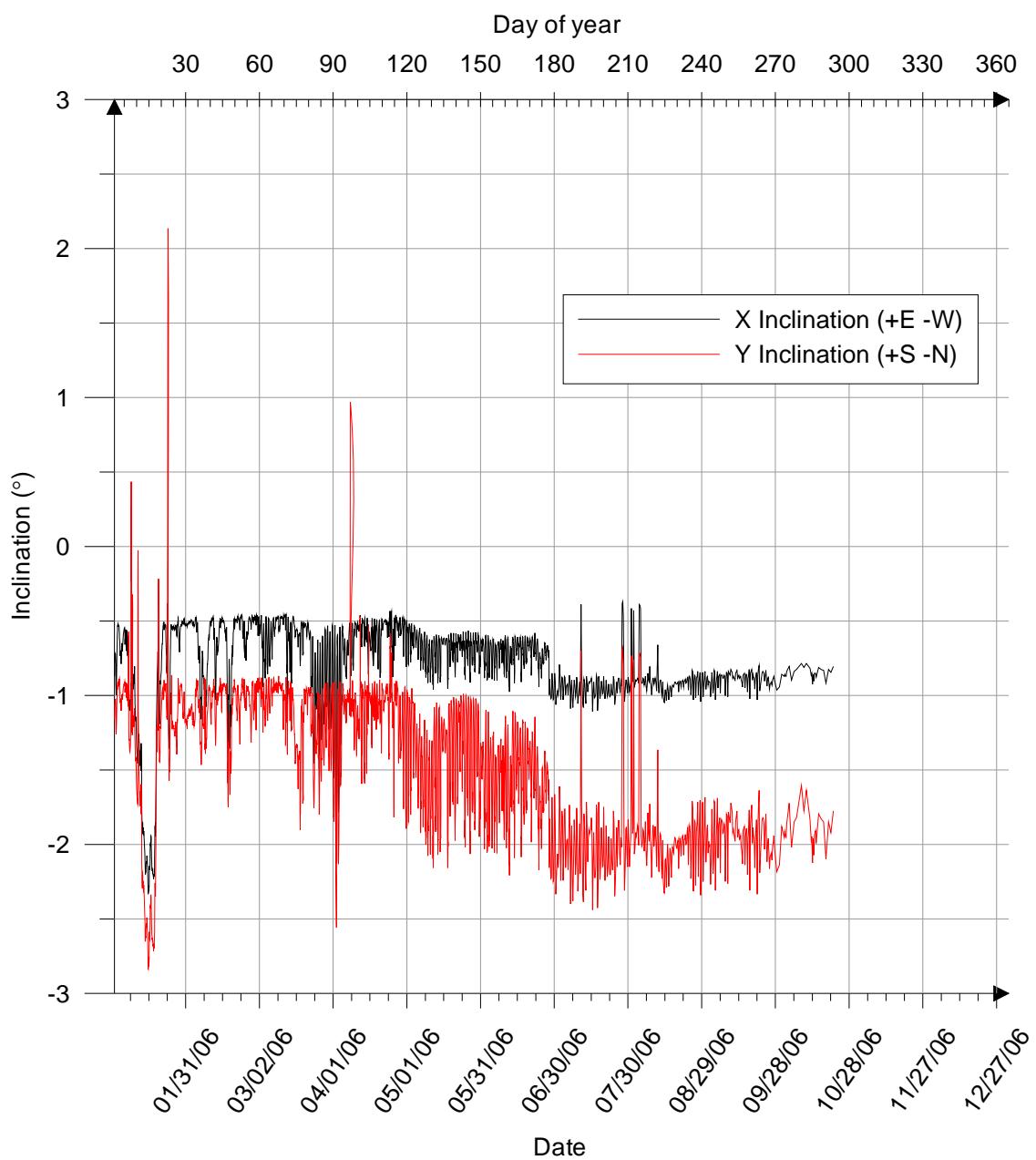
Tasiilaq1 Radiation 2006



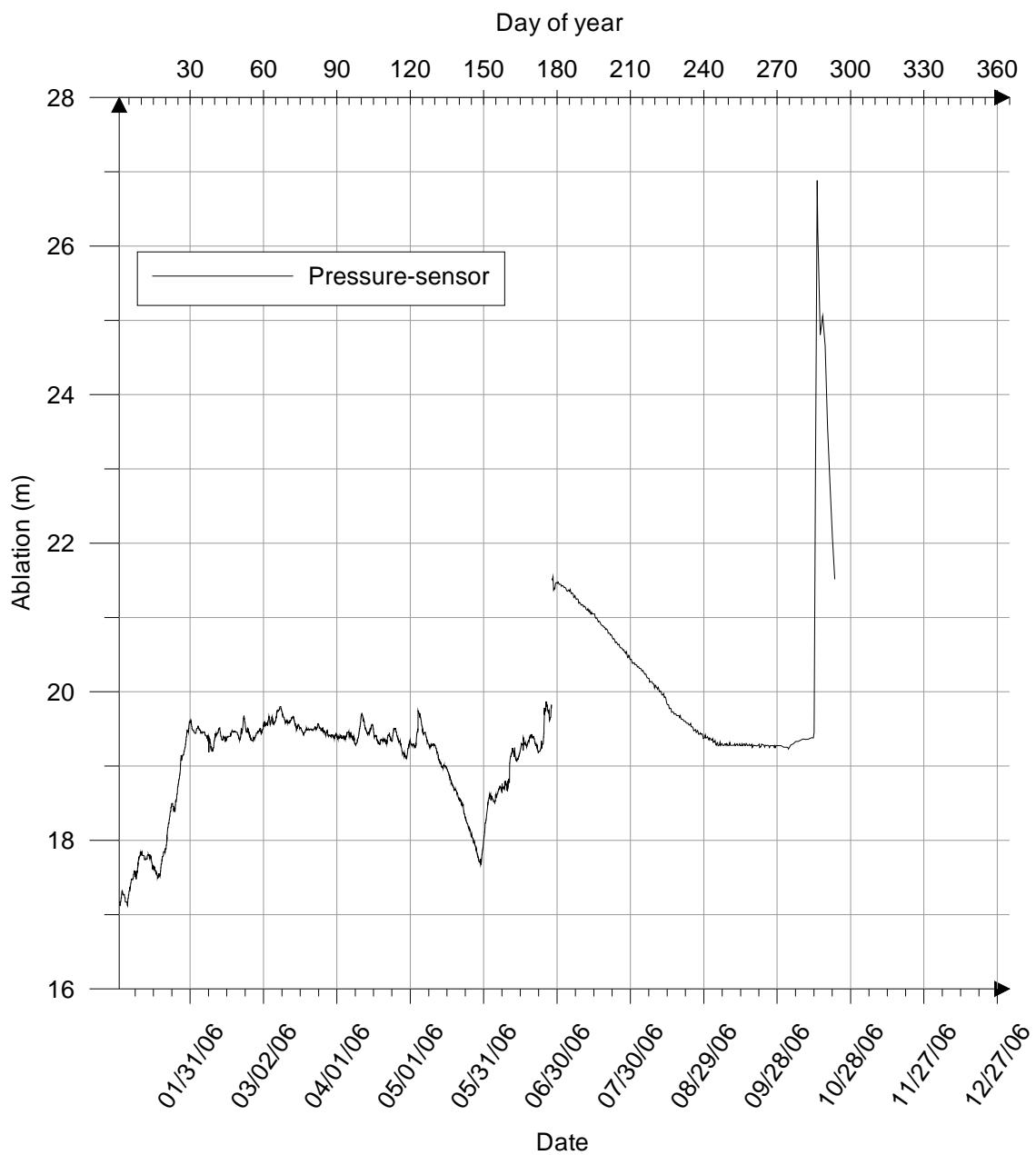
Tasiilaq1 Compass 2006



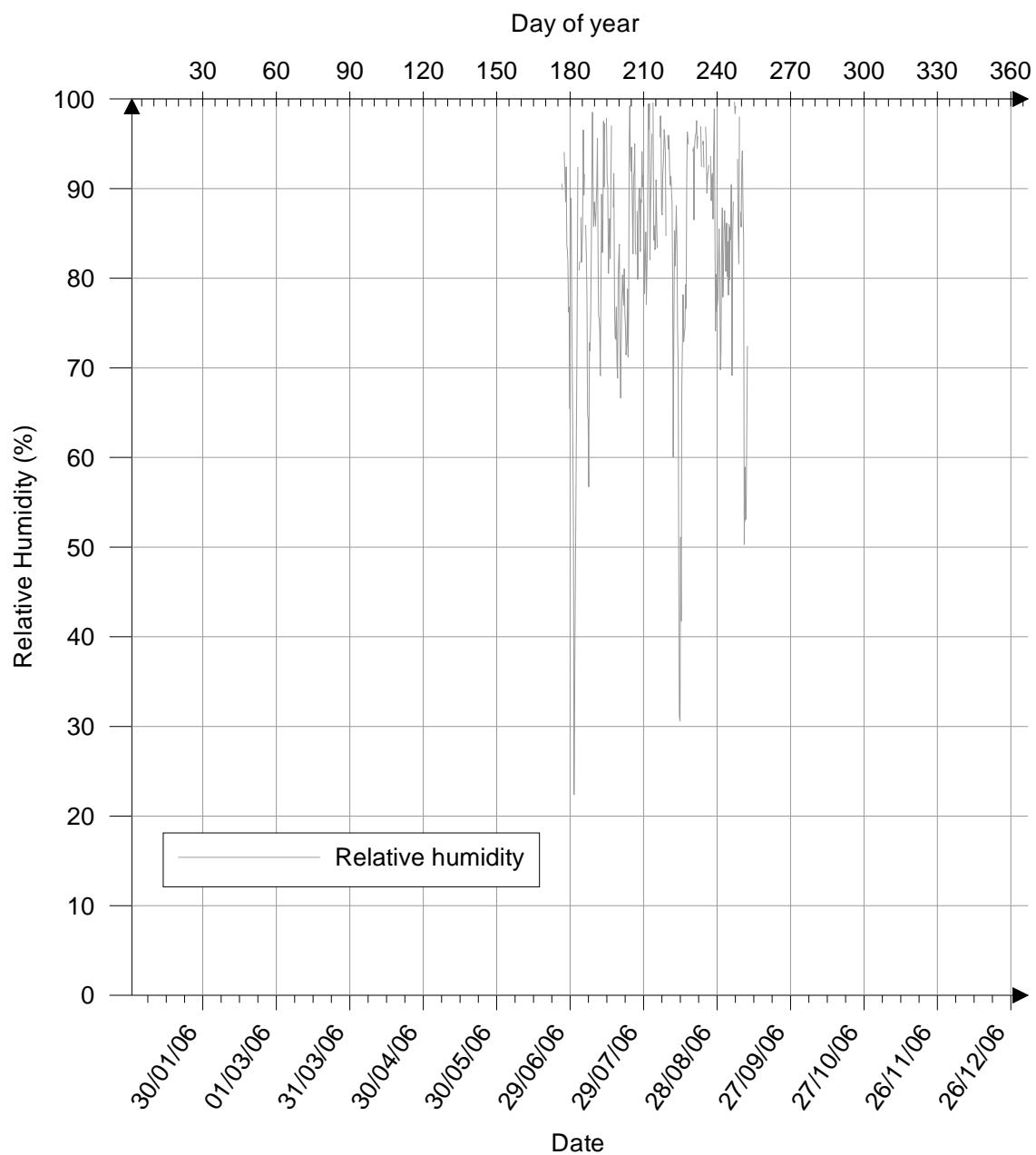
Tasiilaq1 Inclination 2006



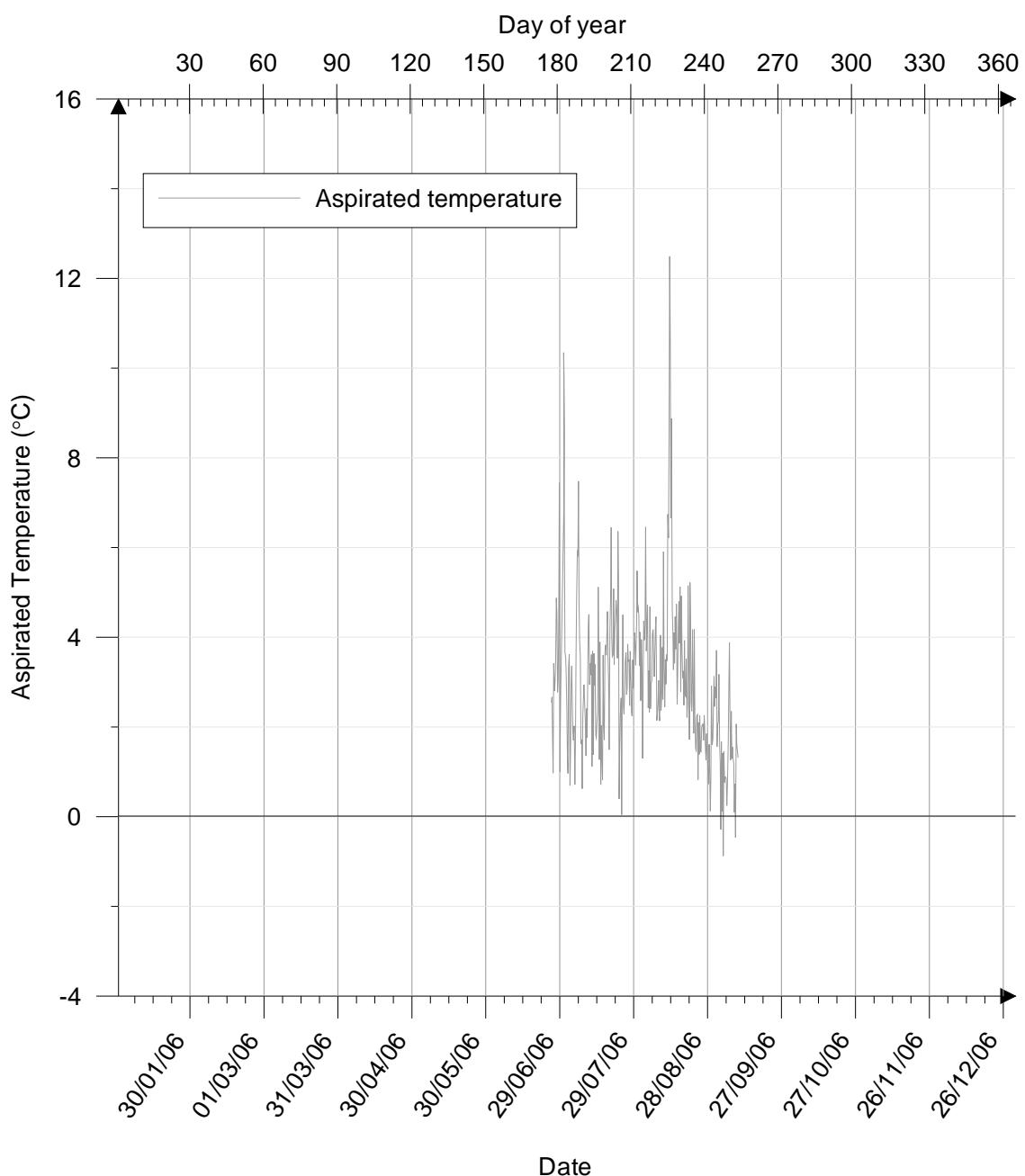
Tasiilaq1 Ablation 2006



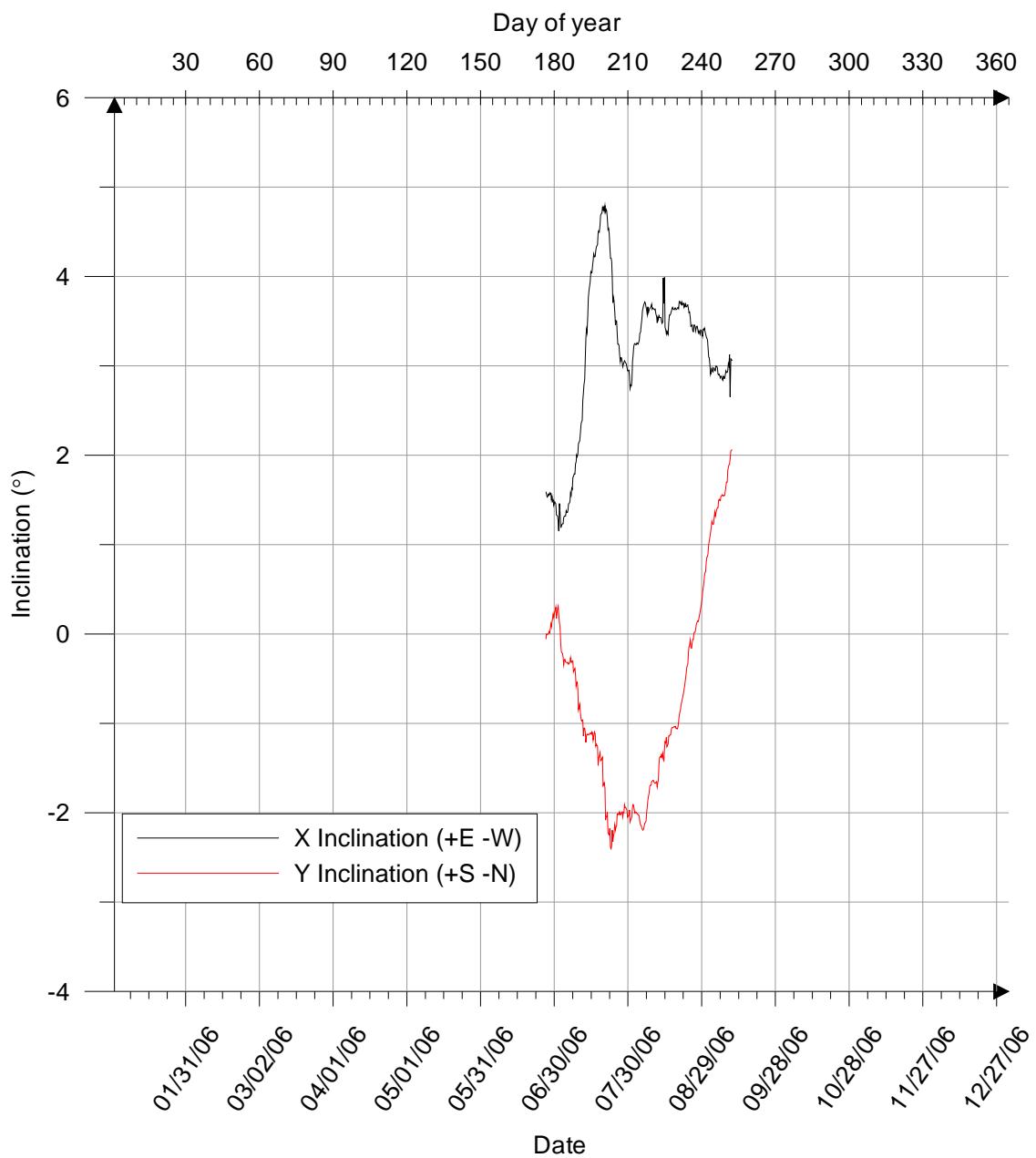
Tasiilaq3.2 Relative Humidity 2006



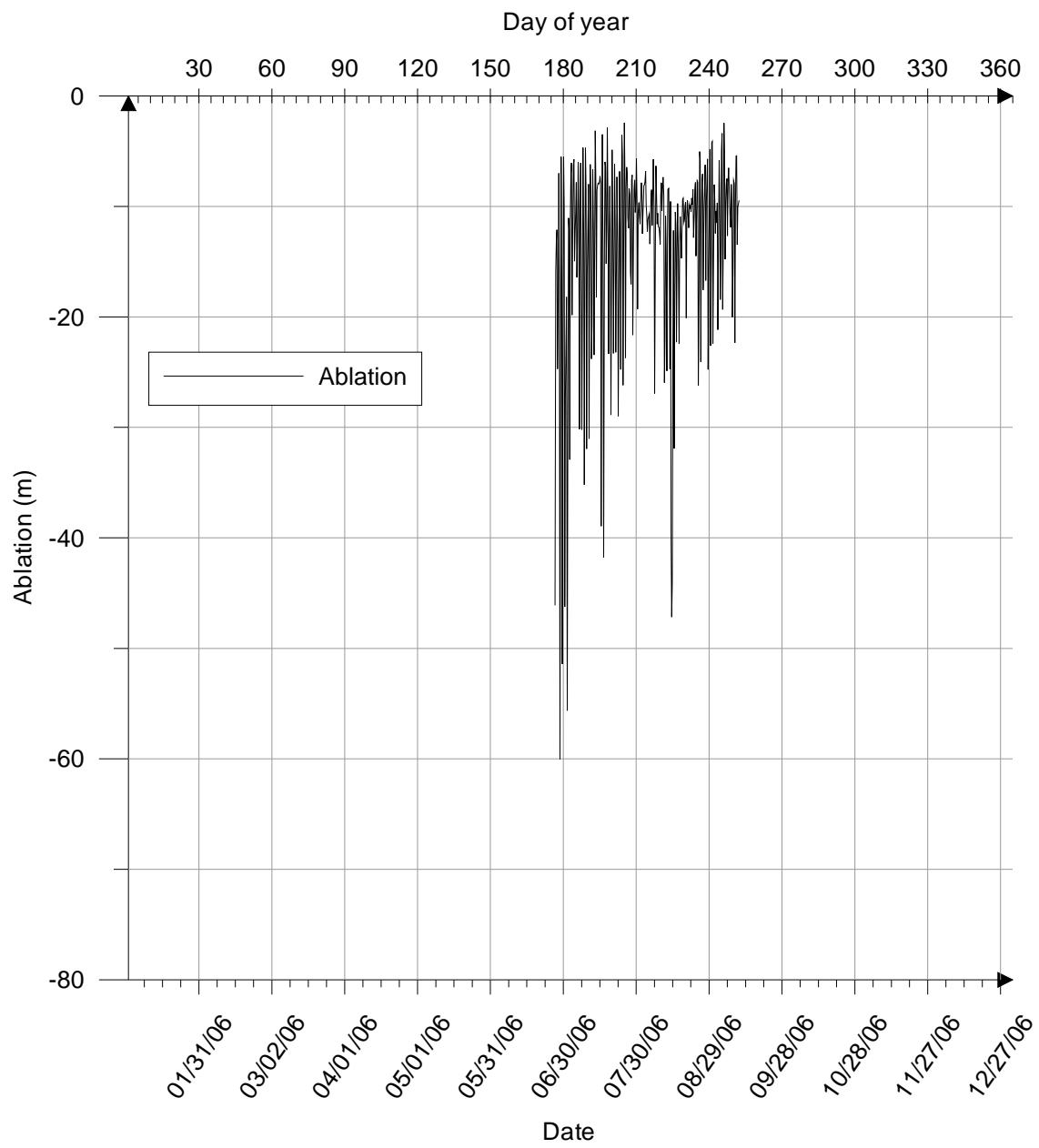
Tasiilaq3.2 Aspirated Temperature 2006



Tasiilaq3.2 Inclination 2006



Tasiilaq3.2 Ablation 2006



Tasiilaq3.2 Barometer 2006

