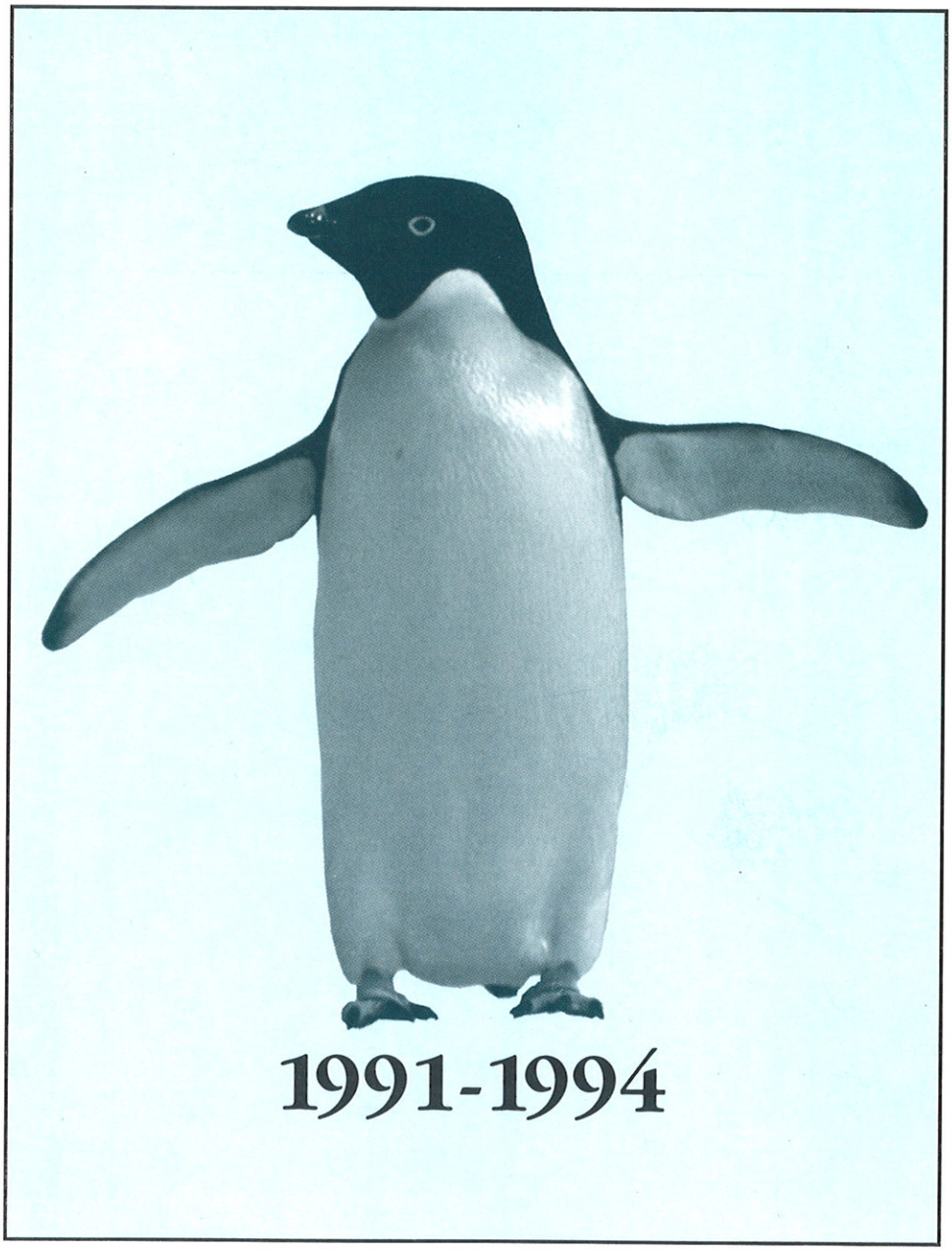
THE AURORA *Programme*

METEOROLOGICAL DATA FROM THE AURORA PROGRAMME JULY - DECEMBER 1992

INGER HANSSEN-BAUER

RAPPORT NR. 5/93 AURORA / 33/93 KLIMA



DNMI-RAPPORT

ISBN

RAPPORT NR.
5/93 AURORA
33/93 KLIMA

DATO
29.09.1993

DET NORSKE METEOROLOGISKE INSTITUTT
POSTBOKS 43 BLINDERN 0313 OSLO 3

TELEFON: (22) 96 30 00

TITTEL

METEOROLOGICAL DATA FROM THE AURORA PROGRAMME
JULY - DECEMBER 1992

UTARBEIDET AV

I. Hanssen-Bauer

OPPDRAGSGIVER

DNMI - KLIMAAVDELINGEN

SAMMENDRAG

The present data report contains time series for the period July - February 1992 of meteorological parameters measured at "Snowhenge", "New Haven", "Theron Mountains" and "Troll" in Antarctica. Some preliminary statistics are presented. Generally , temperature increased with altitude from Snowhenge (110 m a.s.l) via New Haven (547) and Theron Mountains (930), to Troll (1290 m a.s.l.). The mean August temperature was -44.0 °C at Snowhenge and -29.6 °C at Troll. It should be emphasized that the sensor at Snowhenge was covered by snow in August.

UNDERSKRIFT

Inger Hanssen-Bauer — SAKSBEHANDLER

Bjørn Aune — FAGSJEF

METEOROLOGICAL DATA FROM THE AURORA PROGRAMME JULY - DECEMBER 1992

Contents:

1. INTRODUCTION

The present data report covers meteorological data collected at the Aurora stations Snowhenge, Theron Mountains and New Haven, and at the Norwegian automatic station at Troll (figure 1), during the period July - December 1992. The data presented in the report are available on ASCII-files and as SAS-datasets. Data from the Aurora stations are free of charge for Aurora programme participants, while others will have to pay handling charges for this information.

Further information about the stations and the data handling were given in the meteorological data report for the period February - June 1992 (Hanssen-Bauer, 1992a).

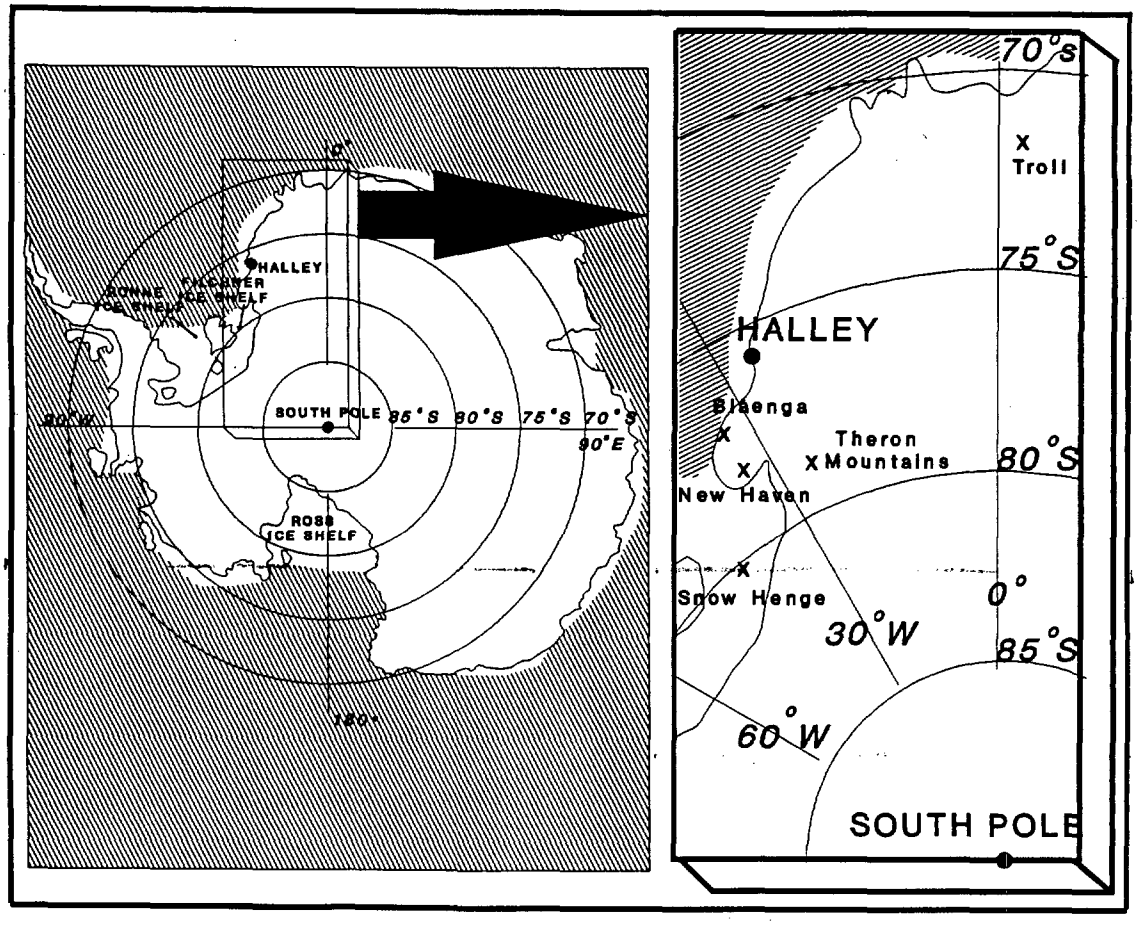


Figure 1. Map of Antarctica (left) and of the station area (right).

2. MISSING VALUES JULY - DECEMBER 1992.

At **Snowhenge, snow temperature Tg and air temperature Ta were not recorded throughout the whole period.** In the present report, the capsules internal temperature (Ti) has been used as a substitute for the air temperature at Snowhenge. It should be emphazised that the Snowhenge capsule was buried by drifting snow during the period covered by this report, and that Ti therefore is the temperature well below the surface. The **wind direction and wind speed** at Snowhenge are missing during most of the period **June - September**, and also in the **beginning of October**, probably because of low temperature.

The reason for the missing temperatures at Snowhenge is not known. The station was replaced by a new station during the field season 1992-93. At the new station, the snow temperature at 8.2 m depth is recorded (Pedersen, 1993). A temperature of -28.35 °C was recorded at this depth half an hour after installation of the sensor. This is reasonable, as it is close to the annual mean air temperature estimated from the recordings of Ti at the station so far. Data from the new station, which started sampling at January 8 1993 are only stored locally, and they will consequently not be available until the fieldwork 1993-94 is completed.

At **New Haven**, the temperature is missing from September 19 to the end of the period. The reason for this is not known, and the station was closed down during the field work in January 1993.

3. PRESENTATION OF DATA FROM JULY-DECEMBER 1992

3.1 Monthly means and extreme values.

Table 1 shows monthly mean values and extreme values for some of the measured variables. August was the coldest month at all stations. At Halley (fig. 1), the average July temperature for the period 1957-89 is 0.5°C below the average August temperature (Hanssen-Bauer, 1992b). The lowest monthly average measured at Halley during this period (-36.8°C) was, however, measured in August.

For all months so far, including February-June 1992 (Hanssen-Bauer, 1992a), Snowhenge had the lowest monthly mean temperature of the 4 stations. The monthly mean temperatures at Theron Mountains were 5-12°C above the Snowhenge temperatures. The difference was at minimum during November-December, when the temperature inversion over the Filchner shelf probably was at the weakest.

Table 1. Some monthly mean and extreme values.

PARAMETER	STATION	JUL	AUG	SEP	OCT	NOV	DEC
MEAN AIR TEMPE-RATURE	SNOWHENGE	-40.7	-44.0	-35.8	-28.1	-19.4	-9.5
	NEW HAVEN	-34.2	-35.7	-30.3*	-	-	-
	THERON M.	-30.3	-32.1	-26.7	-16.9	-14.1	-5.3
	TROLL	-27.9	-29.6	-25.9	-17.7	-11.0	-5.7
HIGHEST MAX.TEMP.	NEW HAVEN	-16.6	-17.3	-15.2*	-	-	-
	THERON M.	-10.9	-12.7	-12.7	-3.5	0.0	7.8
LOWEST MIN.TEMP.	NEW HAVEN	-48.0	-50.1	-48.4*	-	-	-
	THERON M.	-49.1	-45.2	-43.1	-36.7	-27.2	-18.7
MEAN AIR PRESSURE	SNOWHENGE	976.0	974.6	974.7	979.1	968.3	976.9
	NEW HAVEN	918.3	916.7	918.9	923.7	916.1	924.9
	THERON M.	876.8	874.8	878.3	883.6	876.6	885.4
	TROLL	829.1	824.3	830.6	833.1	830.7	837.7
MEAN WIND SPEED	SNOWHENGE	-	-	-	3.4	4.0	3.2

* New Haven: Temperature missing from September 19.

For most months, Troll had the highest average temperature. In October and December, however, Theron Mountains had the highest mean temperatures. The high December mean temperature at Theron Mountain was mainly caused by extremely high maximum temperatures during several days. These maximum temperatures are **not** representative for the air temperature. They are probably caused by radiation error. It is known that the radiation screening of the internal temperature sensor of the ICEX capsule is insufficient under certain circumstances. No systematic testing of this error has been done, but simple field tests indicate that the error may exceed 5 °C under conditions of bright sunshine and light winds (Brækkan, pers. comm.).

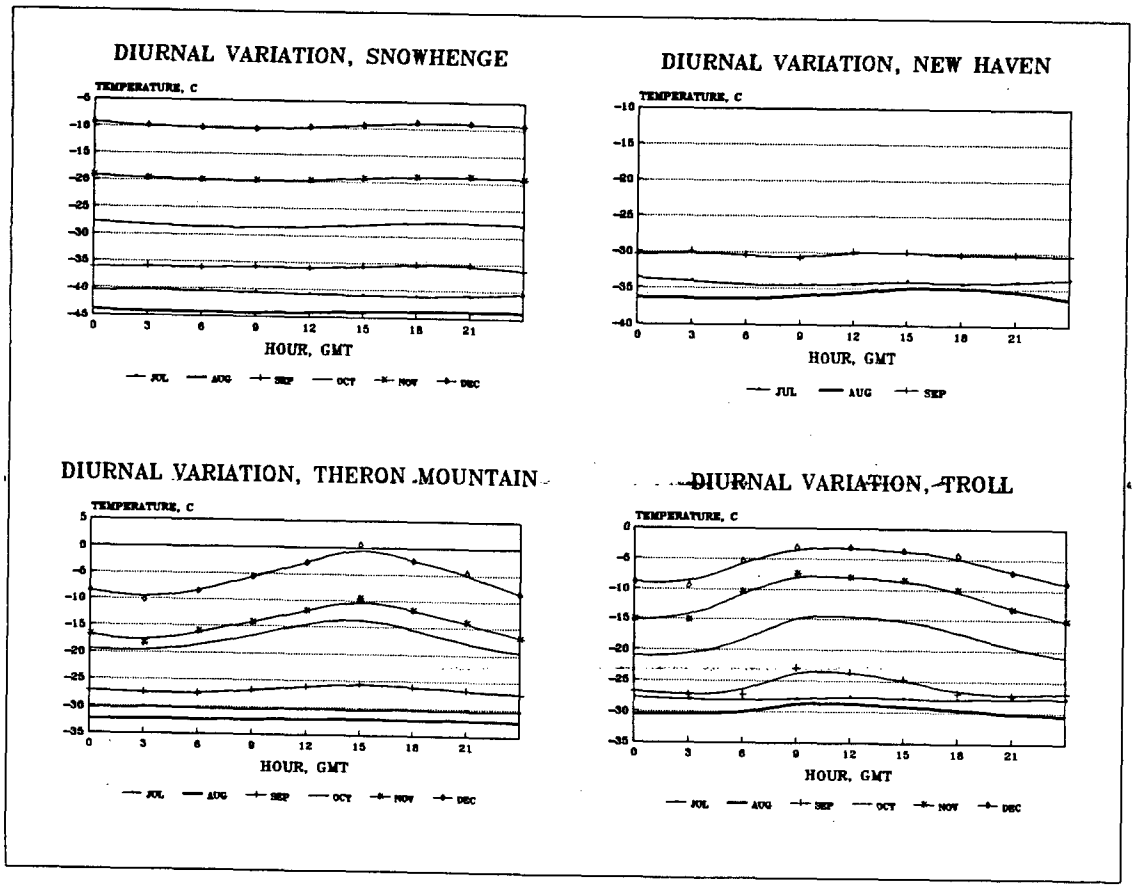


Figure 2. Diurnal temperature variation at each station.

The average diurnal temperature variation for each month, and at the different stations are shown in figure 2. The amplitudes in July and August are generally small.

The monthly averaged diurnal amplitudes at Snowhenge do not exceed 1.5°C for any month. The reason for this is that the Snowhenge Capsule was covered by snow during the period. Without a snowcover, the average diurnal temperature amplitude for the last 4 months would probably be 3-4 times those observed at this station.

The monthly averaged diurnal temperature amplitudes at Troll for September through December are roughly 1.5 times the mean amplitudes for the same months at Halley for the period 1957-89 (Hanssen-Bauer, 1992b). This indicates that an eventual snow cover over the Troll capsule has been thin (only a few cm thick). When the station was visited by the Norwegian Polar Institute in January 1993, there was no snow on the capsule (Jon Ove Hagen, pers. comm.).

The diurnal temperature amplitudes at Theron Mountains are, compared with the long term monthly averages at Halley, reasonable for September and October. For the last two months, however, the amplitudes are very large. This is certainly the result of the radiation error mentioned earlier.

3.2 Time series.

Figure 3a shows time series of temperature (Ti) from all stations during July 1.-15. 1992. Figure 3b shows series of air pressure (p) from all stations during the same period. Figures 3c and d show wind speed and direction, respectivly, at Snowhenge during this period. Figures 4 to 14 show similar time series for the rest of the period treated by this report. Figure c and d are left out for periods through which the wind data are totally missing.

3.3 Correlation analysis - temperature.

Correlation coefficients were computed between the temperature series at the different stations for every month separately, and for the whole period (table 2). To avoid "noise" because of differences in diurnal variation, daily mean temperatures were used in these analyses. New Haven and Theron Mountains were the best correlated stations for all months when New Haven data were available. Snowhenge was also fairly well correlated to these stations for the period as a whole, but the correlation coefficients for individual months varies considerably.

Table 2. Pearson correlation coefficients between daily mean temperatures at different stations for individual months and for the whole period February-June.

	STATION:	SNOWHENGE	NEW HAVEN	THERON M.	TROLL
PERIOD	STATION				
JUL	SNOWHENGE	1.00	0.80	0.82	0.43
	NEW HAVEN	0.80	1.00	0.95	0.49
	THERON M.	0.82	0.95	1.00	0.62
	TROLL	0.43	0.49	0.62	1.00
AUG	SNOWHENGE	1.00	0.83	0.74	-0.01
	NEW HAVEN	0.83	1.00	0.92	0.19
	THERON M.	0.74	0.92	1.00	0.32
	TROLL	-0.01	0.19	0.32	1.00
SEP	SNOWHENGE	1.00	0.79*	0.71	0.43
	NEW HAVEN	0.79*	1.00	0.83*	0.27*
	THERON M.	0.71	0.83*	1.00	0.25
	TROLL	0.43	0.27*	0.25	1.00
OKT	SNOWHENGE	1.00	.	0.73	0.53
	NEW HAVEN	.	.	.	.
	THERON M.	0.73	.	1.00	0.54
	TROLL	0.53	.	0.54	1.00
NOV	SNOWHENGE	1.00	.	0.69	0.68
	NEW HAVEN	.	1.00	.	.
	THERON M.	0.69	.	1.00	0.65
	TROLL	0.68	.	0.65	1.00
DES	SNOWHENGE	1.00	.	0.11	0.24
	NEW HAVEN	.	.	.	.
	THERON M.	0.11	.	1.00	0.41
	TROLL	0.24	.	0.41	1.00
YEAR	SNOWHENGE	1.00	0.83	0.89	0.73
	NEW HAVEN	0.83	1.00	0.92	0.49
	THERON M.	0.89	0.92	1.00	0.75
	TROLL	0.73	0.49	0.75	1.00

3.4 Correlation analysis - air pressure.

Table 3 shows that air pressure is very well correlated at Snowhenge, New Haven and Theron Mountains (R=0.88-0.99 for all months). The correlation coefficients between the pressure at these stations and the pressure at the more distant station Troll are considerably lower. The pressure at Troll is generally best correlated with the pressure at Theron Mountains.

Table 3. Pearson correlation coefficients between air pressure at different stations for individual months and for the whole period February-June.

	STATION	SNOWHENGE	NEW HAVEN	THERON M.	TROLL
PERIOD	STATION				
JUL	SNOWHENGE	1.00	0.98	0.97	0.82
	NEW HAVEN	0.98	1.00	0.99	0.86
	THERON M.	0.97	0.99	1.00	0.88
	TROLL	0.82	0.86	0.88	1.00
AUG	SNOWHENGE	1.00	0.96	0.91	0.50
	NEW HAVEN	0.96	1.00	0.99	0.53
	THERON	0.91	0.99	1.00	0.52
	TROLL	0.50	0.53	0.52	1.00
SEP	SNOWHENGE	1.00	0.95	0.90	0.44
	NEW HAVEN	0.95	1.00	0.97	0.59
	THERON	0.90	0.97	1.00	0.68
	TROLL	0.44	0.59	0.68	1.00
OCT	SNOWHENGE	1.00	0.95	0.92	-0.30
	NEW HAVEN	0.95	1.00	0.99	-0.20
	THERON	0.92	0.99	1.00	-0.14
	TROLL	-0.30	-0.20	-0.14	1.00
NOV	SNOWHENGE	1.00	0.95	0.88	0.38
	NEW HAVEN	0.95	1.00	0.97	0.49
	THERON	0.88	0.97	1.00	0.59
	TROLL	0.38	0.49	0.59	1.00
DEC	SNOWHENGE	1.00	0.98	0.97	0.45
	NEW HAVEN	0.98	1.00	0.99	0.45
	THERON	0.97	0.99	1.00	0.48
	TROLL	0.45	0.45	0.48	1.00
YEAR	SNOWHENGE	1.00	0.95	0.90	0.55
	NEW HAVEN	0.95	1.00	0.98	0.68
	THERON	0.90	0.98	1.00	0.72
	TROLL	0.55	0.68	0.72	1.00

4. FINAL REMARKS

This report is mainly a data report from the stations Snowhenge, New Haven, Theron Mountains and Troll. The statisical analyses conducted should be considered as preliminary. Further analyses of the data set will be done later, when longer time series and data from other stations (e.g. Blåenga and Halley) are available.

REFERENCES

Kristensen, M., 1992: *Field report from the Aurora Programme 1991/92*. Aurora programme 4/92.

Hanssen-Bauer, I., 1992a: *Meteorological data from the Aurora Programme February-June 1992*. Aurora programme 6/92, DNMI-klima report no.20/92.

Hanssen-Bauer, I., 1992b: *The climate of Halley - Antarctica*. Aurora programme 3/92, DNMI-klima report no.20/92.

Pedersen, Kåre, 1993: *Field report 1992/93*. Aurora programme 4/93.

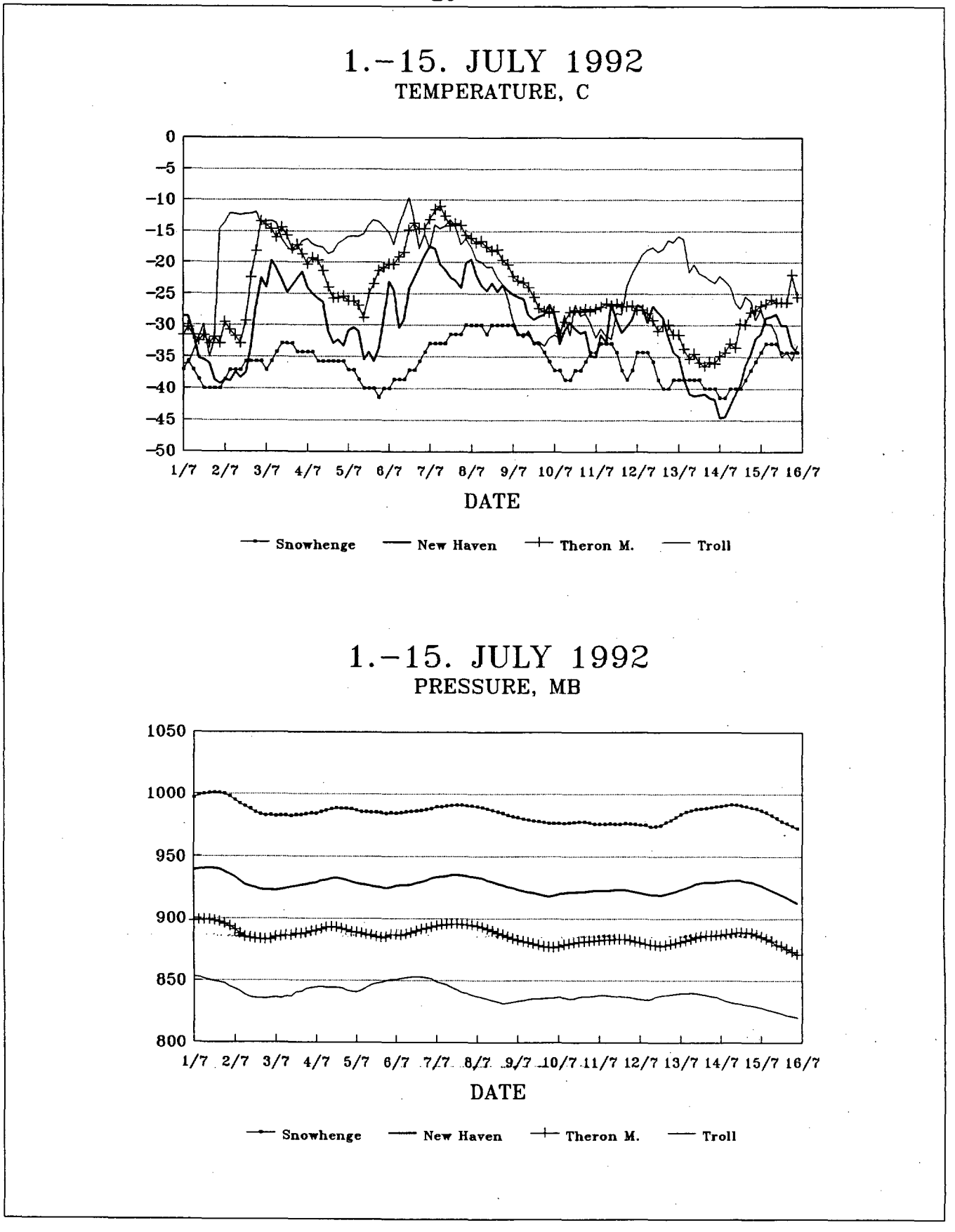
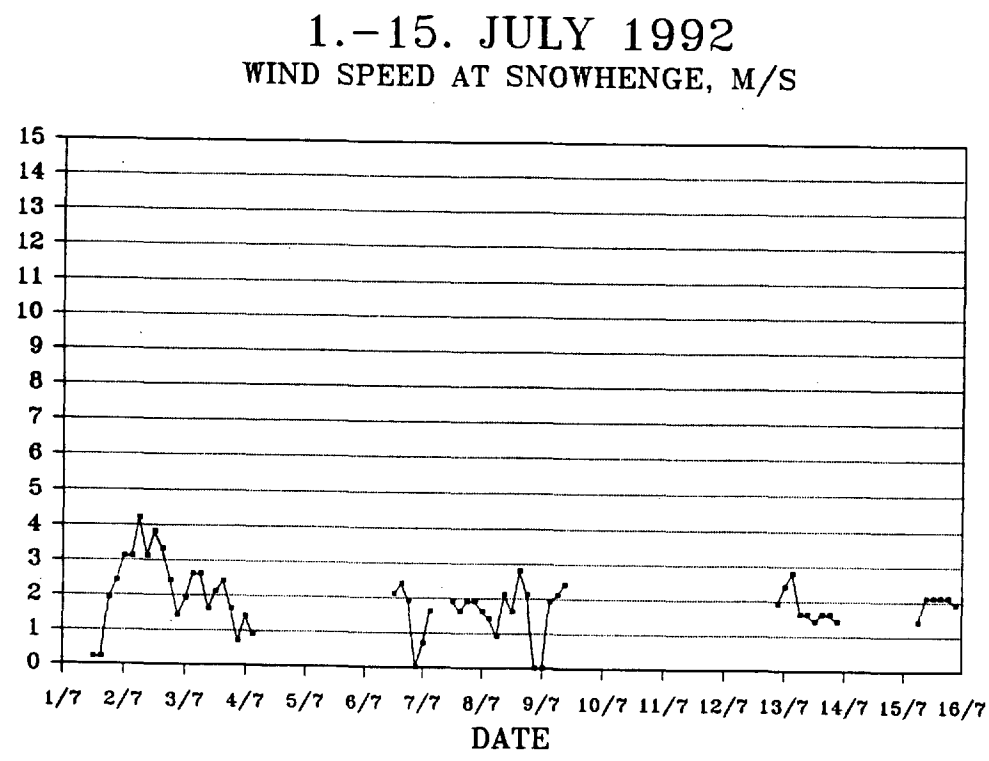


Figure 3. Time series of temperature (a) and air pressure (b) from all stations July 1 - 15 1992.



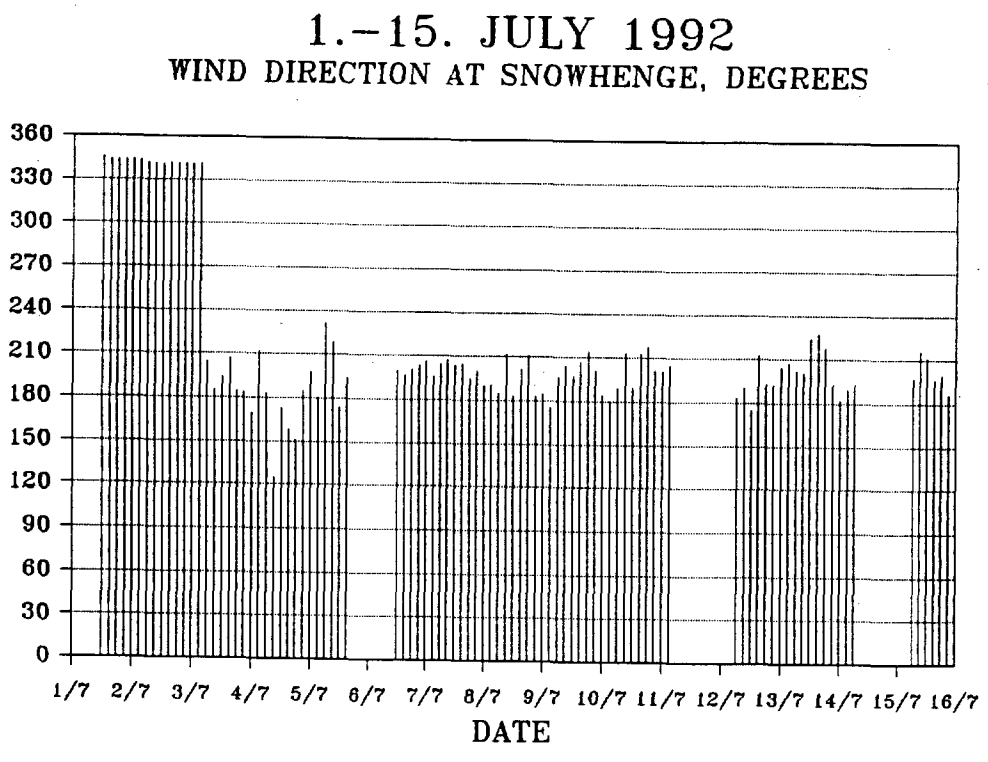
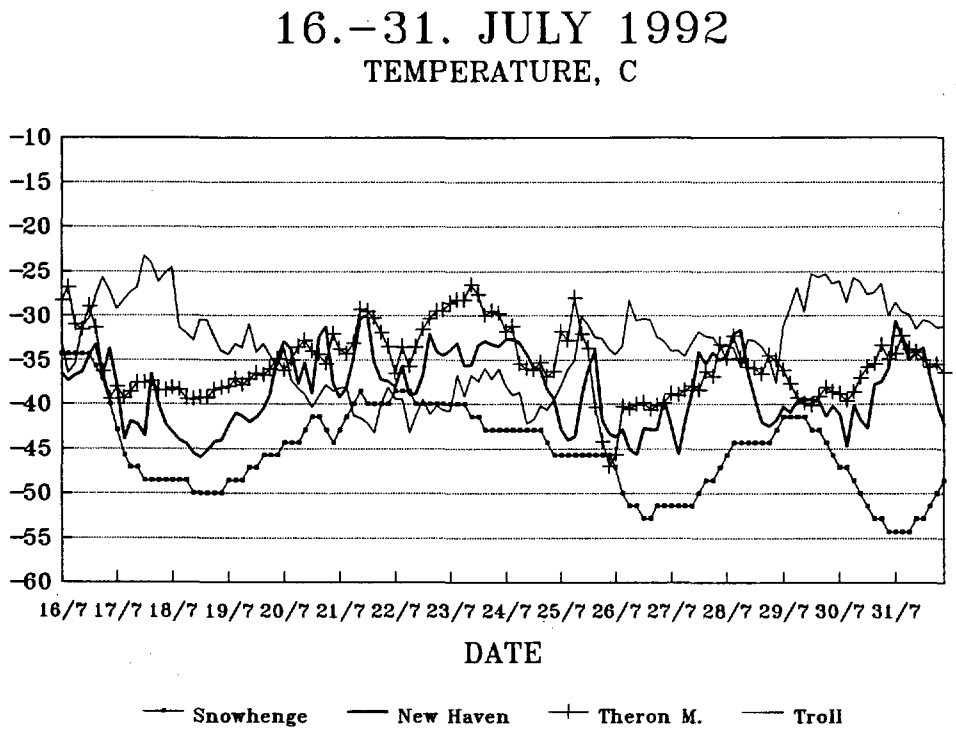


Figure 3.(cont.) Time series of wind speed (c) and direction (d) from Snowhenge July 1 - 15 1992.



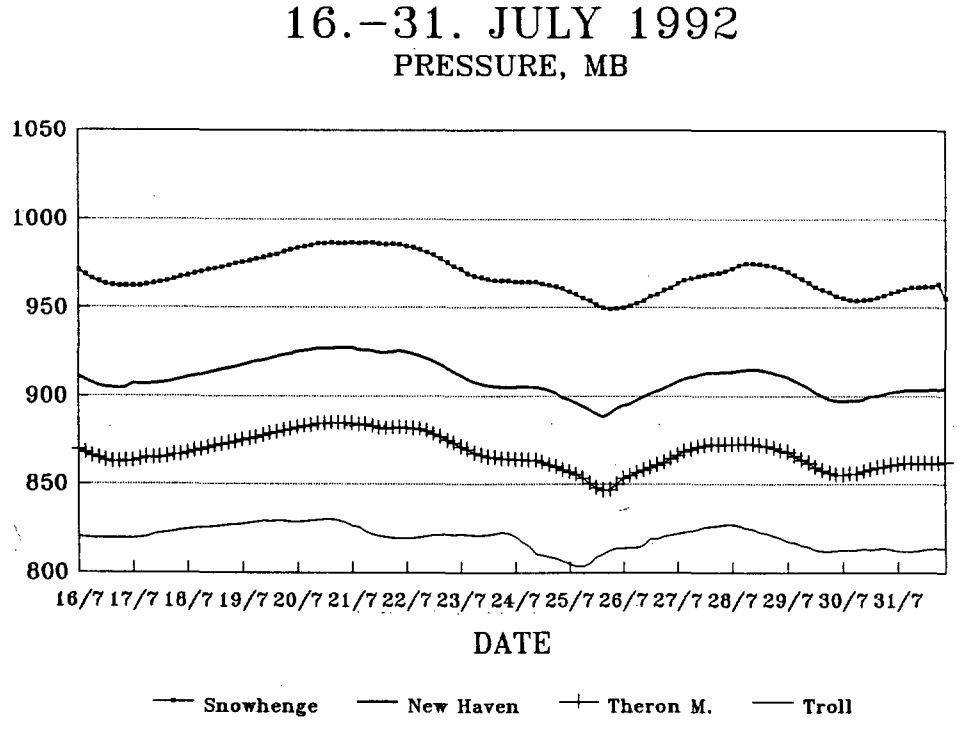
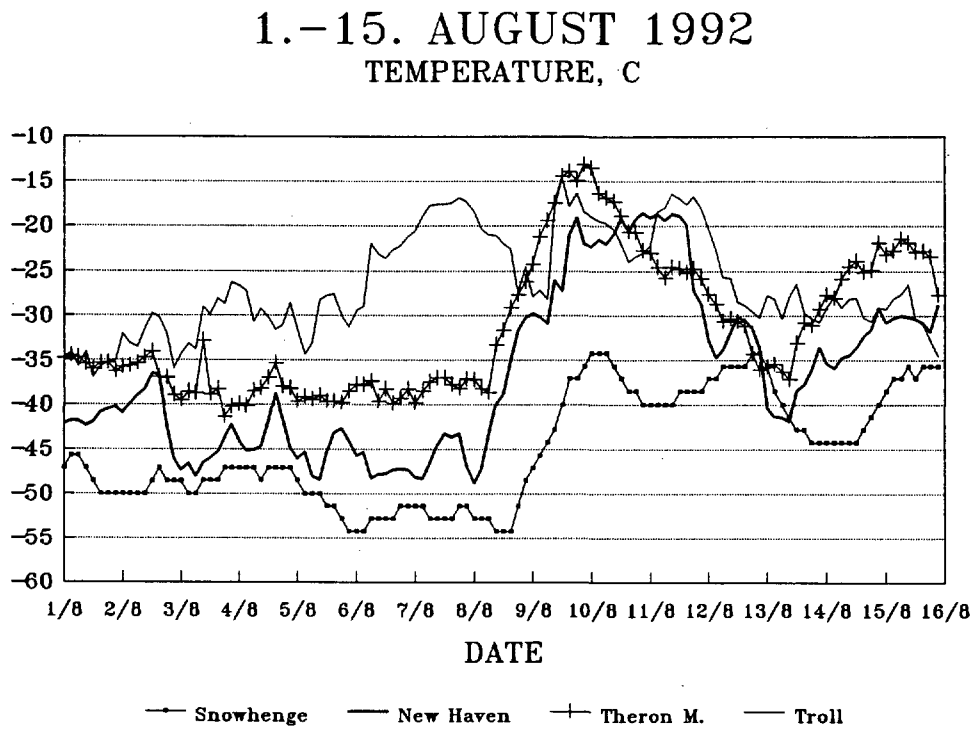


Figure 4. Time series of temperature (a) and air pressure (b) from all stations July 16 - 31 1992.



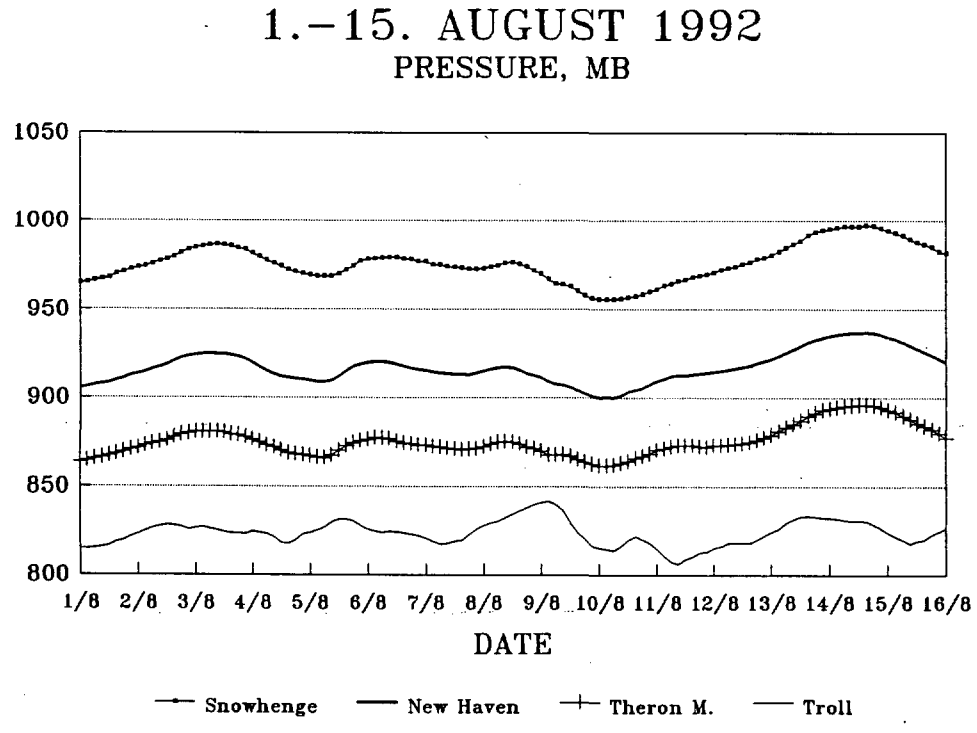
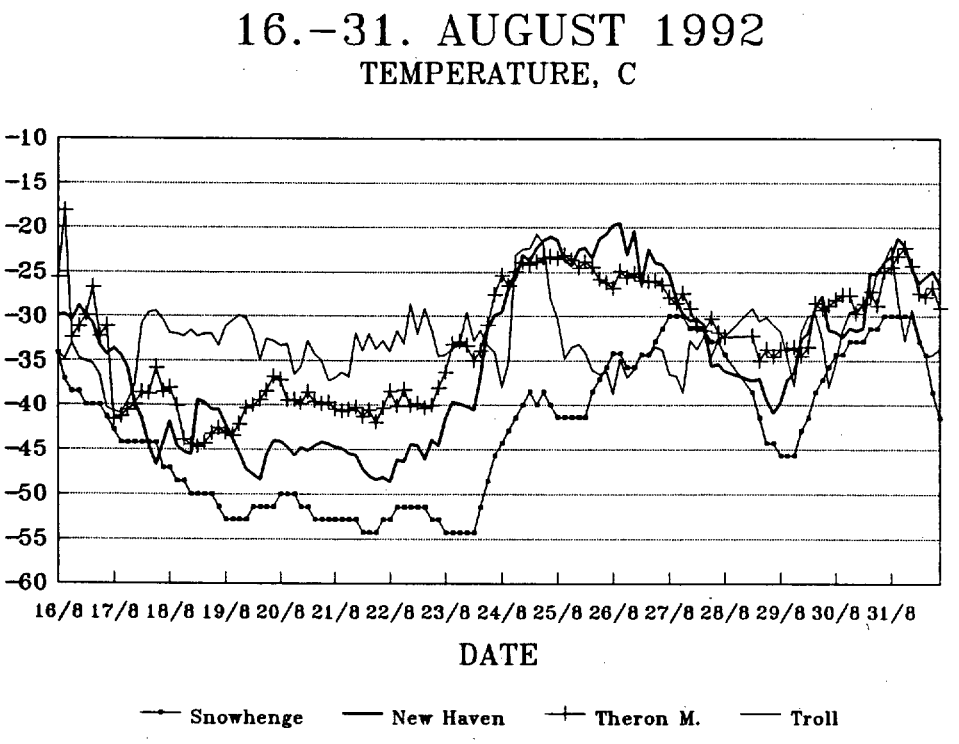


Figure 5. Time series of temperature (a) and air pressure (b) from all stations August 1 - 15 1992.



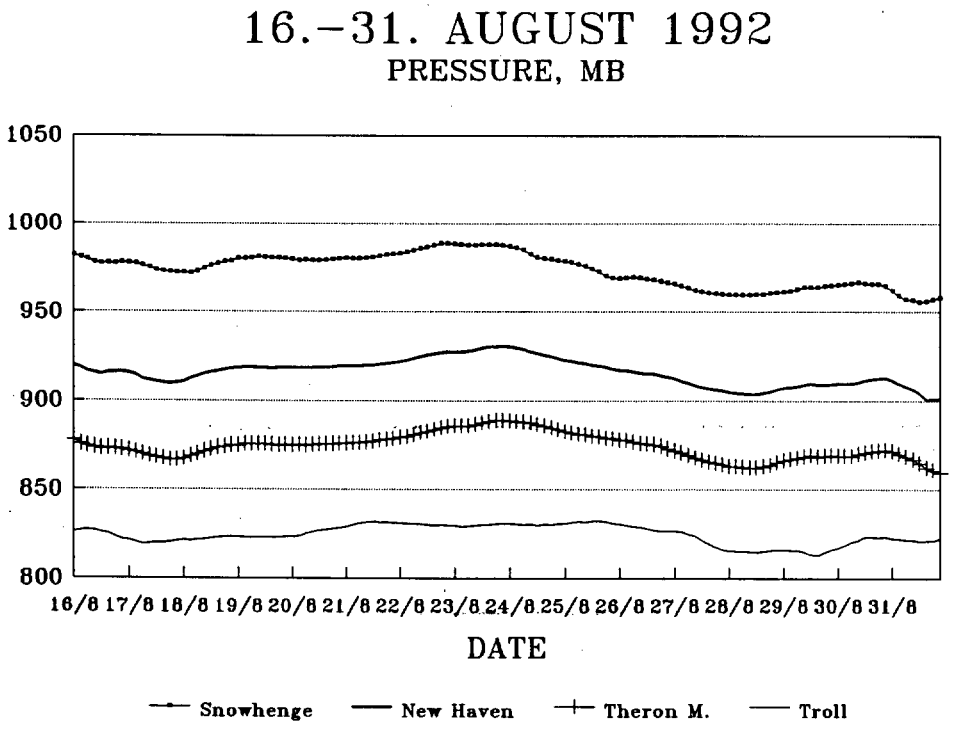
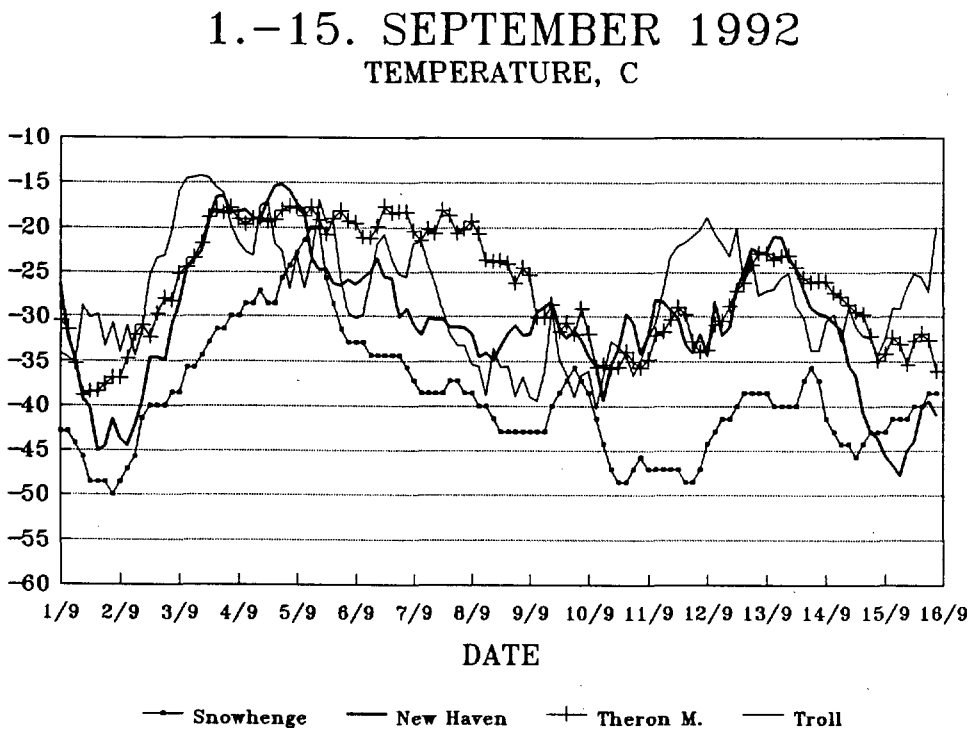


Figure 6. Time series of temperature (a) and air pressure (b) from all stations August 16 - 31 1992.



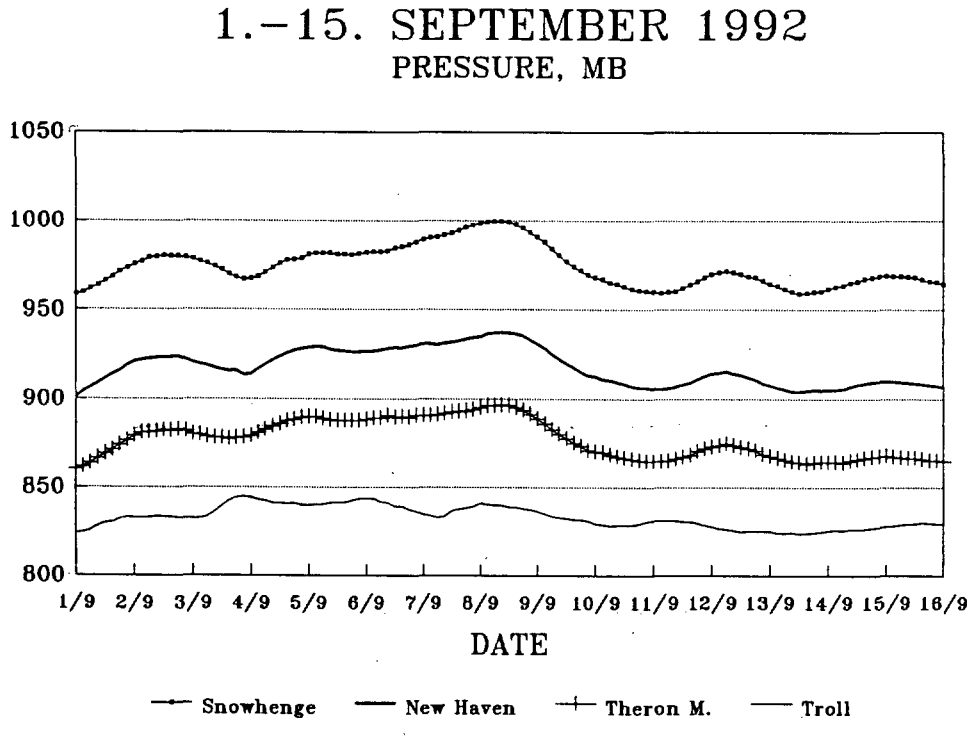


Figure 7. Time series of temperature (a) and air pressure (b) from all stations September 1 - 15 1992.

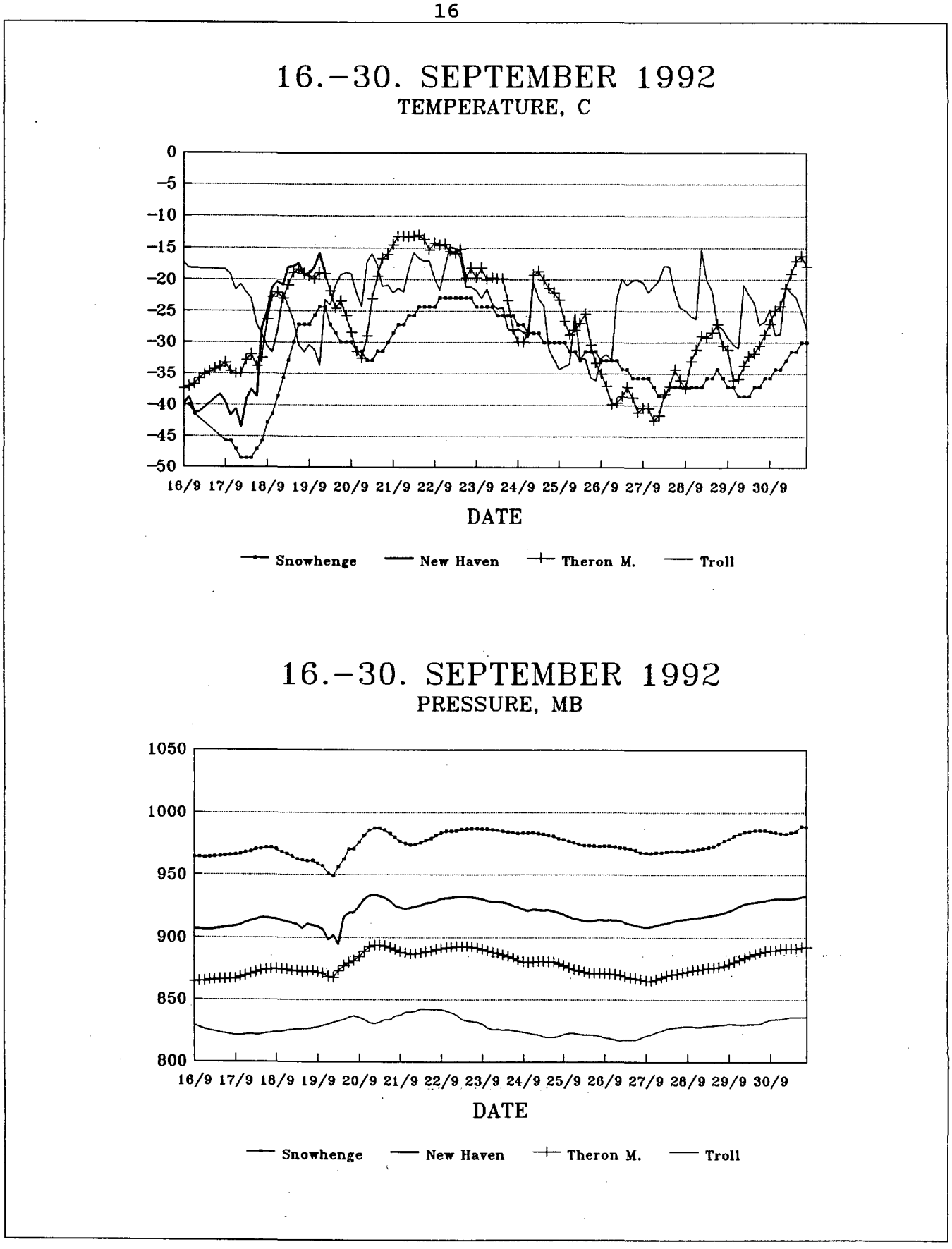


Figure 8. Time series of temperature (a) and air pressure (b) from all stations September 16 - 30 1992.

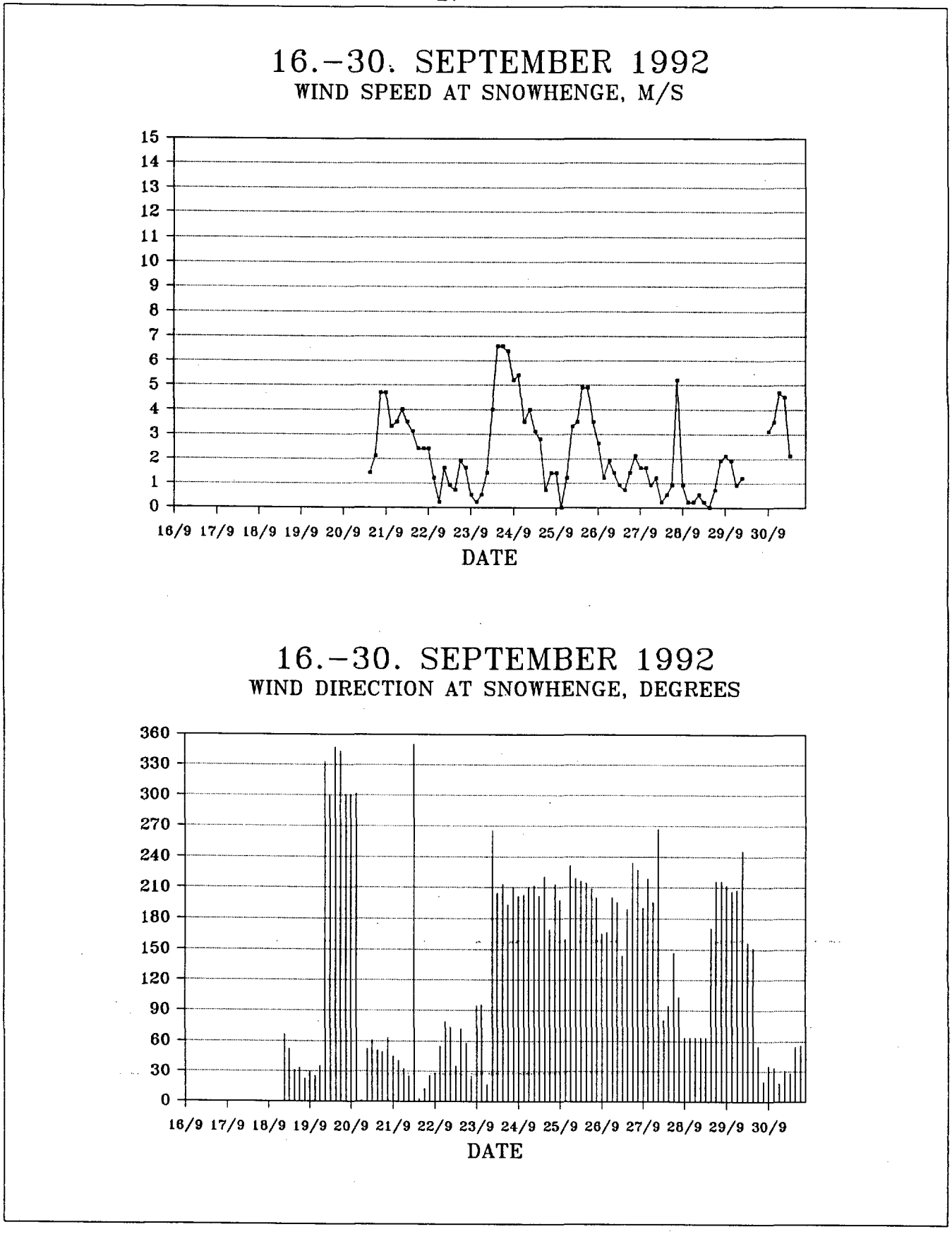
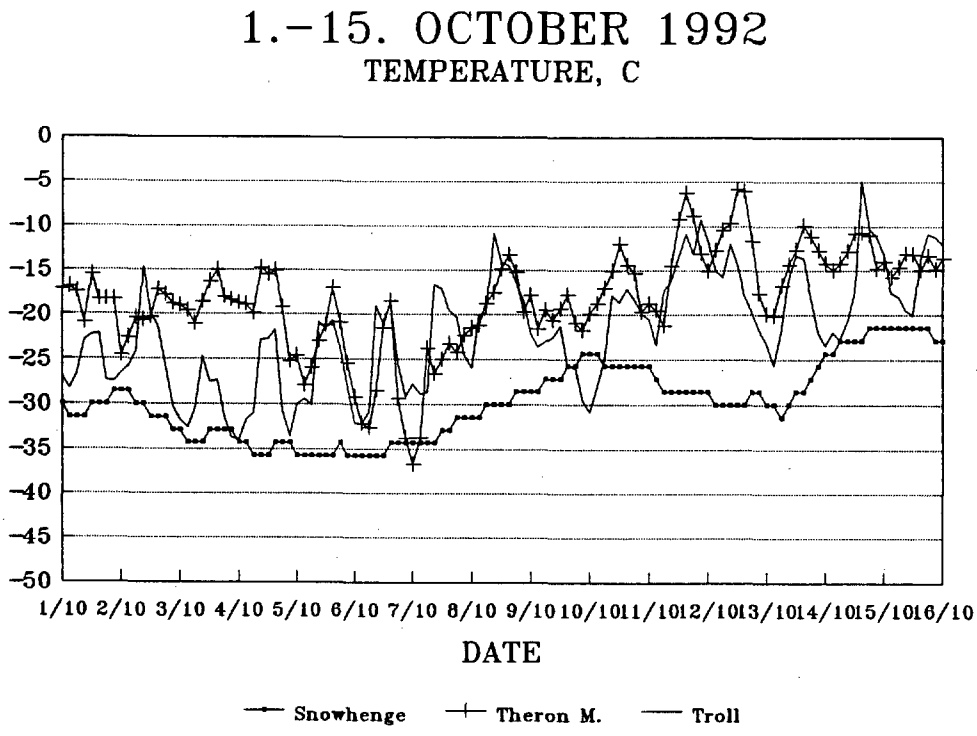


Figure 8.(cont.) Time series of wind speed (c) and direction (d) from Snowhenge September 16 - 30 1992.



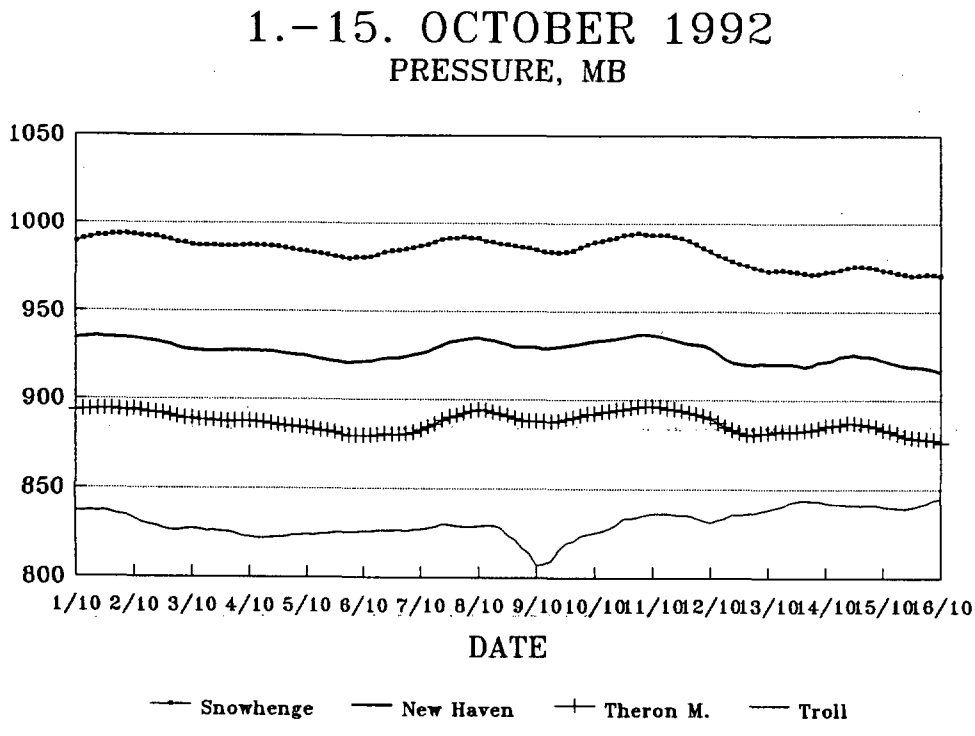
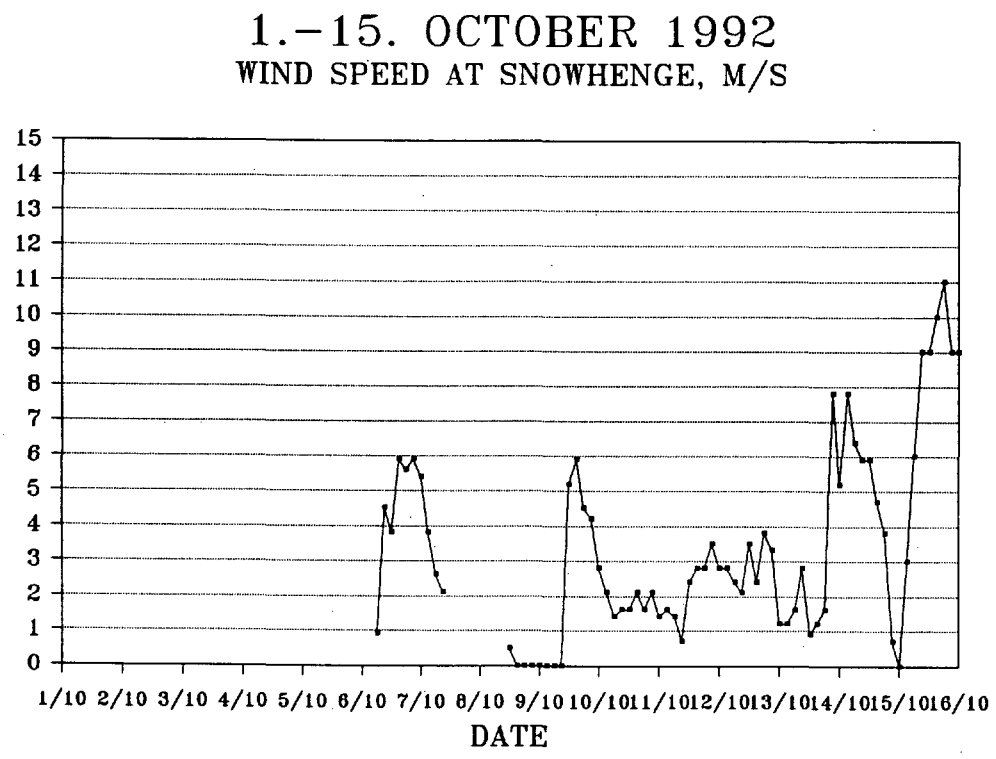


Figure 9. Time series of temperature (a) and air pressure (b) from all stations October 1 - 15 1992.



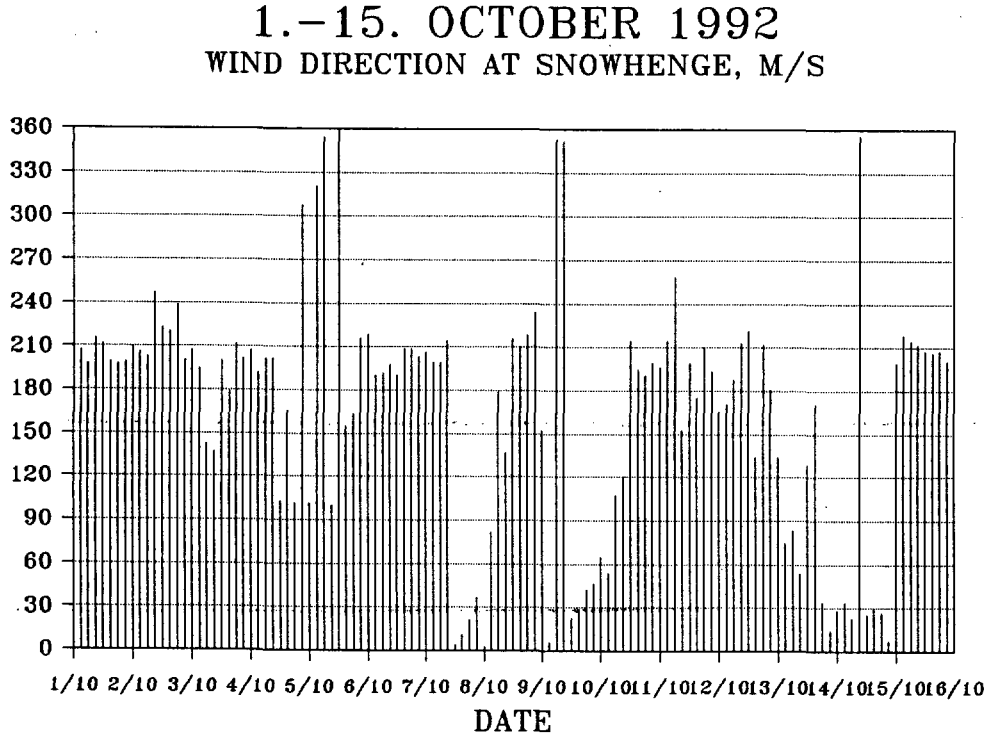
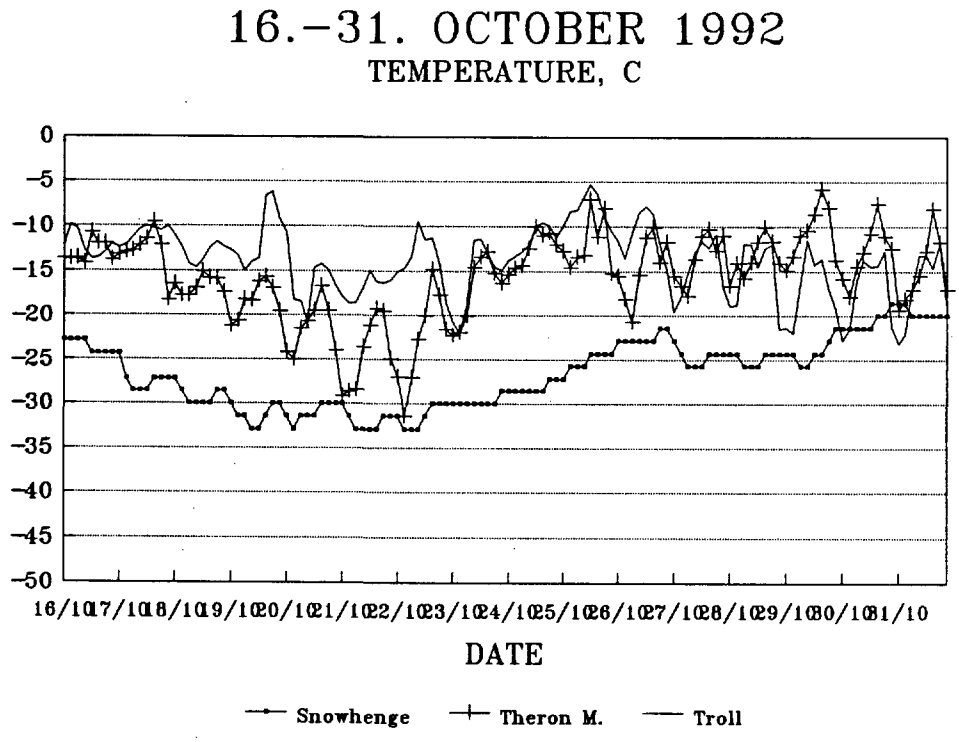


Figure 9.(cont.) Time series of wind speed (c) and direction (d) from Snowhenge October 1 - 15 1992.



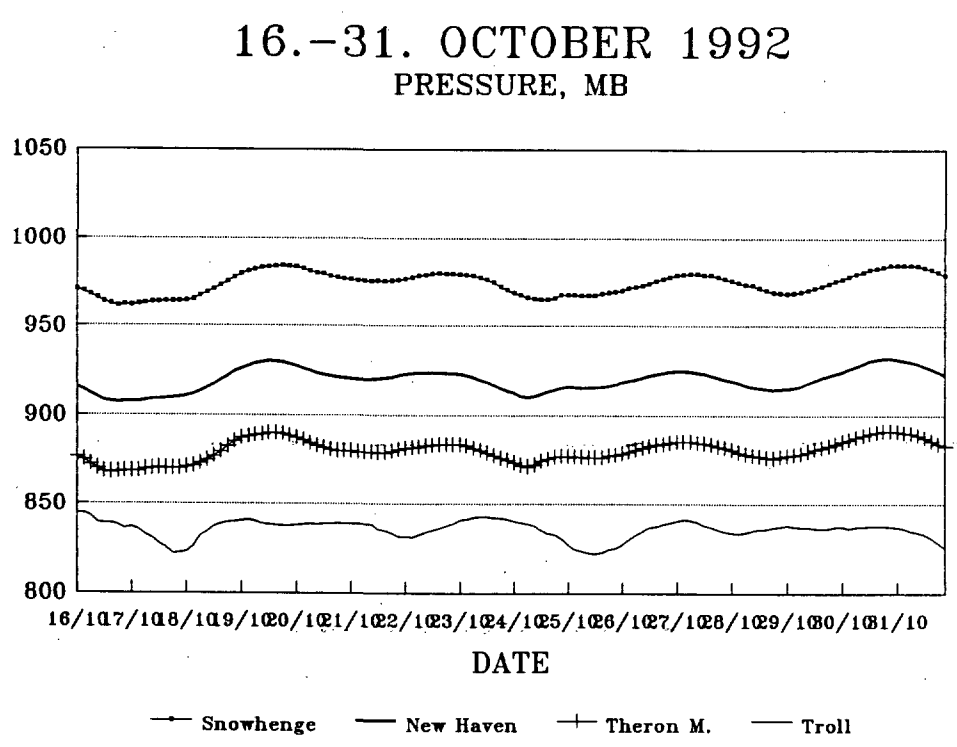
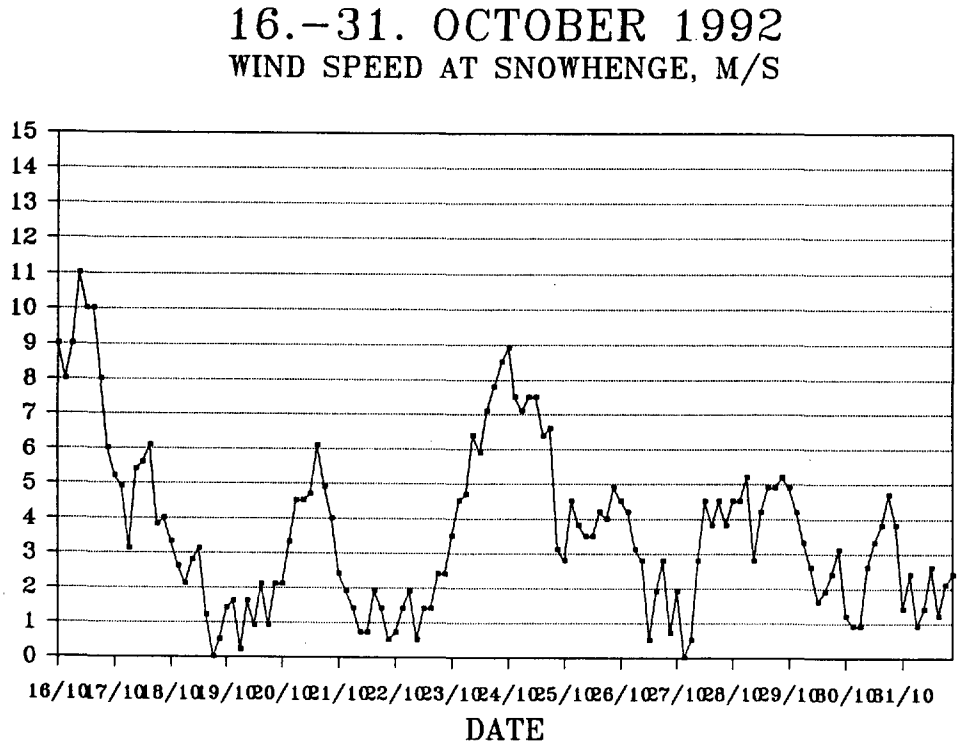


Figure 10. Time series of temperature (a) and air pressure (b) from all stations October 16 - 31 1992.



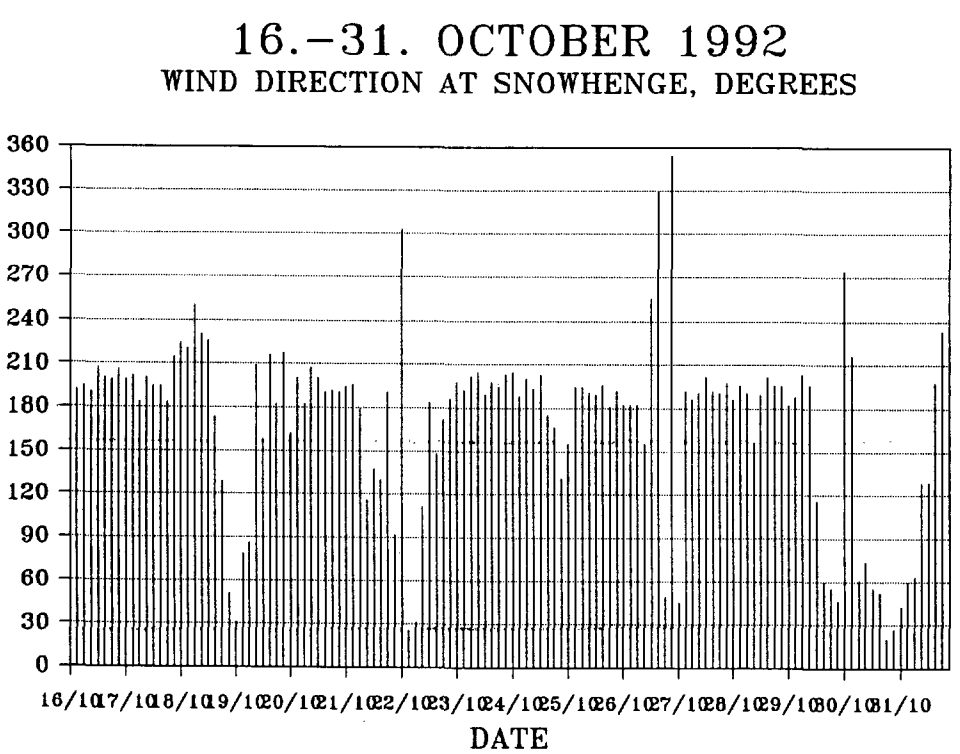
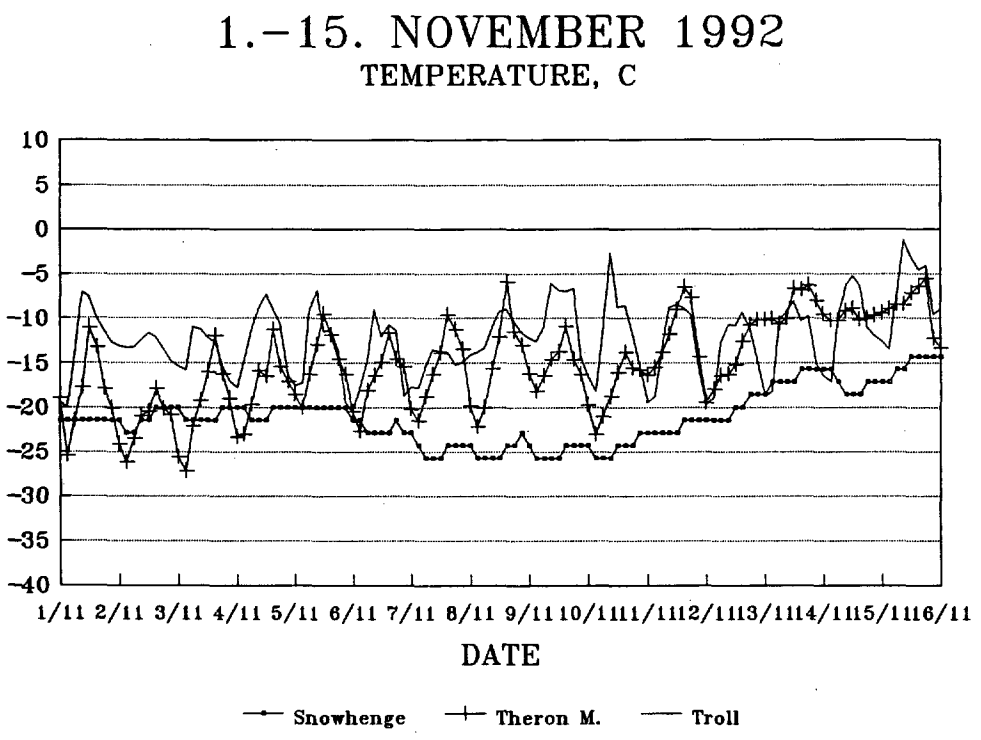


Figure 10.(cont.) Time series of wind speed (c) and direction (d) from Snowhenge October 16 - 31 1992.



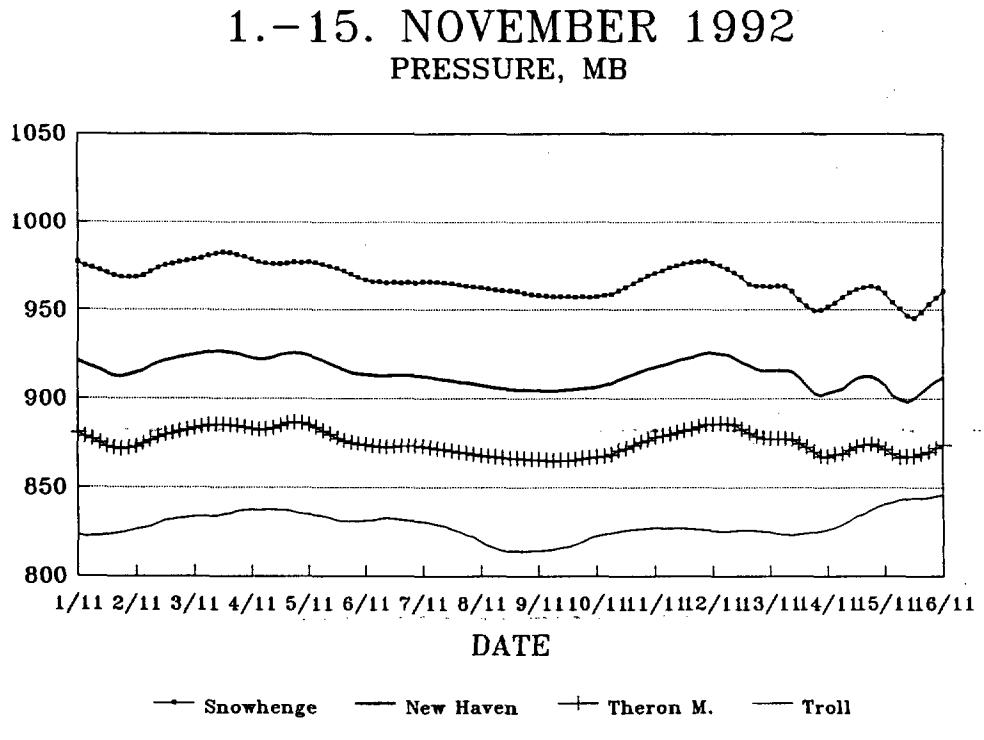
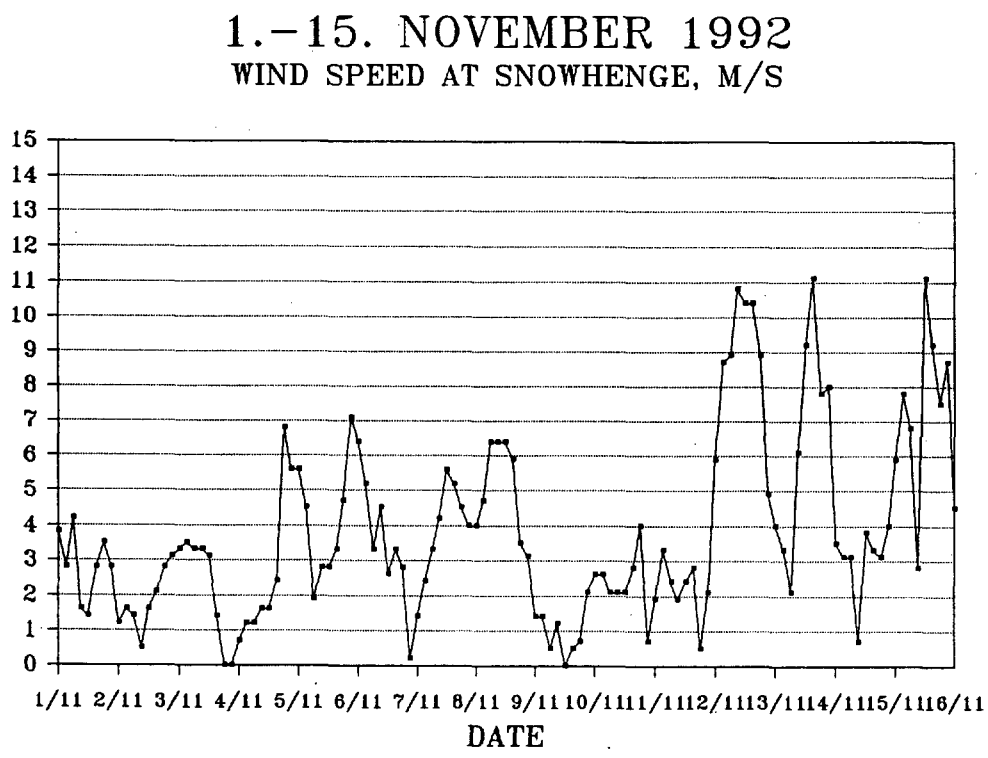


Figure 11. Time series of temperature (a) and air pressure (b) from all stations November 1 - 15 1992.



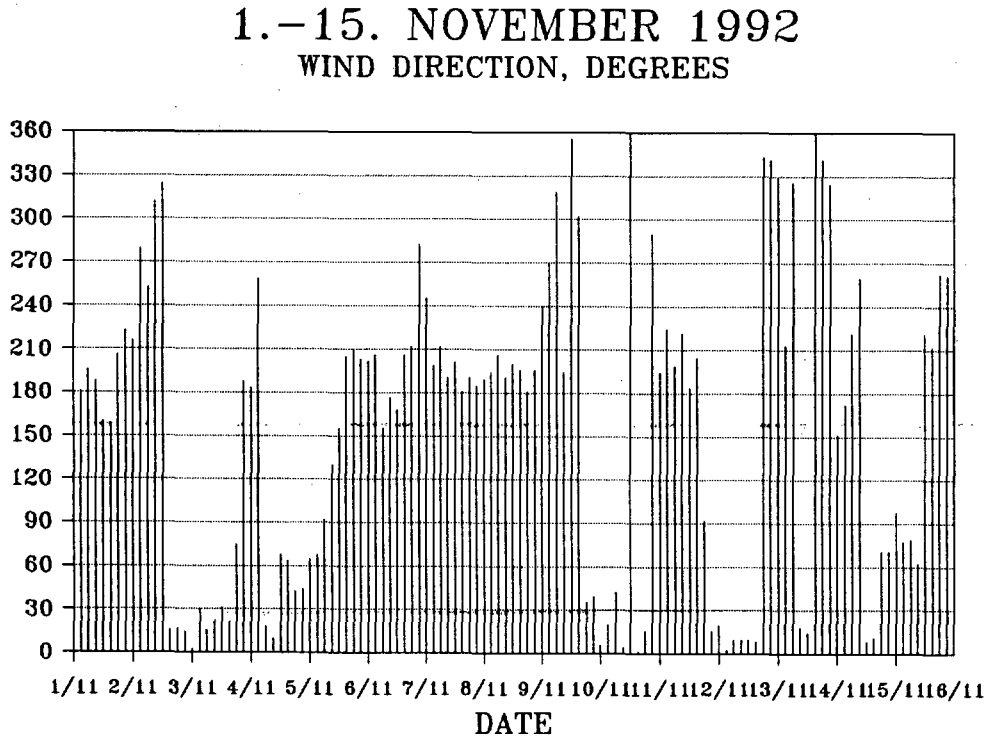
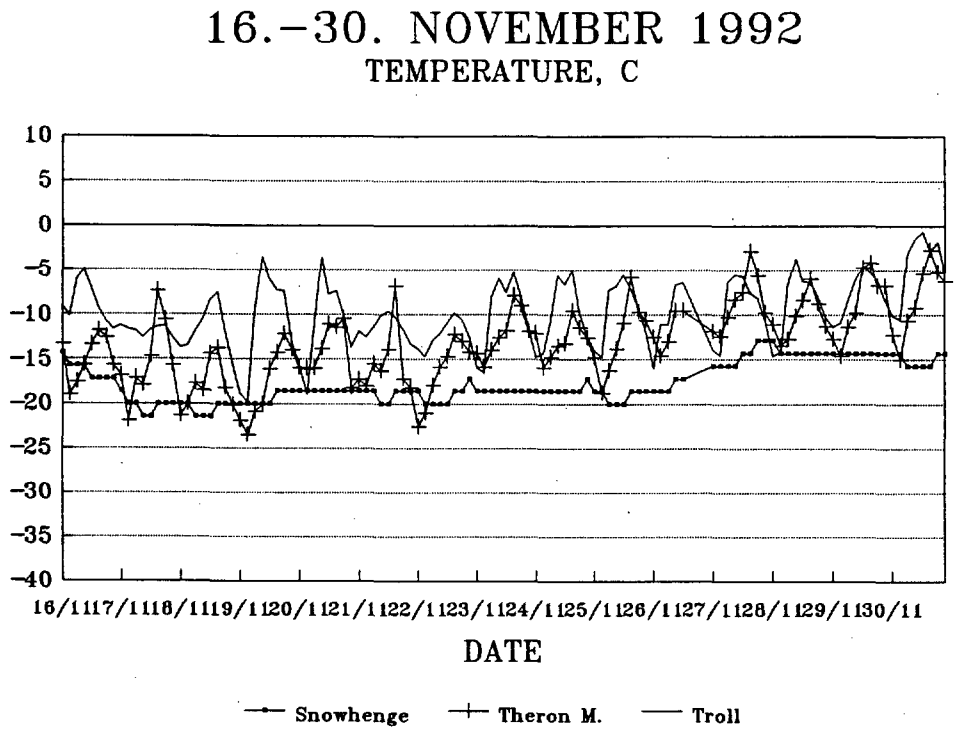


Figure 11. Time series of wind speed (c) and direction (d) from Snowhenge November 1 - 15 1992.



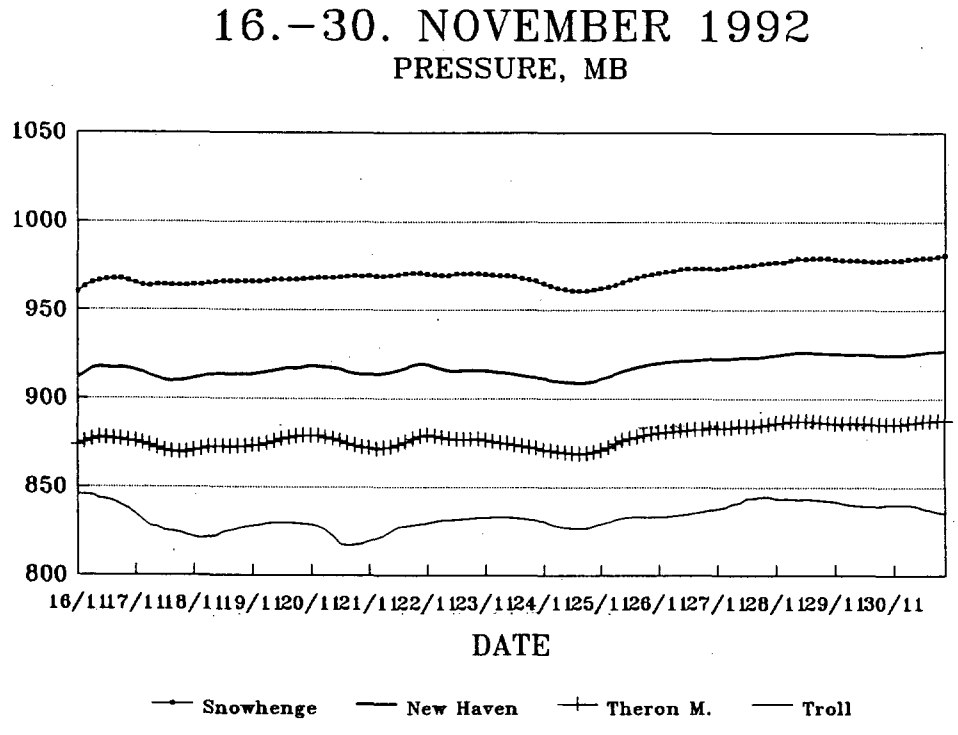
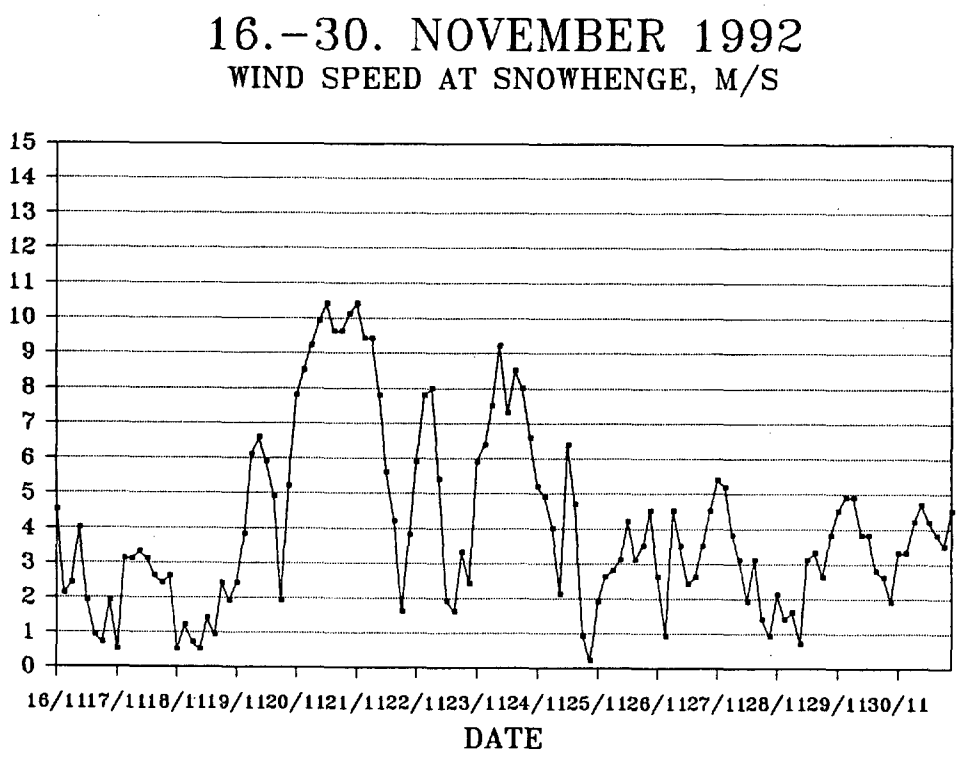


Figure 12. Time series of temperature (a) and air pressure (b) from all stations November 16 - 30 1992.



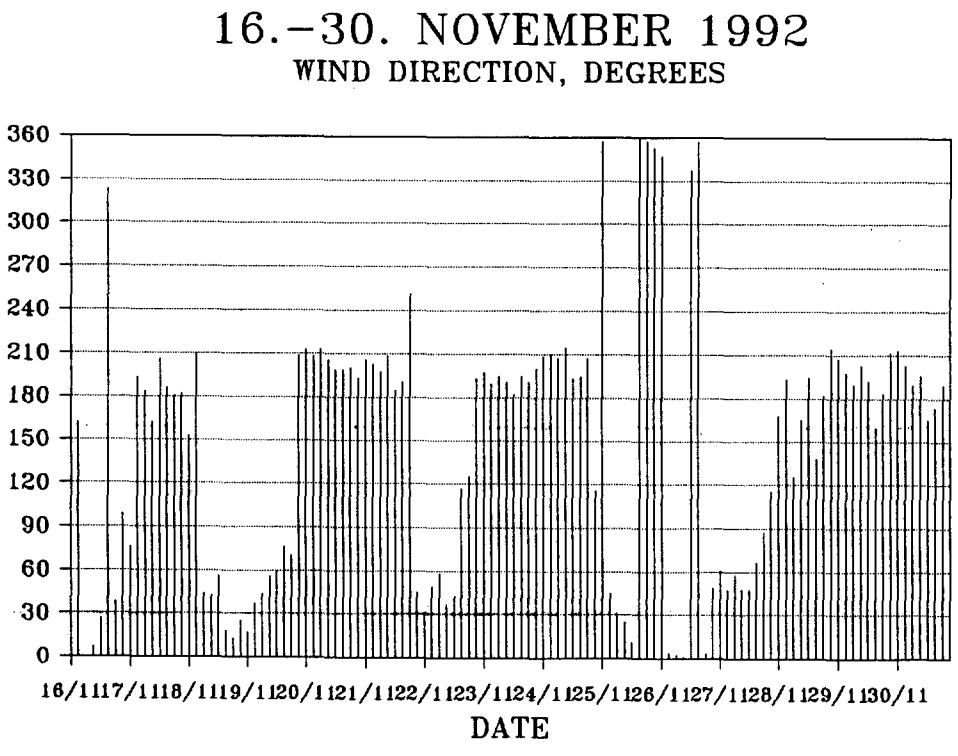
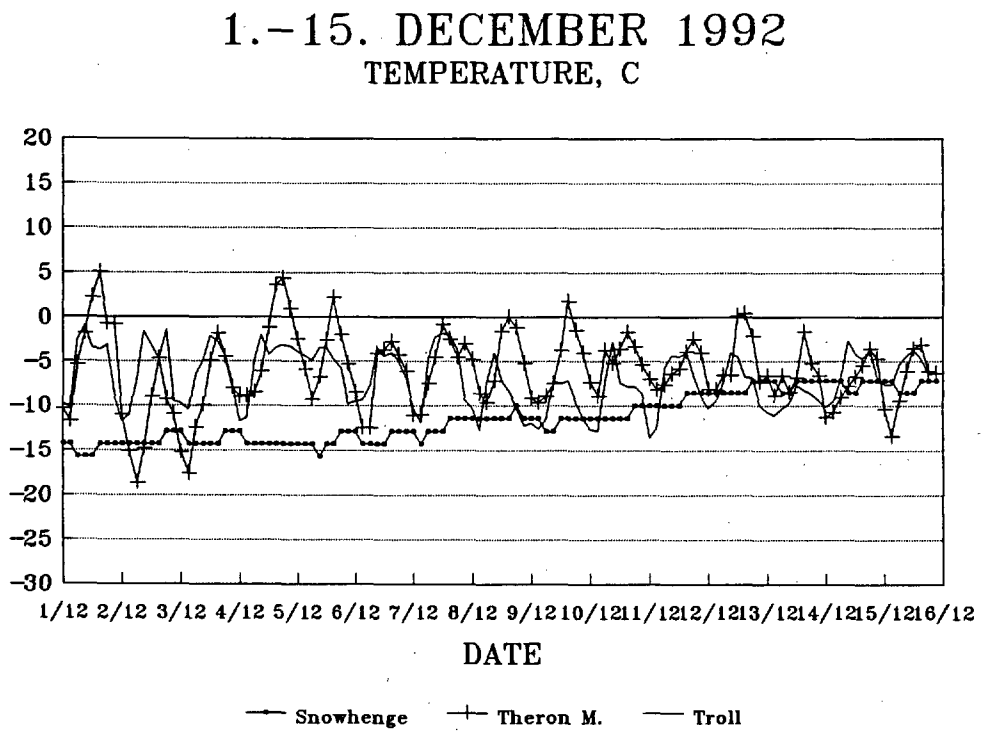


Figure 12.(cont.) Time series of wind speed (c) and direction (d) from Snowhenge November 16 - 30 1992.



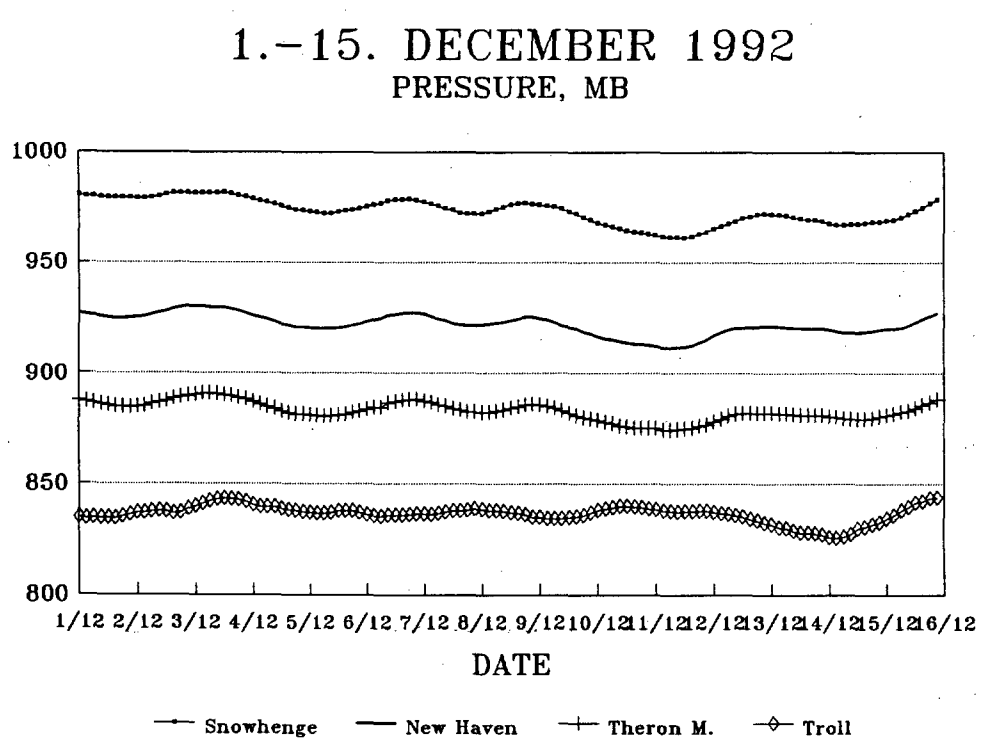
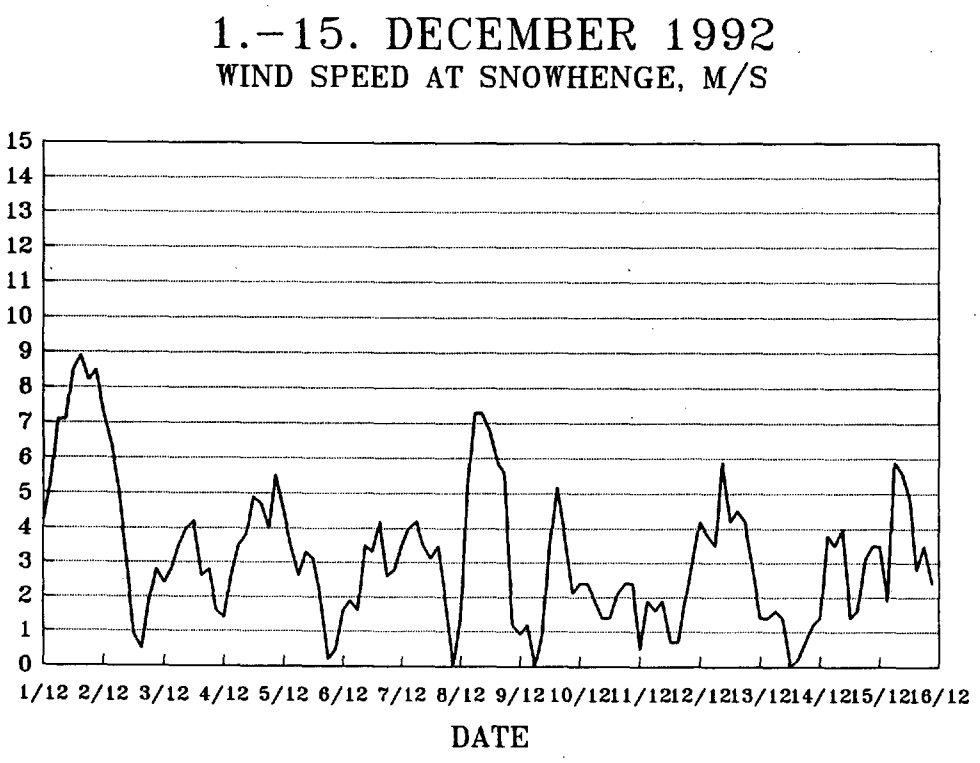


Figure 13. Time series of temperature (a) and air pressure (b) from all stations December 1 - 15 1992.



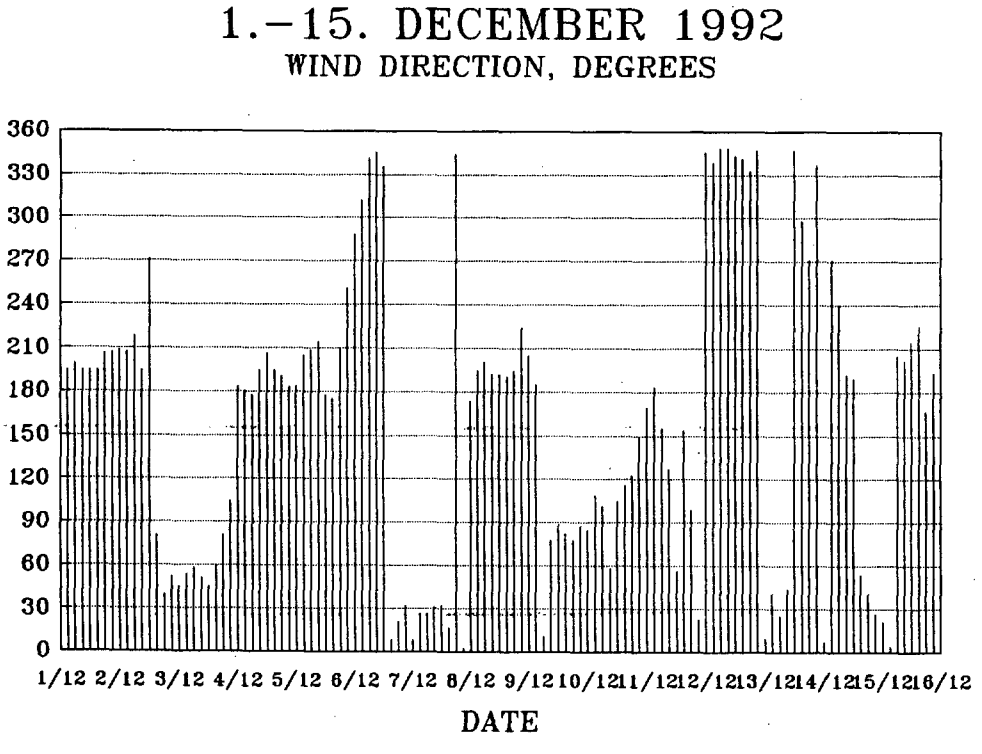
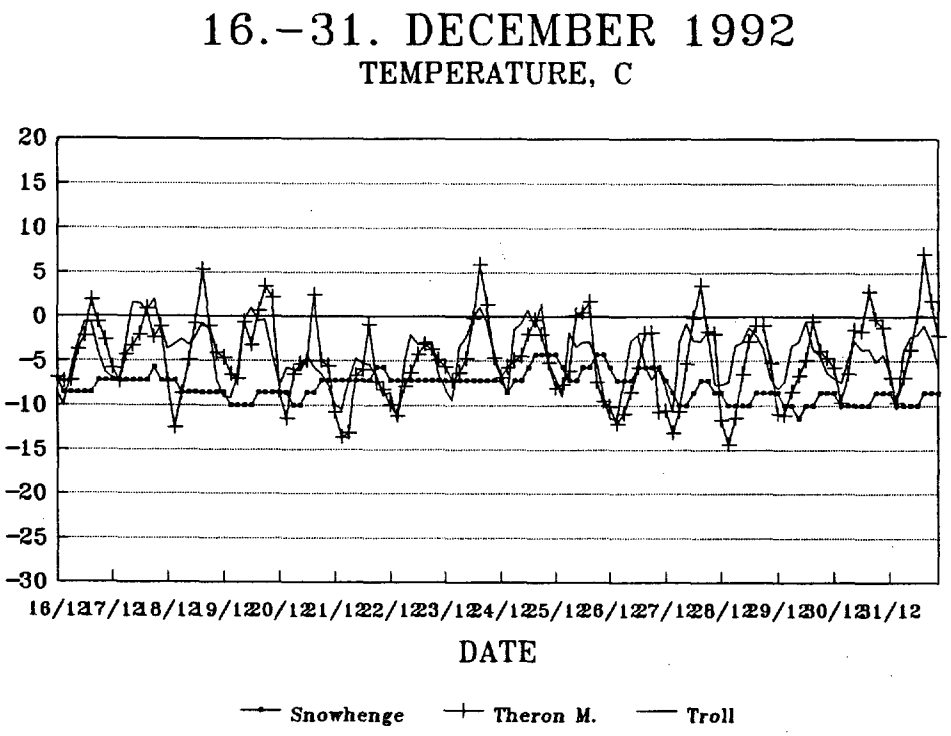


Figure 13.(cont.) Time series of wind speed (c) and direction (d) from Snowhenge December 1 - 15 1992.



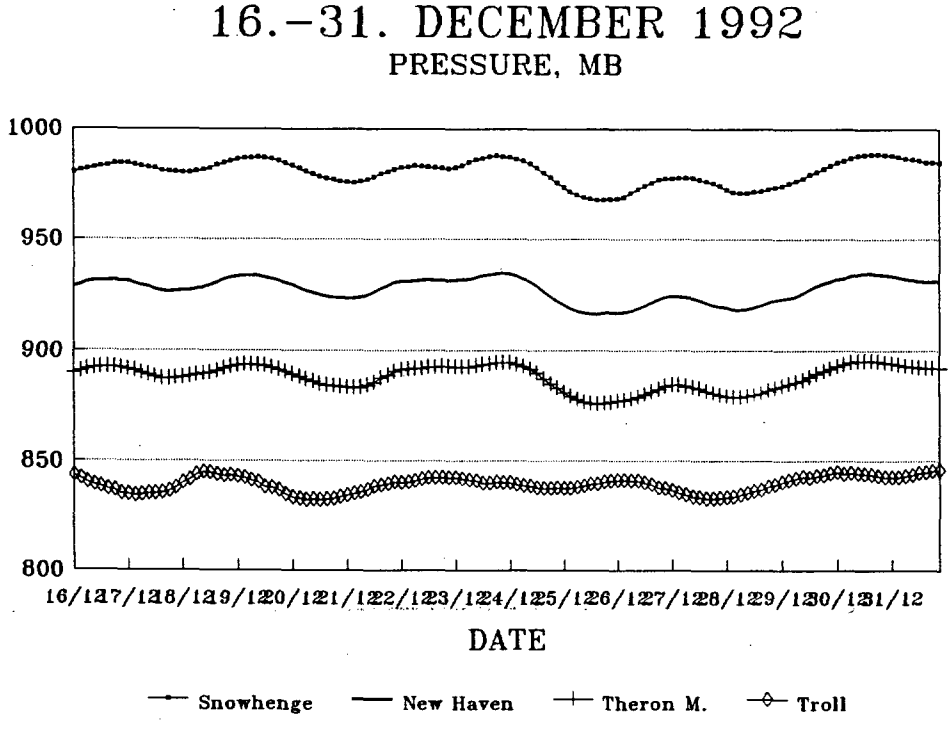
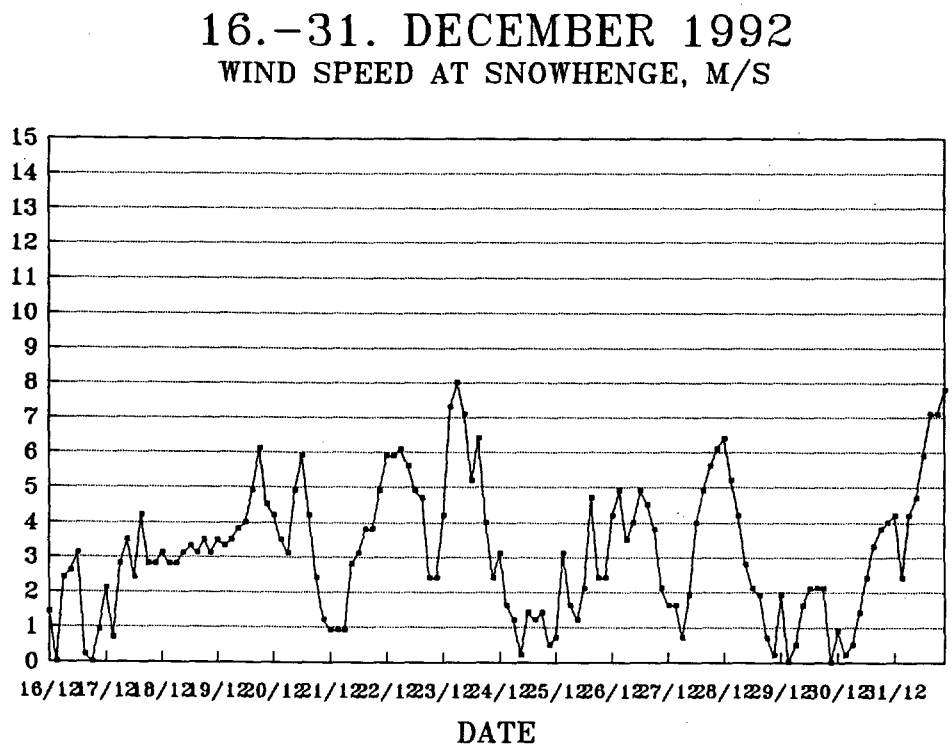


Figure 14. Time series of temperature (a) and air pressure (b) from all stations December 16 - 31 1992.



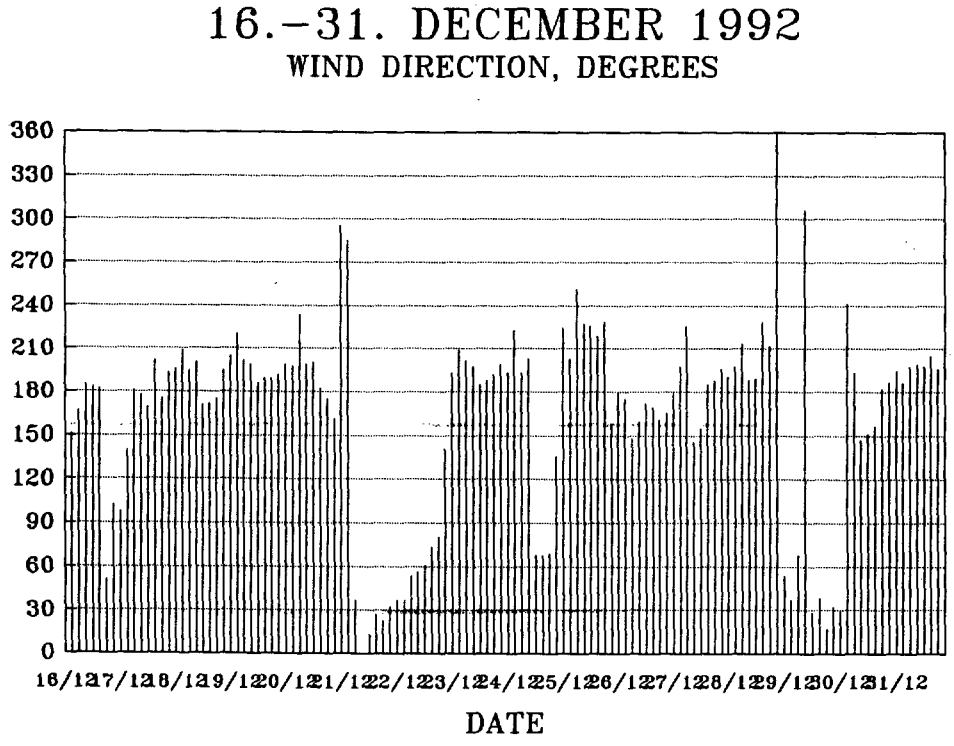


Figure 14.(cont.) Time series of wind speed (c) and direction (d) from Snowhenge December 16 - 31 1992.