

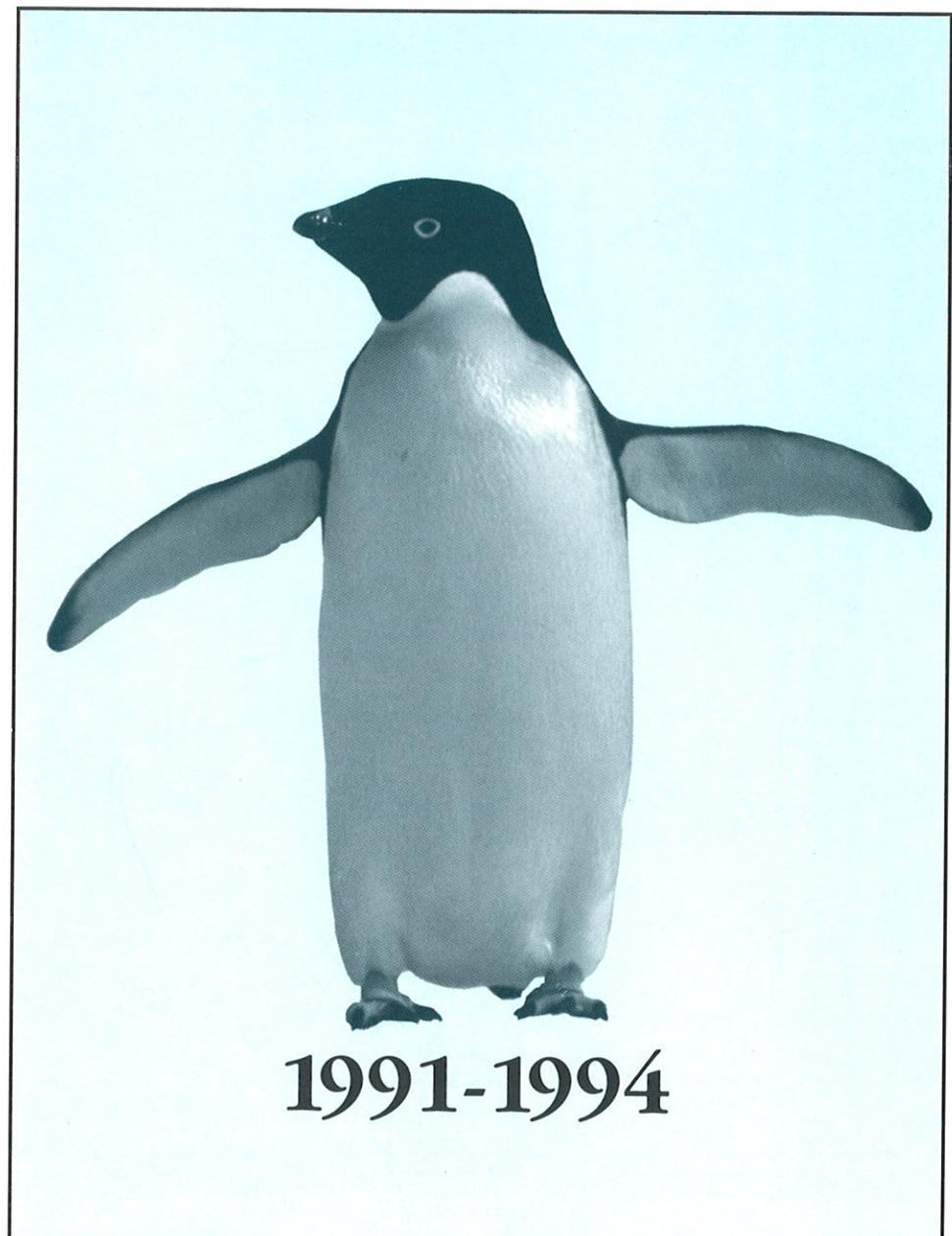
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THE AURORA *Programme*

METEOROLOGICAL DATA FROM BLUFIELDS
FEBRUARY - DECEMBER 1992

Inger Hanssen-Bauer

RAPPORT NR. 7/93 AURORA / 37/93 KLIMA



DNMI-RAPPORT

ISBN

RAPPORT NR.
7/93 AURORA
37/93 KLIMA

DATO
17.11.1993

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FEBRUARY - DECEMBER 1992

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DNMI - KLIMAAVDELINGEN

SAMMENDRAG

The present data report contains time series for the period February-December 1992 of meteorological elements measured at "Bluefields" in Antarctica. Some preliminary statistics are presented. The temperature at Bluefields was usually higher than the temperatures at the other Aurora stations in fall, winter and spring. In summer, however, the temperature at Theron Mountains was often higher than the temperature at Bluefields.

The wind direction was NE or E more than 75% of the time. The wind speed at Bluefields was higher than the wind speed at Snowhenge most of the time.

UNDERSKRIFT


.....
Inger Hanssen-Bauer


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Bjørn Aune

SAKSBEHANDLER

FAGSJEF

METEOROLOGICAL DATA FROM BLUEFIELDS
FEBRUARY - DECEMBER 1992

<u>Contents:</u>	page
1. Introduction	2
2. Station description.....	3
3. Presentation of data from 1992	4
3.1 Monthly mean values	4
3.2 Correlation analysis - temperature and wind speed.	6
3.3 Crosstabulation of wind direction.....	7
3.4 Frequency of wind direction and strength	10
3.5 Time series of temperature and wind	10
4. Final remarks	11
References	11
Appendix:	
Description of the Aanderaa station	43

1. INTRODUCTION

Four automatic weather stations were established during the Aurora field season 1991-92 (Kristensen, 1992): Bluefields Snowhenge, New Haven and Theron Mountains (figure 1). The 1992 data from the latter 3 stations were transmitted via the Argos system, and have been published earlier together with data from the Norwegian automatic station at Troll (Hanssen-Bauer, 1992 and 1993). Data from Bluefields, however, were only stored locally. They were collected during the field season 1992-93, and are published in the present data report. The Bluefield data are here compared with data from Snowhenge, Theron Mountains and Troll. Data from the Aurora stations are available on ASCII-files and as SAS-datasets. They are free of charge for Aurora programme participants, while others will have to pay handling charges for this information.

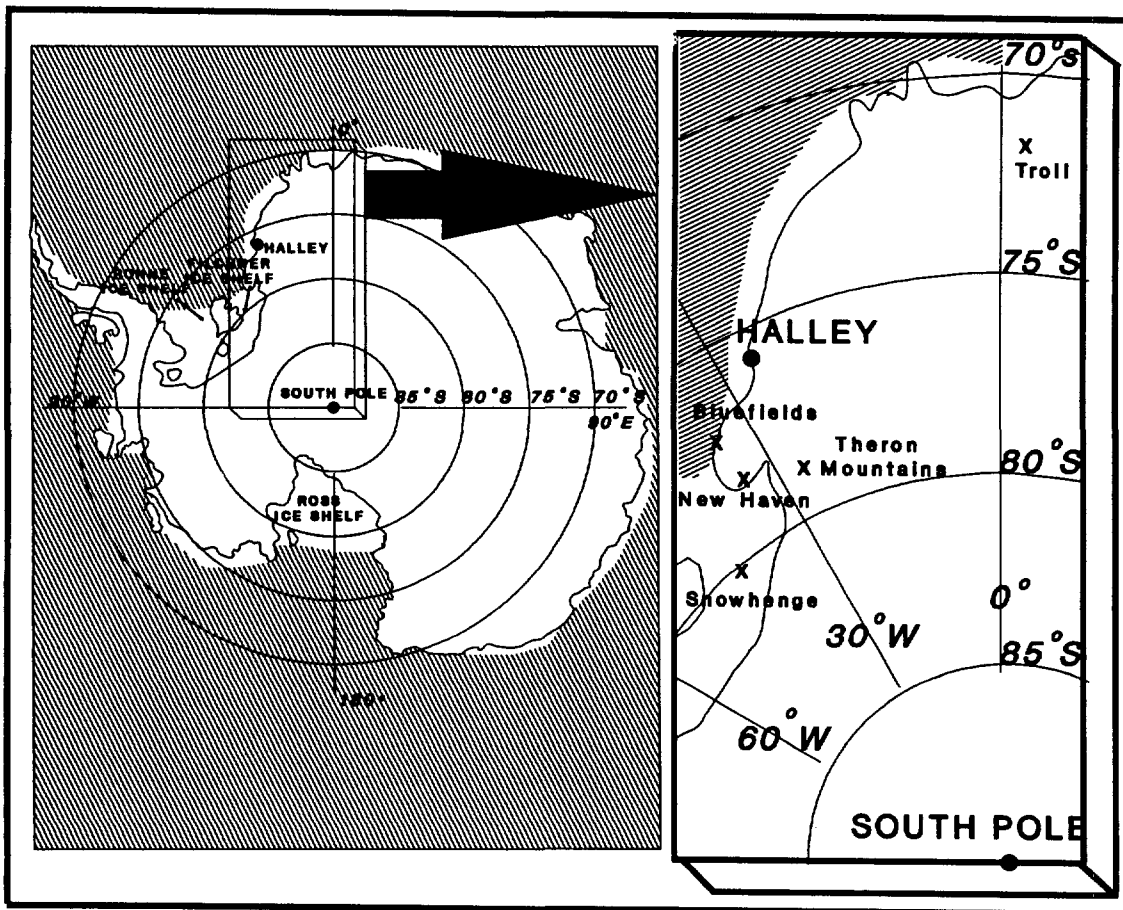


Figure 1. Map of Antarctica (left) and of the station area (right).

2. STATION DESCRIPTION

Bluefields is situated 77°30'S, 34°12'W. The height above sea level is 375 m, while Snowhenge is at 110 m a.s.l, Theron Mountains is at 930 m and Troll is 1290 m. The station is an Aanderaa automatic weather station (Appendix) with sensors for measuring air temperature (T), relative humidity (RH), wind speed (F) and direction (D). All sensors were situated 4m above the surface. The relative humidity sensor has malfunctioned, while the other sensors have been working satisfactory. Measurements were stored every hour. In this report, however, only data from every third hour are presented.

3. PRESENTATION OF DATA FROM 1992

3.1 Monthly mean values.

Table 1 shows monthly mean temperatures at Bluefields, Snowhenge, Theron Mountain and Troll, and monthly mean wind speeds at Bluefields and Snowhenge. The February values from different stations should not be compared directly, as data records from different stations do not start simultaneously.

As earlier reported (Hanssen-Bauer 1992 and 1993), the monthly mean temperatures at Snowhenge, Theron Mountains and Troll reflect a temperature inversion (i.e. the temperature increase with height) most of the year. The monthly mean temperatures at Bluefields, however, were higher than the similar temperatures at the other stations for the period April through October, in spite of the fact that Bluefields is situated only 375 m a.s.l. The reason for this is that the climate at Bluefields, more than at the other stations, is affected by air from the ocean, which in fall, winter and spring is relatively warm. During summer, the temperatures were frequently higher at Troll and Theron Mountains than at Bluefields.

Table 1. Monthly mean values 1992.

ELEMENT:	T E M P E R A T U R E, C				W I N D S P E E D, M/S	
STATION: MONTH:	BLUE-FIELDS	SNOW-HENGE	THERON MOUNT.	TROLL	BLUE-FIELDS	SNOW-HENGE
FEBRUARY	-13.2*	-20.5*	-12.8*	-8.8	5.7*	3.0*
MARS	-18.9	-30.9	-22.1	-14.2	7.8	4.0
APRIL	-19.8	-32.8	-25.6	-20.9	7.5	3.6
MAY	-20.2	-34.9	-25.2	-21.3	7.1	2.5
JUNE	-21.1	-36.5**	-27.0	-24.7	9.9	3.8**
JULY	-24.0	-40.7	-30.3	-27.9	8.6	-
AUGUST	-27.4	-44.0	-32.1	-29.6	8.5	-
SEPTEMBER	-22.7	-35.8	-26.7	-25.9	9.7	-
OCTOBER	-12.9	-28.1	-16.9	-17.7	7.2	3.4
NOVEMBER	-12.7	-19.4	-14.1	-11.0	6.9	4.0
DECEMBER	-6.8	-9.5	-5.3	-5.7	5.9	3.2

* Bluef.:Feb.23-29, Snowh.:Feb.22-29, Theron M.:Feb.18.-29

** Several values missing at Snowhenge in June.

The monthly mean wind speed at Bluefields was usually about 2 times the similar value at Snowhenge.

The average diurnal temperature variation at Bluefields for each month is shown in figure 2. The average diurnal amplitude reached its maximum of 3°C in November, while there was no significant diurnal variation during April through August. The monthly averaged diurnal amplitudes at Bluefields were generally smaller than the diurnal amplitudes at the other Aurora stations, except for periods where some of the other temperature sensors were buried by snow. The reason for this is partly that the climate at Bluefields is more "coastal" than the climate at the other Aurora stations, and partly that the measurements at Bluefields were taken 4 m above ground, while the temperatures at the other stations were measured less than 1 m above ground.

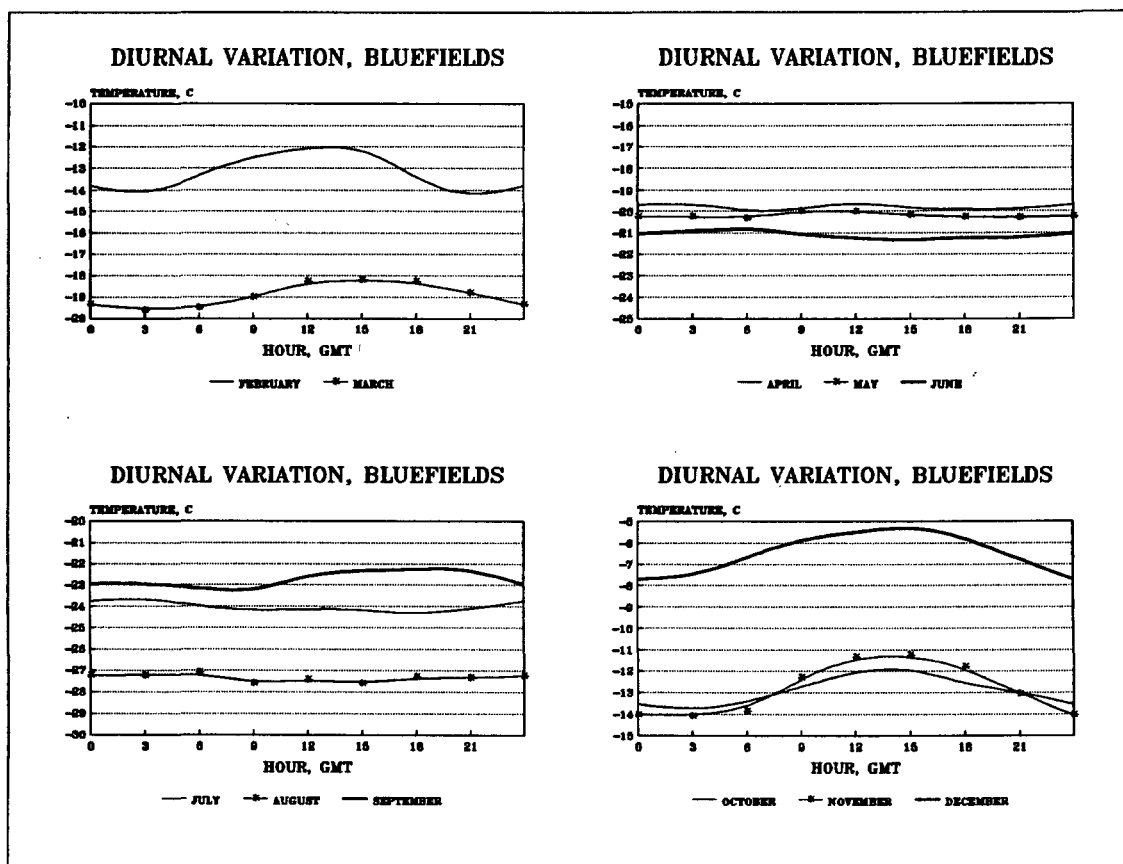


Figure 2. Diurnal temperature variation at each station.

3.2 Correlation analysis - temperature and wind speed.

Correlation coefficients were computed between the temperature series from Bluefields and the series from Snowhenge, Theron Mountains and Troll, for every month separately, and for the whole period (table 2a). To avoid "noise" because of differences in diurnal variation, daily mean temperatures were used in these analyses. For every single month and for the whole period, the series from Theron Mountains was best correlated to the series from Bluefields. The correlation coefficients were generally at minimum during summer and early fall.

Table 2b shows that wind speed is poorly correlated at Snowhenge and Bluefields. This is not surprising, as the wind-speed is heavily influenced by local conditions.

Table 2. a) Correlation coefficients R_t , between daily mean temperatures at Bluefields and the other stations. b) Correlation coefficients R_f , between wind speed at Bluefields and Snowhenge. Correlation coefficients are given for the individual months, and for at the whole period February - December.

a)

R_t:	SNOWHENGE - BLUEF.	THERON M. - BLUEF.	TROLL - BLUEF.
PERIOD:			
FEB	0.37	0.68	0.01
MAR	0.06	0.70	-0.14
APR	0.75	0.79	-0.11
MAY	0.50	0.80	0.57
JUN	0.58	0.81	0.47
JUL	0.85	0.94	0.49
AUG	0.70	0.87	0.18
SEP	0.78	0.88	0.38
OCT	0.52	0.75	0.43
NOV	0.71	0.80	0.50
DEC	0.31	0.58	0.41
FEB-DEC	0.84	0.92	0.70

b)

R_f:	SNOWHENGE - BLUEF.
PERIOD:	
FEB	0.08
MAR	0.07
APR	0.57
MAY	-0.17
JUN	0.48
JUL	0.17
AUG	0.12
SEP	0.41
OCT	0.16
NOV	0.15
DEC	-0.09
FEB-DEC	0.15

3.3 Crosstabulation of wind direction.

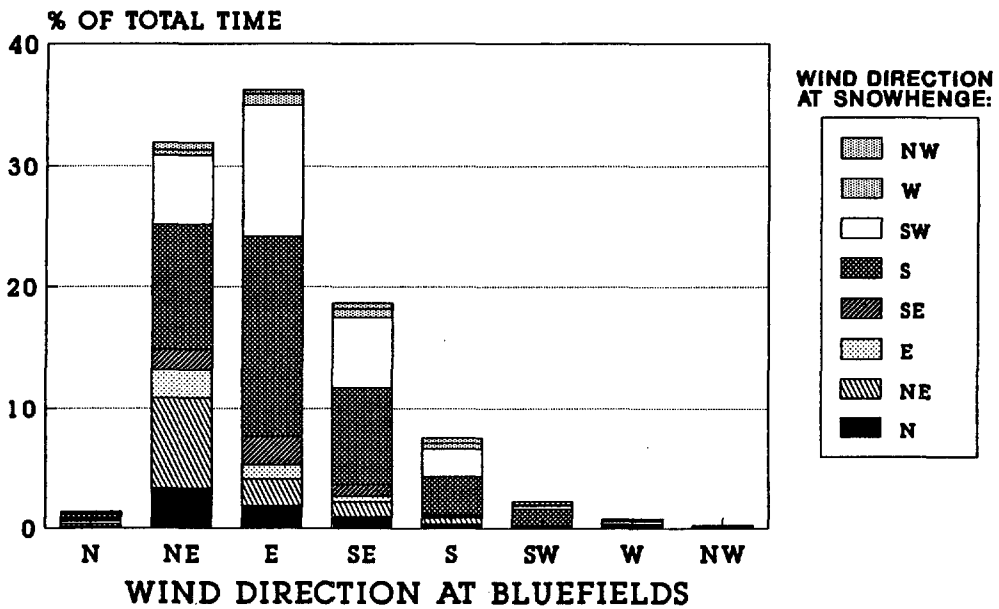
Figure 3 is an illustration of the crosstabulation of wind direction at Bluefields and Snowhenge. The figure is based upon all nonmissing pairs of observations in 1992. As wind direction at Snowhenge was missing through the colder parts of the winter, the distribution is not representative for the whole period February - December.

In figure 3a, the stacked bars show the frequency of different wind directions at Bluefields in % of all observations. The subdivision of the bars show the frequency of different wind directions at Snowhenge when the wind direction at Bluefields is given. Figure 3b show the frequency distribution of wind direction at Snowhenge, subdivided by the frequency of wind directions at Bluefields.

Most of the time, the wind direction at Bluefields had an easterly component, while the wind direction at Snowhenge was most frequently south to southwest. This is in accordance with the average pattern of the surface windflow in Antarctica (Schwerdtfeger 1970). The flow of cold air from the polar plateau to the coast is a dominating feature of the climate of Antarctica. Topographical influence makes this flow southerly at Snowhenge, while topography combined with coriolis acceleration makes it easterly at Bluefields. Figure 3a shows that in 3 of 4 cases with easterly wind at Bluefields, the wind was southerly or southwesterly at Snowhenge. Figure 3b shows that more than 4 of 5 cases with southerly wind at Snowhenge, the wind at Bluefields had an easterly component.

At Snowhenge, there is a secondary frequency maximum at northeasterly winds. This is associated with passing pressure systems which occasionally allow warmer air from the coast to penetrate deep into the shelf. In 5 of 6 cases with northeasterly wind at Snowhenge, the wind direction was easterly or northeasterly at Bluefields.

a) DISTRIBUTION OF WIND DIRECTION
AT BLUEFIELDS



b) DISTRIBUTION OF WIND DIRECTION
AT SNOWHENGE

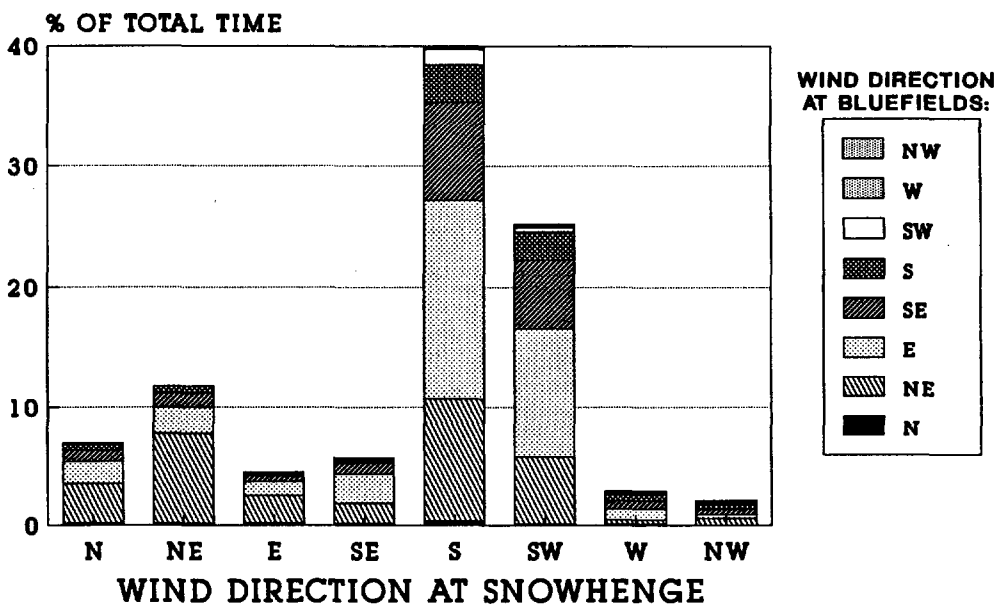


Figure 3. Distribution of wind direction at Bluefields and Snowhenge.

WIND DISTRIBUTION AT BLUEFIELDS DIRECTION AND SPEED

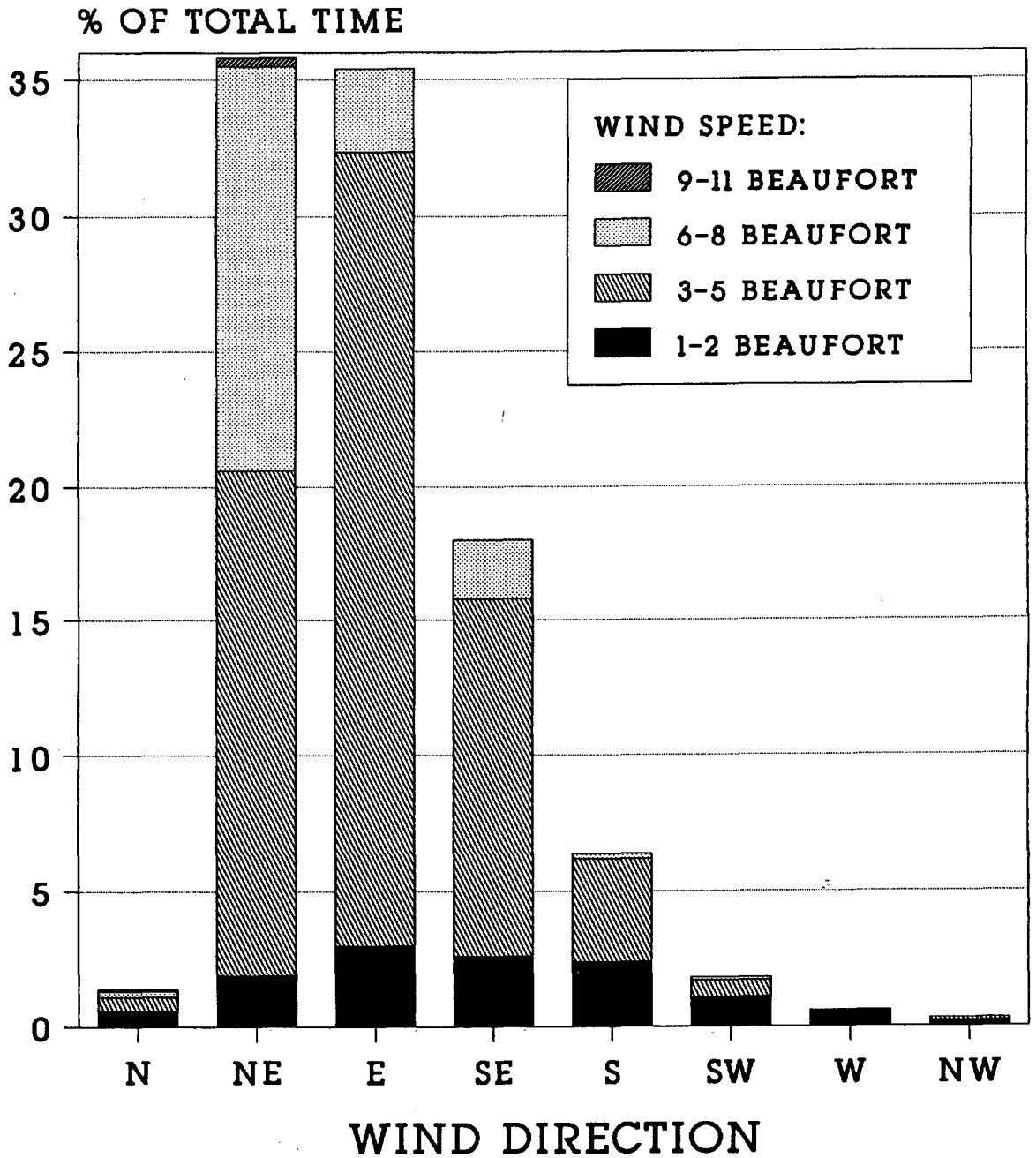


Figure 4. Distribution of wind direction and wind strength at Bluefields.

Northeasterly winds at Bluefields, however, may often occur when the wind at Snowhenge is southerly. As the cold air flow from the inlands has a strong easterly component at Bluefields, it is more difficult than at Snowhenge to distinguish between periods dominated by cold air flow from the inlands and by passing pressure systems solely by watching the wind direction.

3.4 Frequency of wind direction and strength.

Figure 4 shows the frequency distribution of wind direction and wind strength at Bluefields. The figure shows that NE and E are the most frequent wind directions. The strongest winds (9-11 Beaufort), however, were observed from N and NE. The strongest winds are thus associated with passing pressure systems, rather than with katabatic winds.

3.5 Time series of temperature and wind.

Figure 5 shows time series of temperature from Bluefields, Snowhenge, Theron Mountains and Troll during February 16.-29. 1992. Figure 6 - 15 show similar time series for March through December. The temperature series at Theron Mountains is the one which in shape reminds most of the series from Bluefields, most of the time. It was, however, warmer at Bluefields than at Theron Mountains most of the time.

Figure 16 shows time series of wind speed and direction from Bluefields and Snowhenge during February 16.-29. 1992. Figure 17 - 36 show similar time series for March through December.

4. FINAL REMARKS

This report is mainly a data report from Bluefields. The statistical analyses conducted should be considered as preliminary. Further analyses of the data set will be done later, when longer time series and data from Halley are available.

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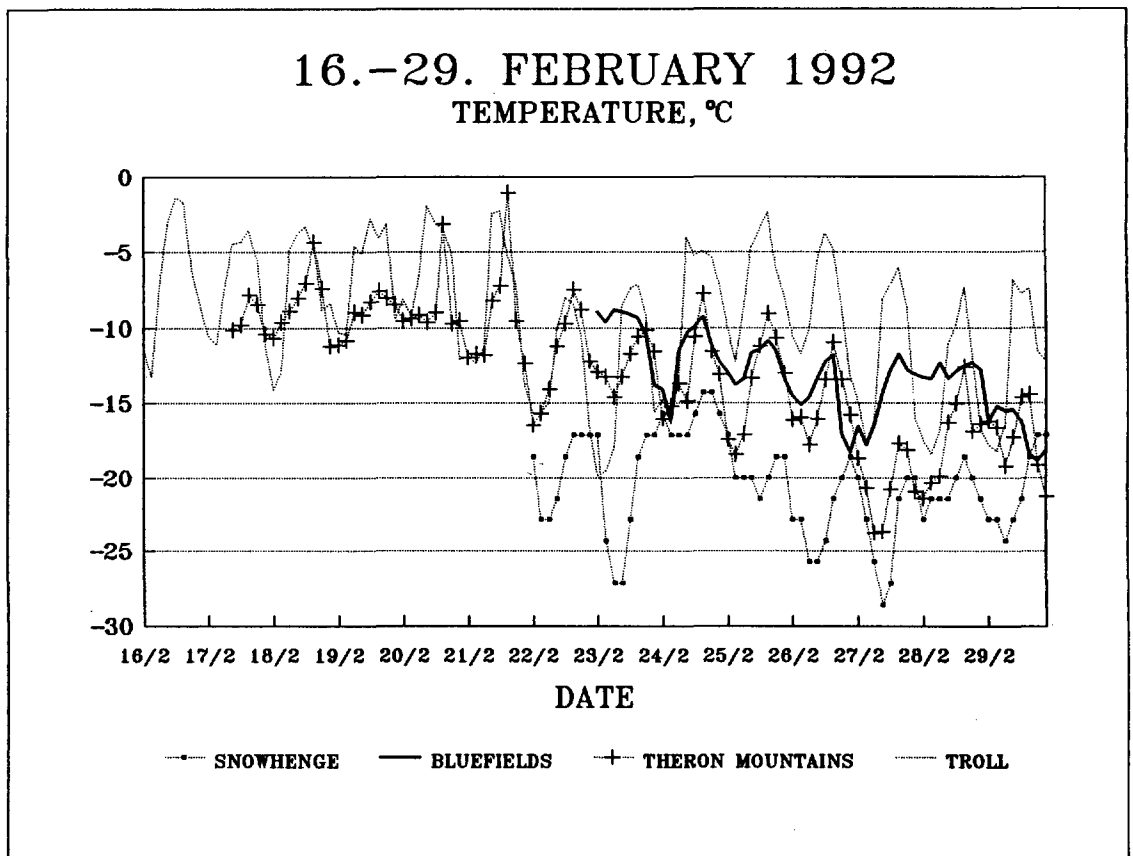
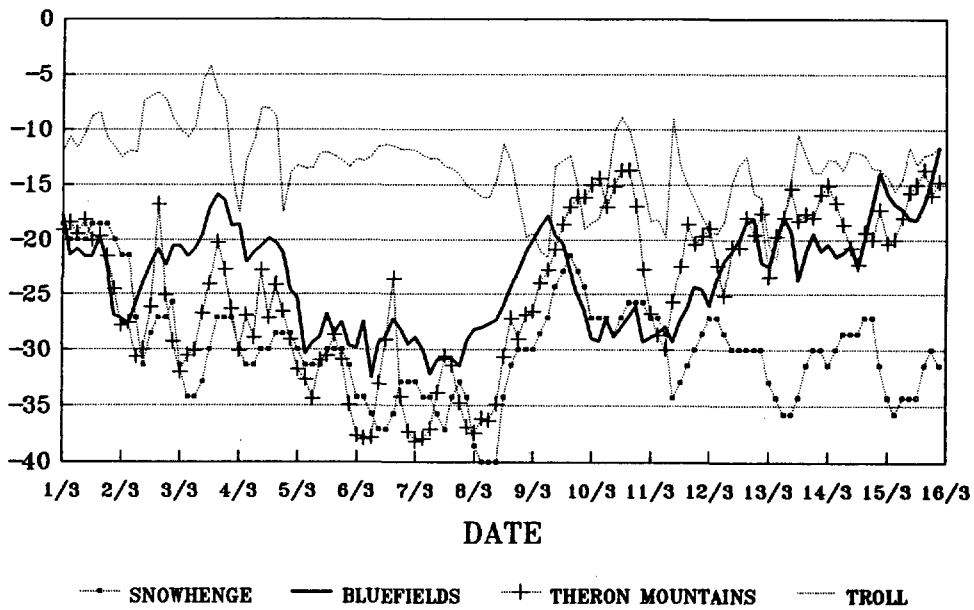


Figure 5. Time series of temperature, February 16.-29. 1992.

1.-15. MARCH 1992
TEMPERATURE, °C



16.-31. MARCH 1992
TEMPERATURE, °C

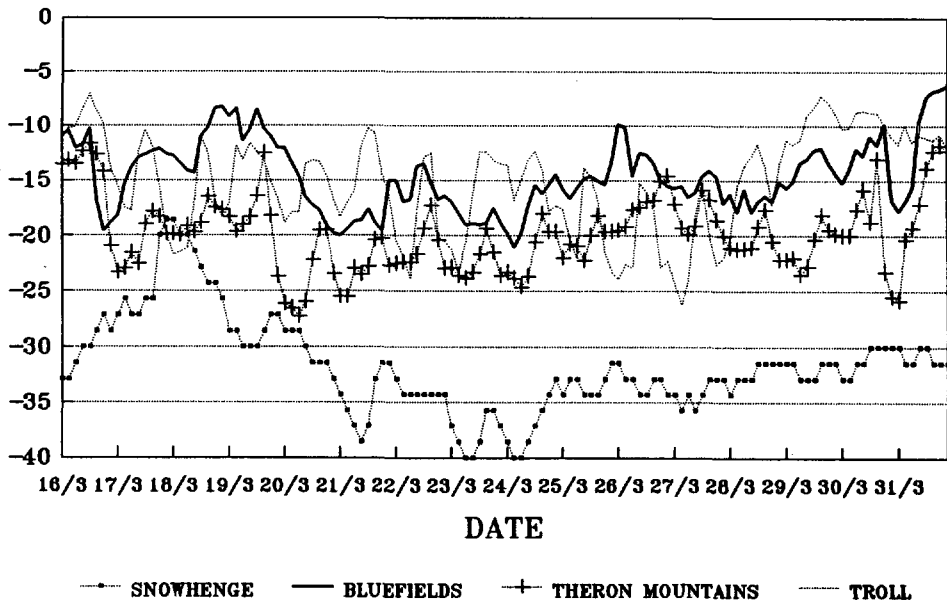
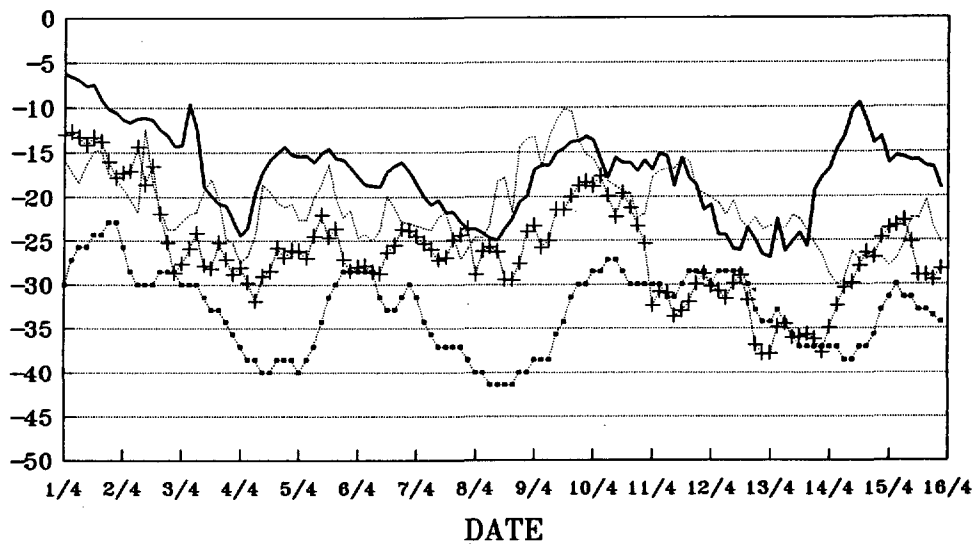


Figure 6. Time series of temperature, March 1992.

1.-15. APRIL 1992
TEMPERATURE, °C



16.-30. APRIL 1992
TEMPERATURE, °C

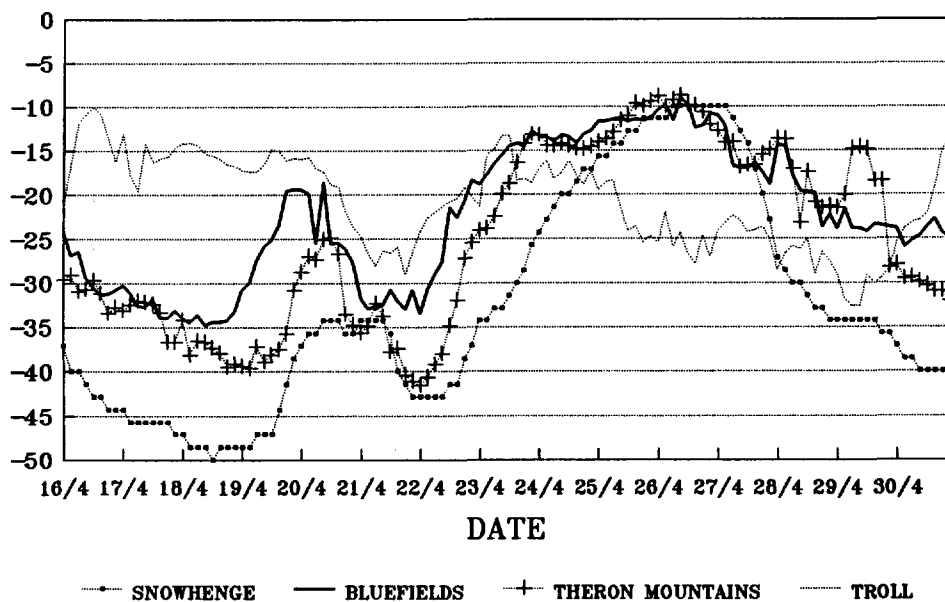
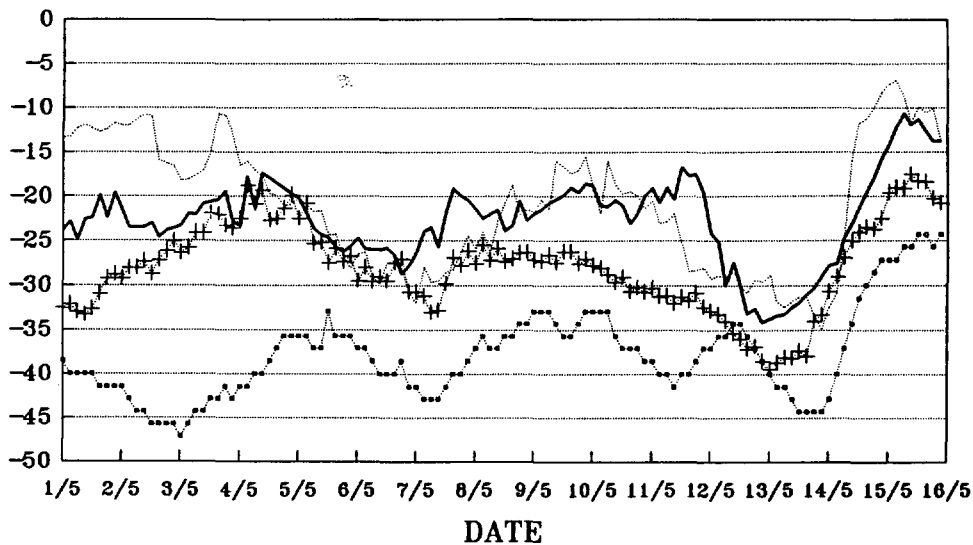


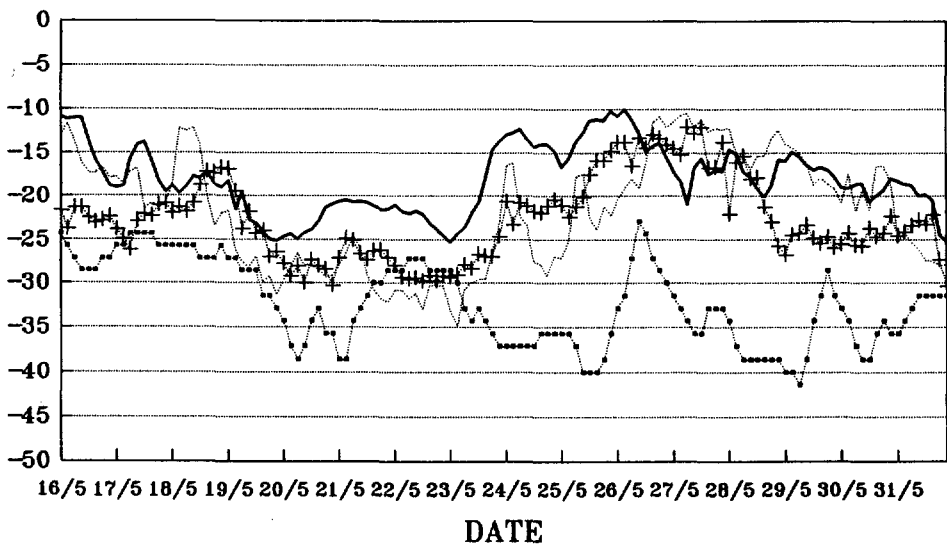
Figure 7. Time series of temperature, April 1992.

1.-15. MAY 1992 TEMPERATURE, °C



—•— SNOWHENGE — BLUEFIELDS —+— THERON MOUNTAINS —•— TROLL

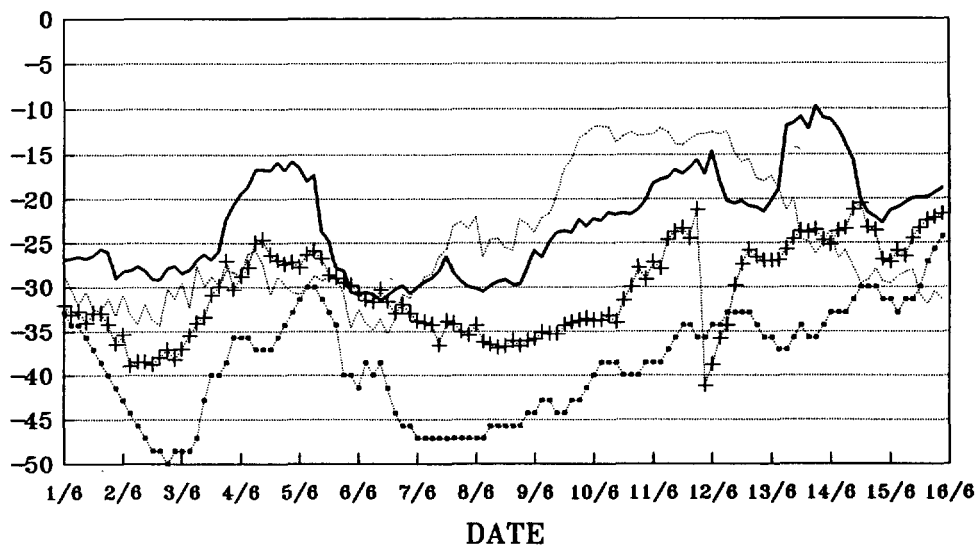
16.-31. MAY 1992 TEMPERATURE, °C



—•— SNOWHENGE — BLUEFIELDS —+— THERON MOUNTAINS —•— TROLL

Figure 8. Time series of temperature, May 1992.

1.-15. JUNE 1992 TEMPERATURE, °C



16.-30. JUNE 1992 TEMPERATURE, °C

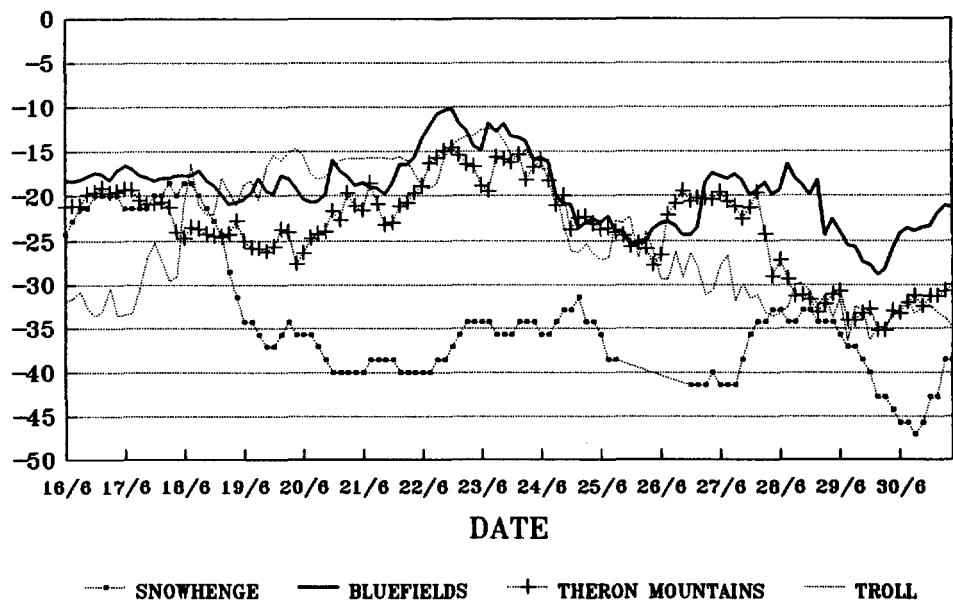
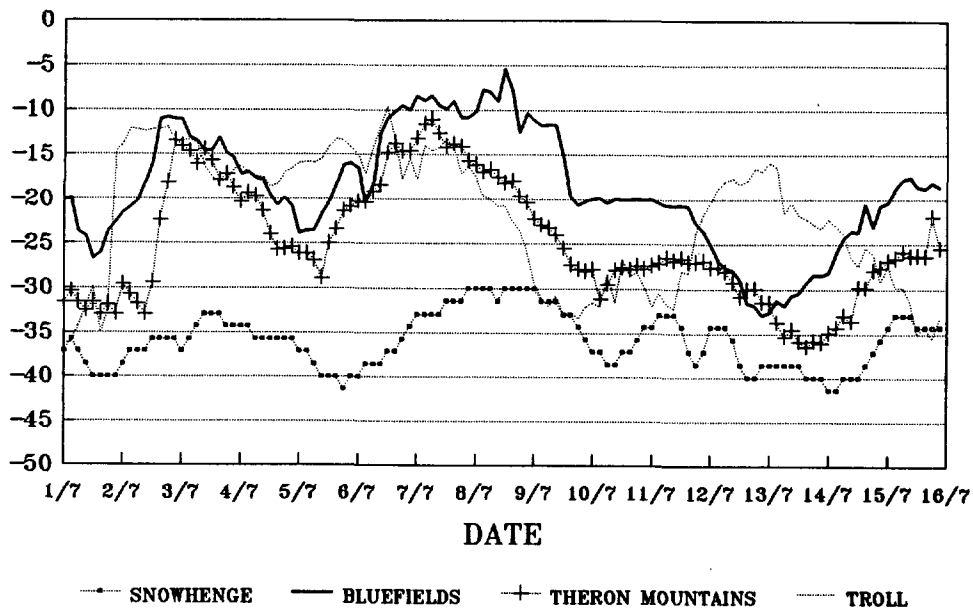


Figure 9. Time series of temperature, June 1992.

1.-15. JULY 1992
TEMPERATURE, °C



16.-31. JULY 1992
TEMPERATURE, °C

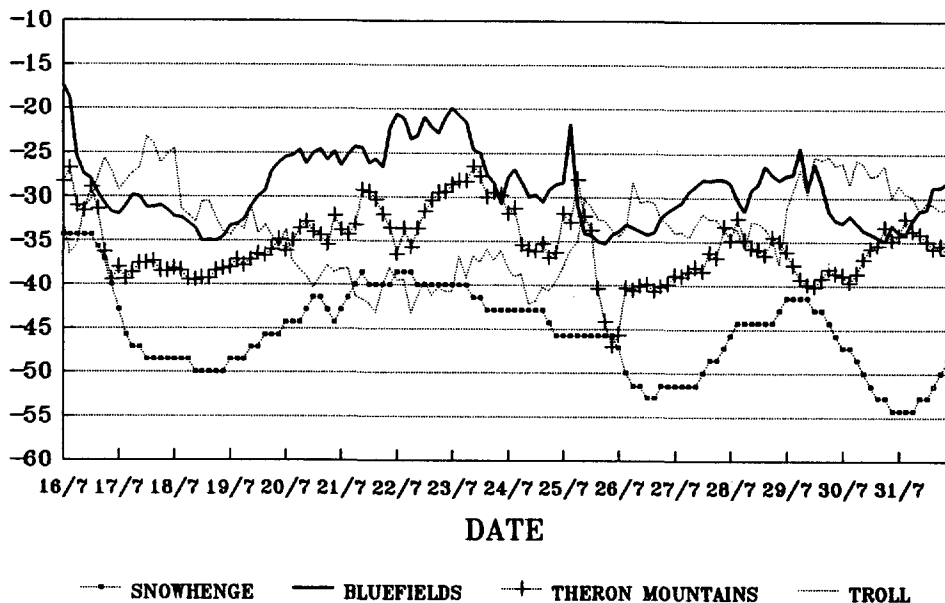
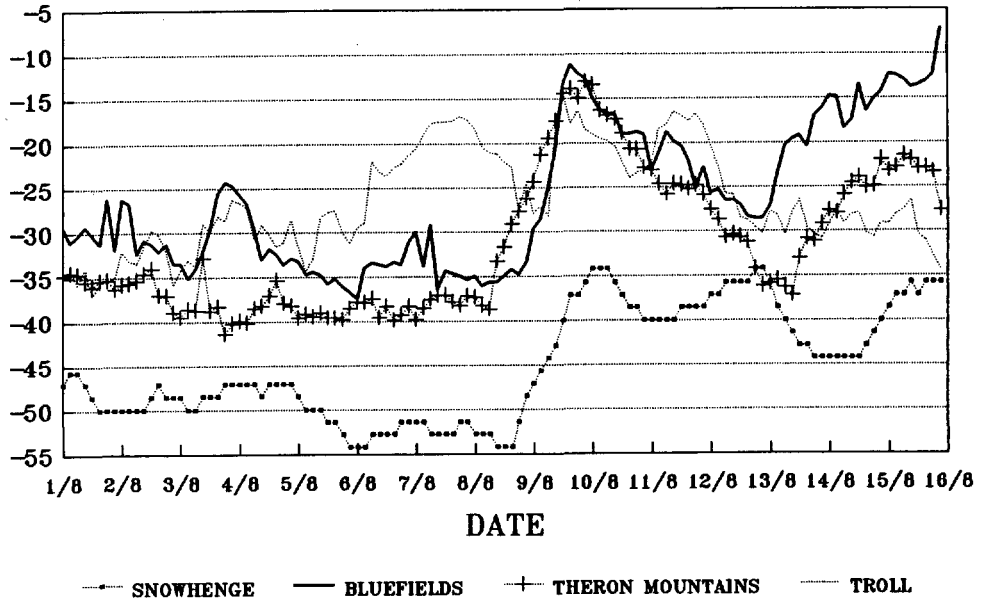


Figure 10. Time series of temperature, July 1992.

1.-15. AUGUST 1992
TEMPERATURE, °C



16.-31. AUGUST 1992
TEMPERATURE, °C

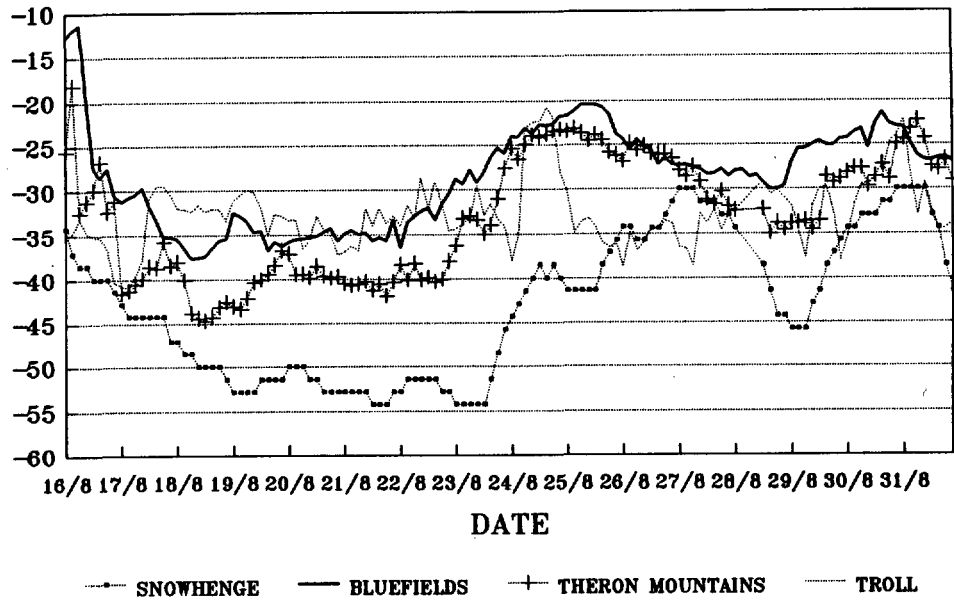
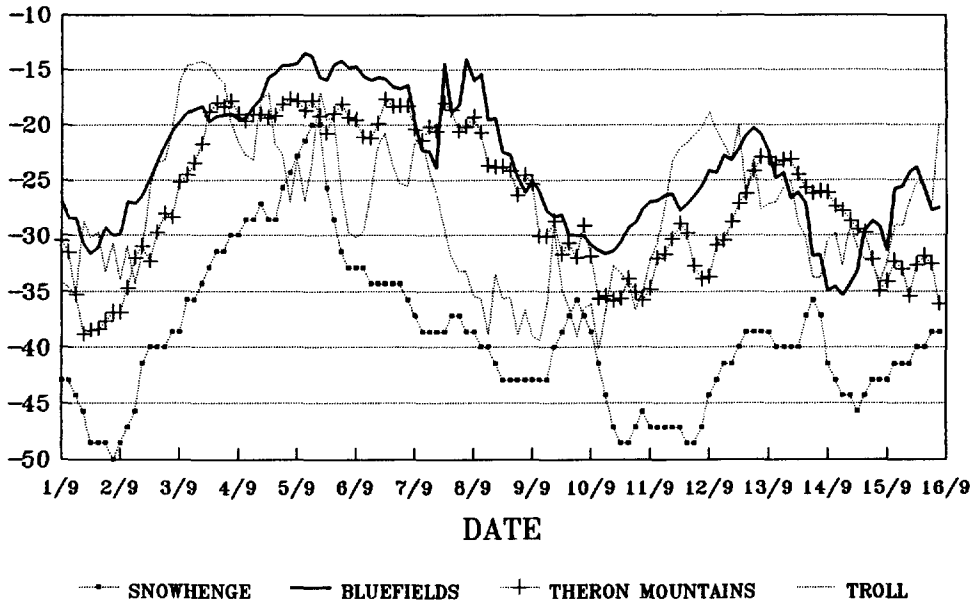


Figure 11. Time series of temperature, August 1992.

1.-15. SEPTEMBER 1992
TEMPERATURE, °C



16.-30. SEPTEMBER 1992
TEMPERATURE, °C

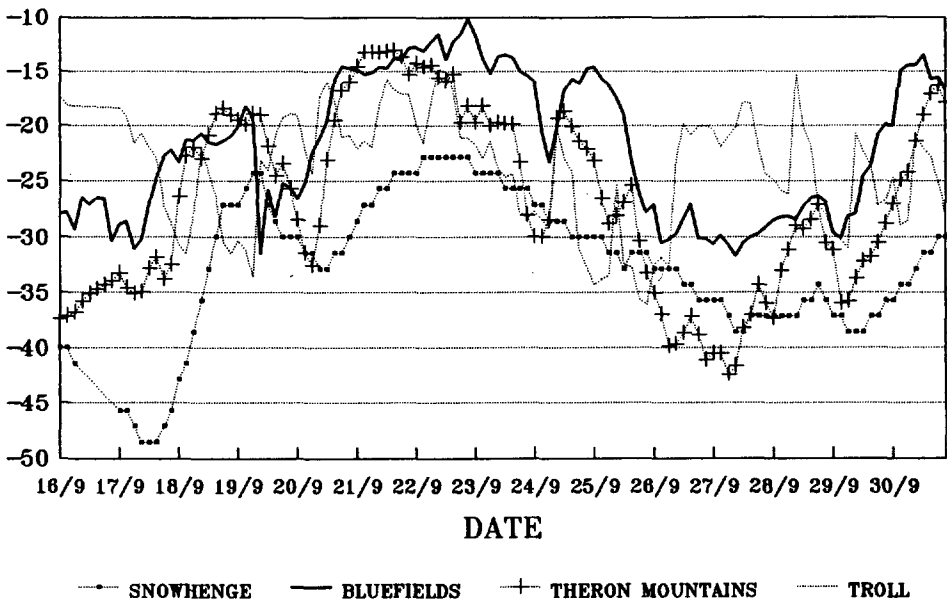
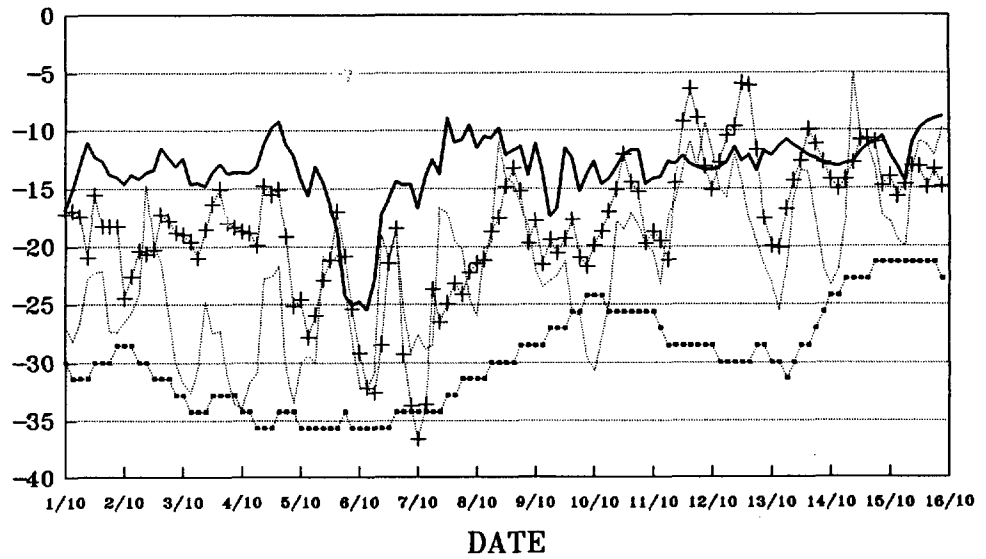


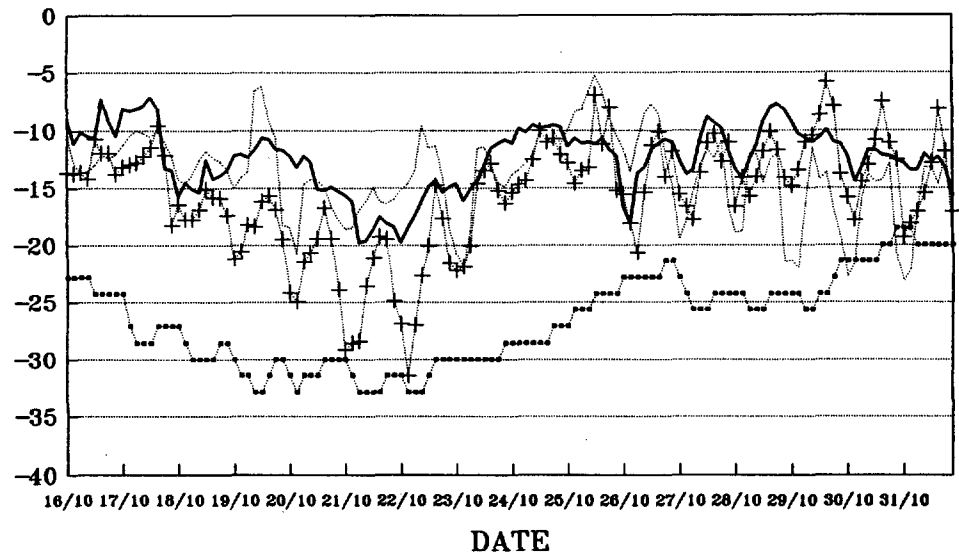
Figure 12. Time series of temperature, September 1992.

1.-15. OCTOBER 1992
TEMPERATURE, °C



— SNOWHENGE — BLUEFIELDS + THERON MOUNTAINS — TROLL

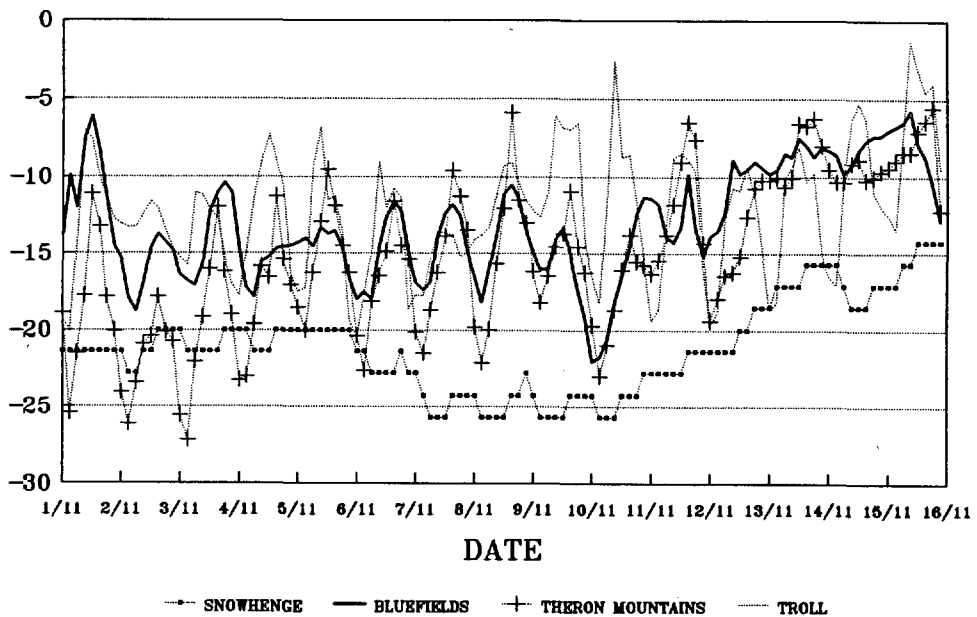
16.-31. OCTOBER 1992
TEMPERATURE, °C



— SNOWHENGE — BLUEFIELDS + THERON MOUNTAINS — TROLL

Figure 13. Time series of temperature, October 1992.

1.-15. NOVEMBER 1992
TEMPERATURE, °C



16.-30. NOVEMBER 1992
TEMPERATURE, °C

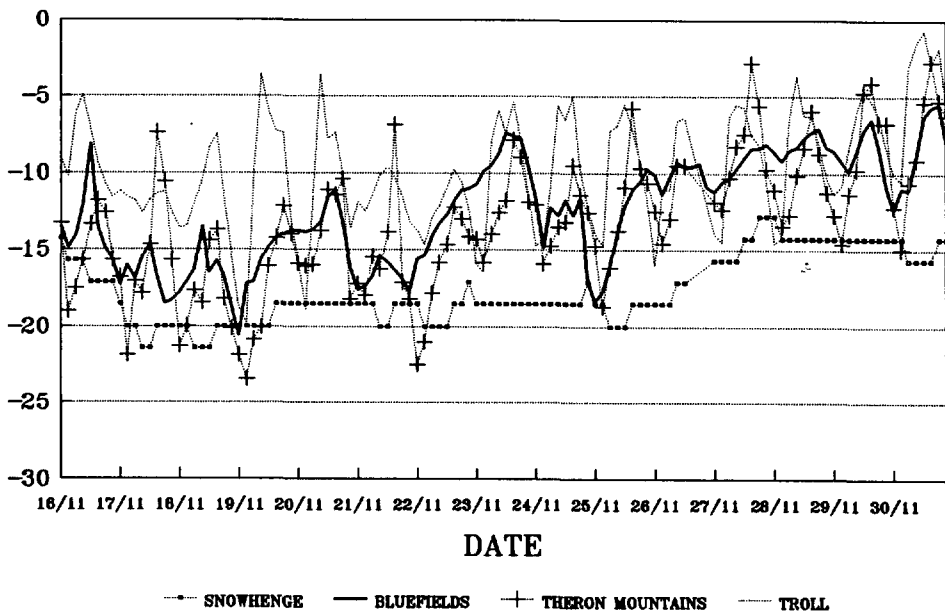
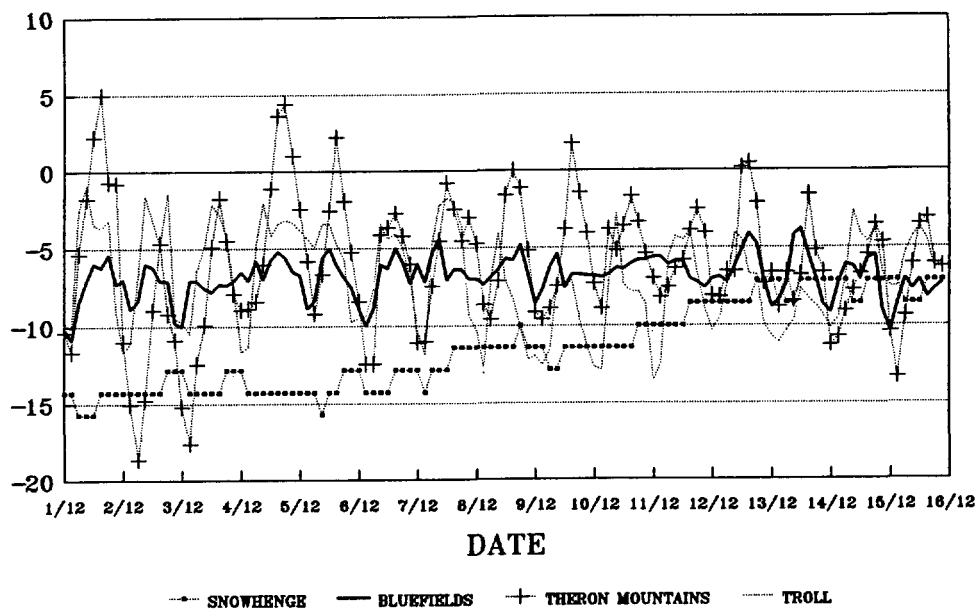


Figure 14. Time series of temperature, November 1992.

1.-15. DECEMBER 1992 TEMPERATURE, °C



16.-31. DECEMBER 1992 TEMPERATURE, °C

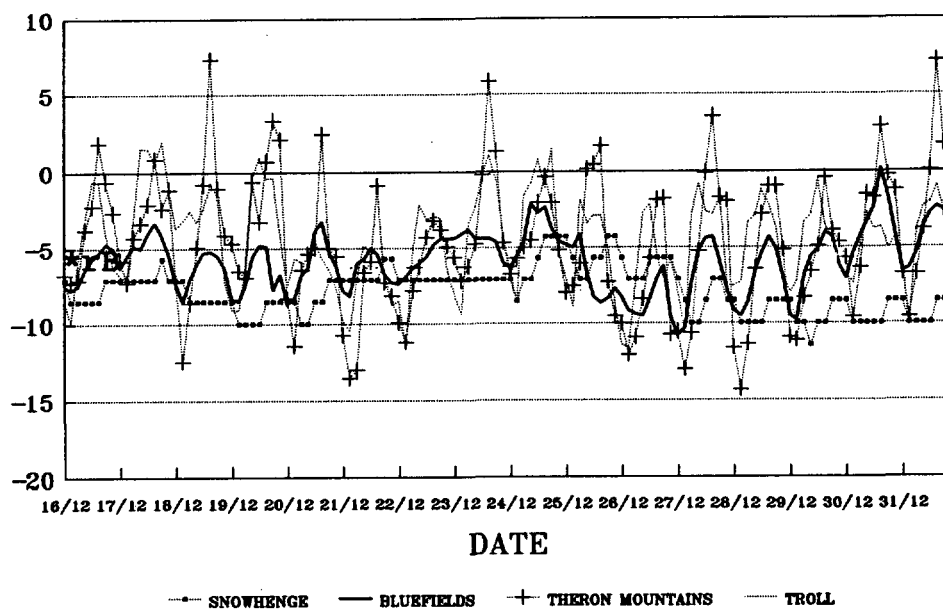
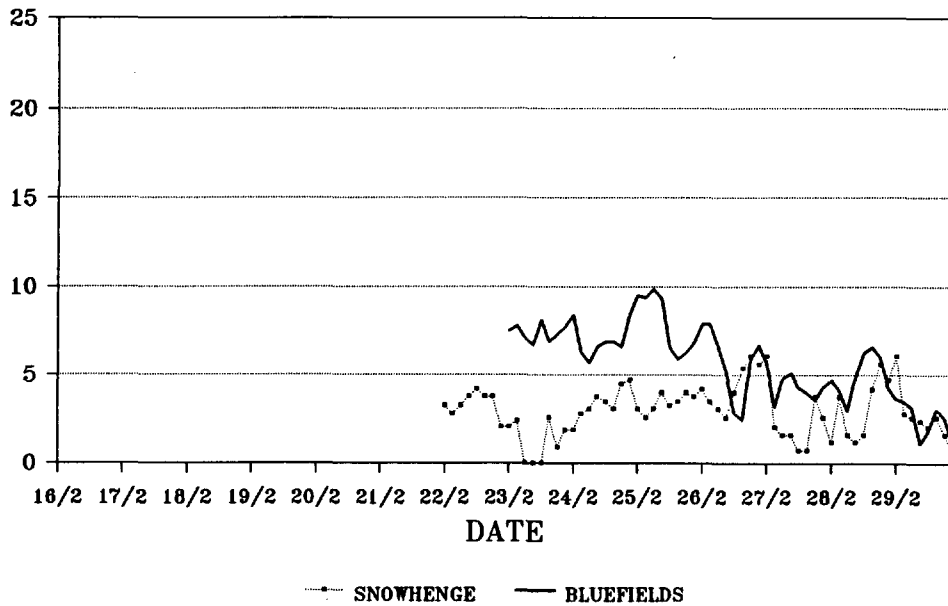


Figure 15. Time series of temperature, December 1992.

16.-29. FEBRUARY 1992
WIND SPEED, M/S



16.-29. FEBRUARY 1992
WIND DIRECTION, DEGREES

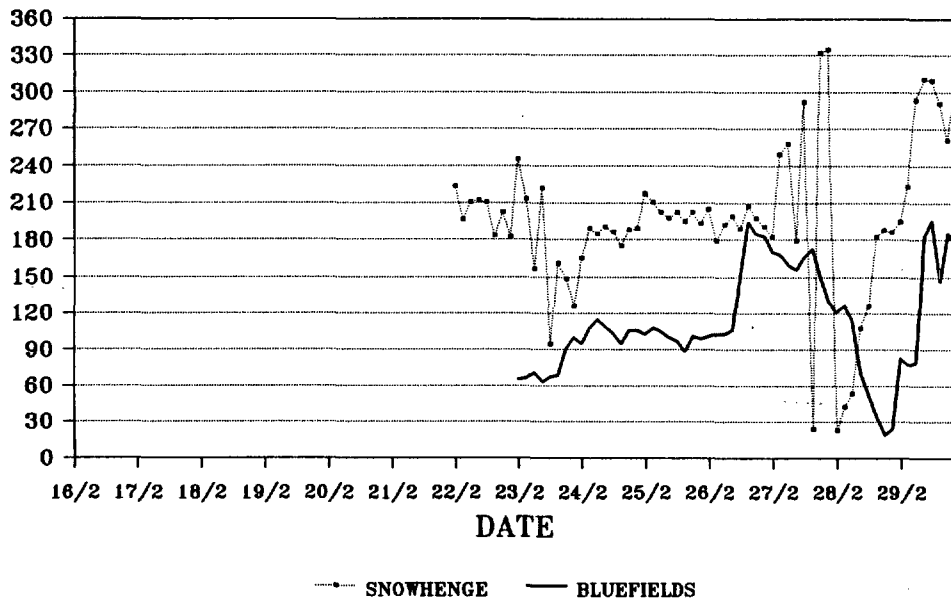
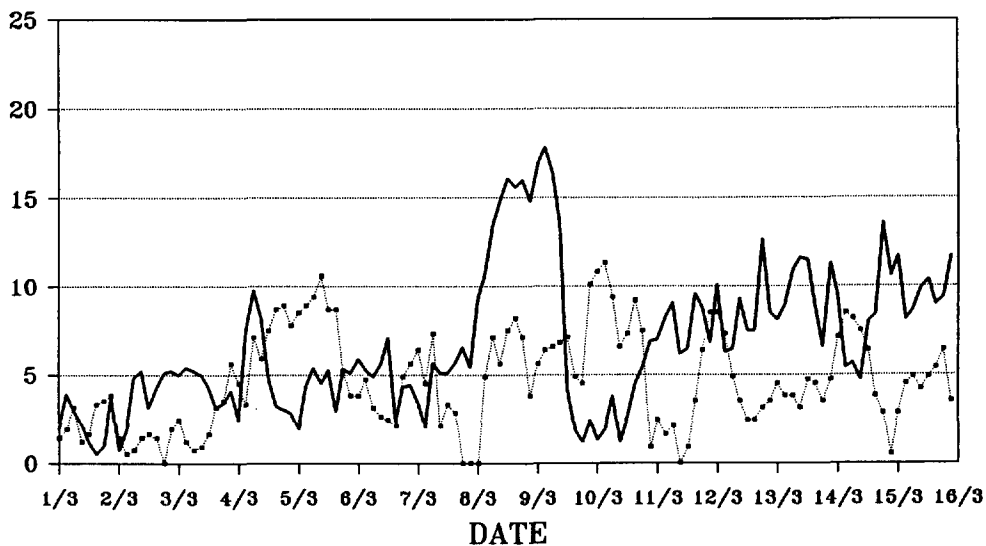


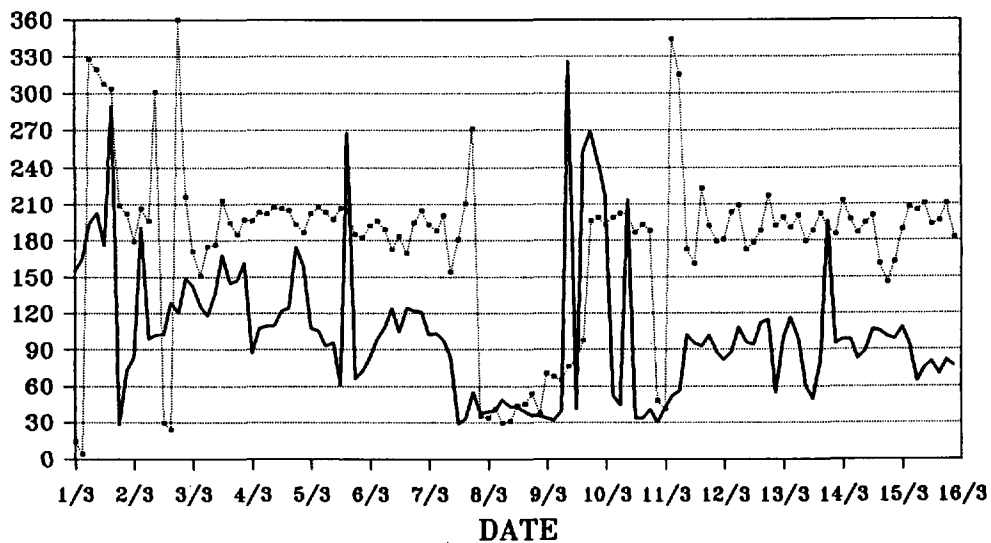
Figure 16. Time series of wind, February 16.-29. 1992.

1.-15. MARCH 1992
WIND SPEED, M/S



—•— SNOWHENGE — BLUEFIELDS

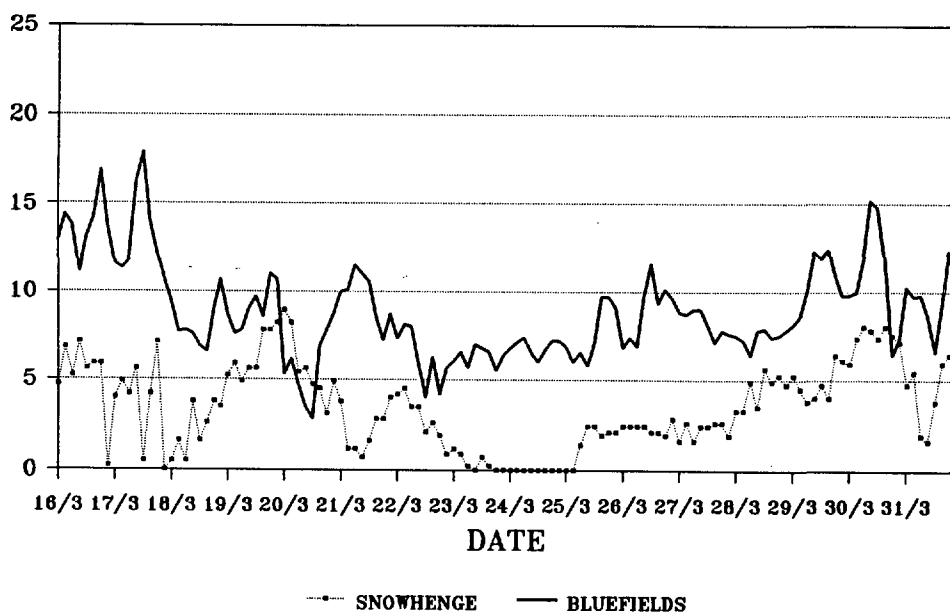
1.-15. MARCH 1992
WIND DIRECTION, DEGREES



—•— SNOWHENGE — BLUEFIELDS

Figure 17. Time series of wind, March 1.-15. 1992.

16.-31. MARCH 1992
WIND SPEED, M/S



16.-31. MARCH 1992
WIND DIRECTION, DEGREES

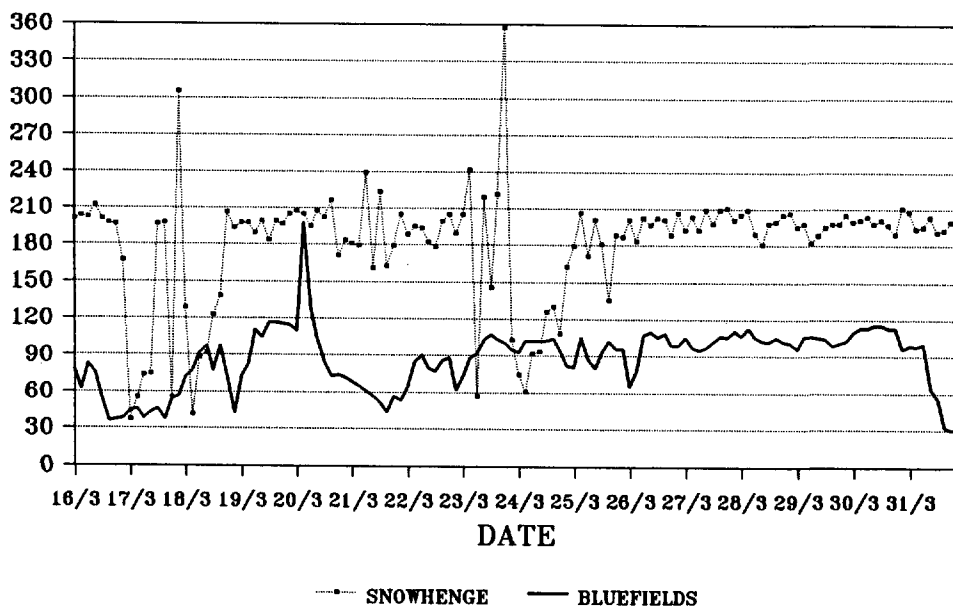
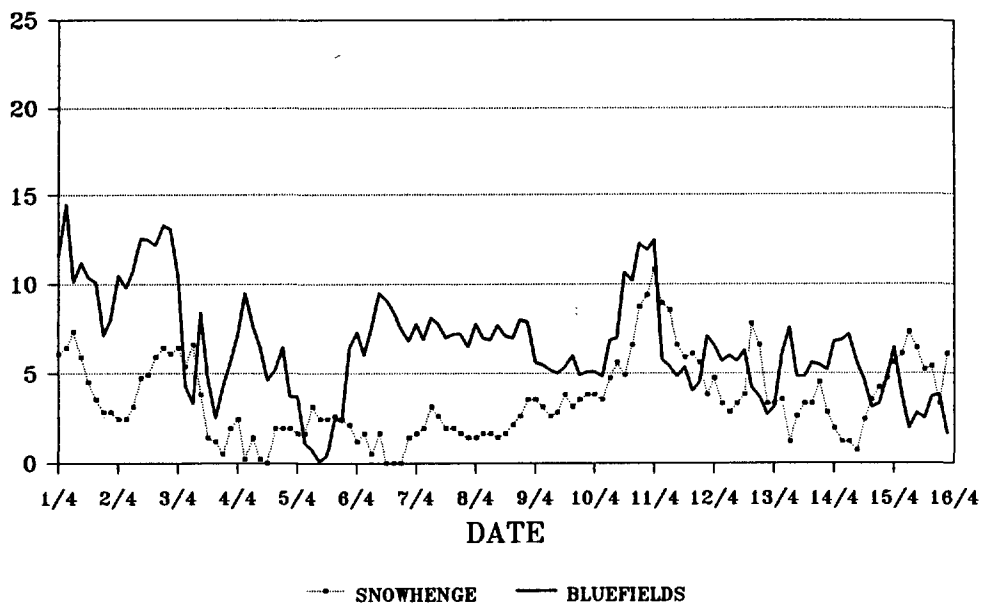


Figure 18. Time series of wind, March 16.-31. 1992.

1.-15. APRIL 1992
WIND SPEED, M/S



1.-15. APRIL 1992
WIND DIRECTION, DEGREES

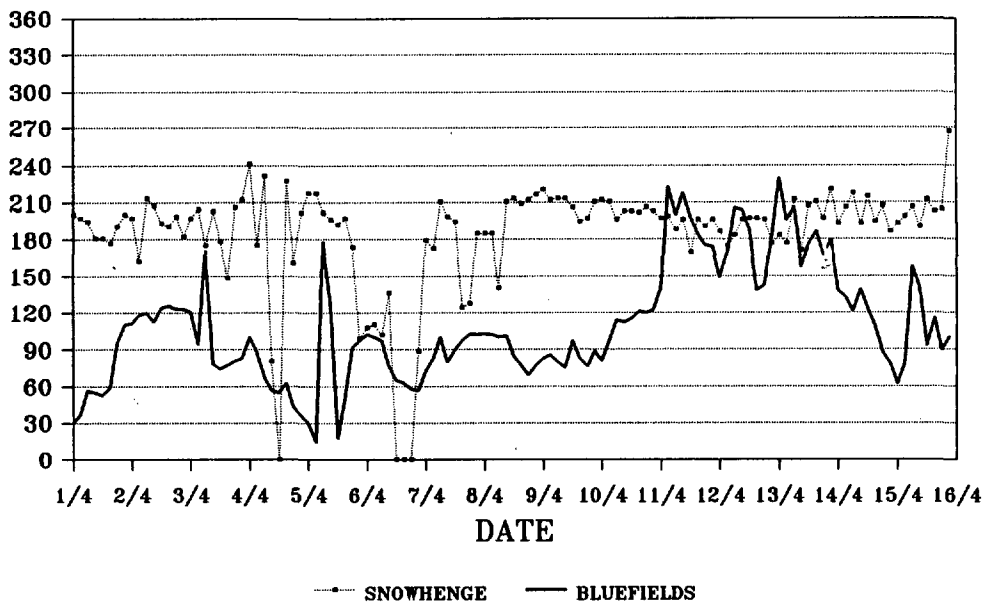
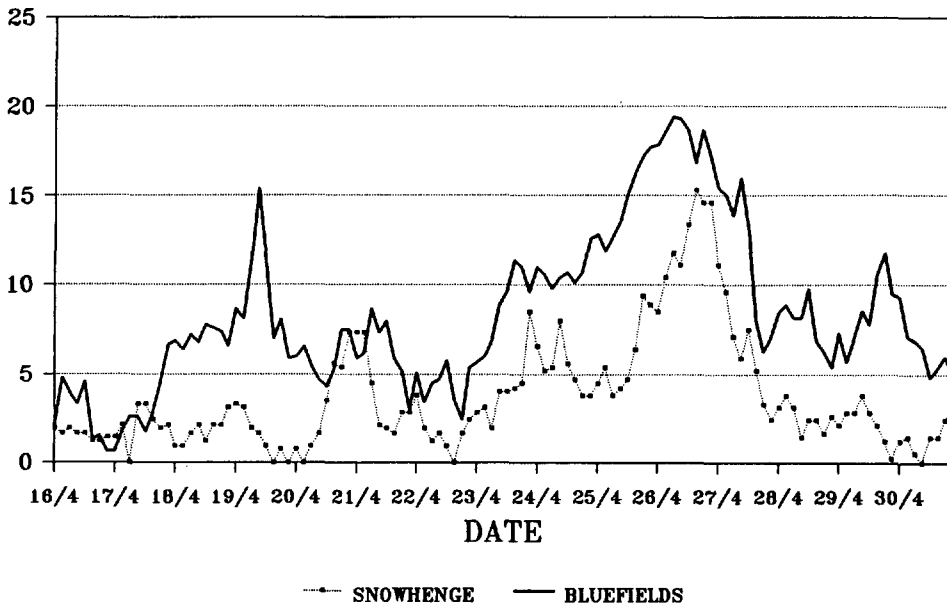


Figure 19. Time series of wind, April 1.-15. 1992.

16.-30. APRIL 1992
WIND SPEED, M/S



16.-30. APRIL 1992
WIND DIRECTION, DEGREES

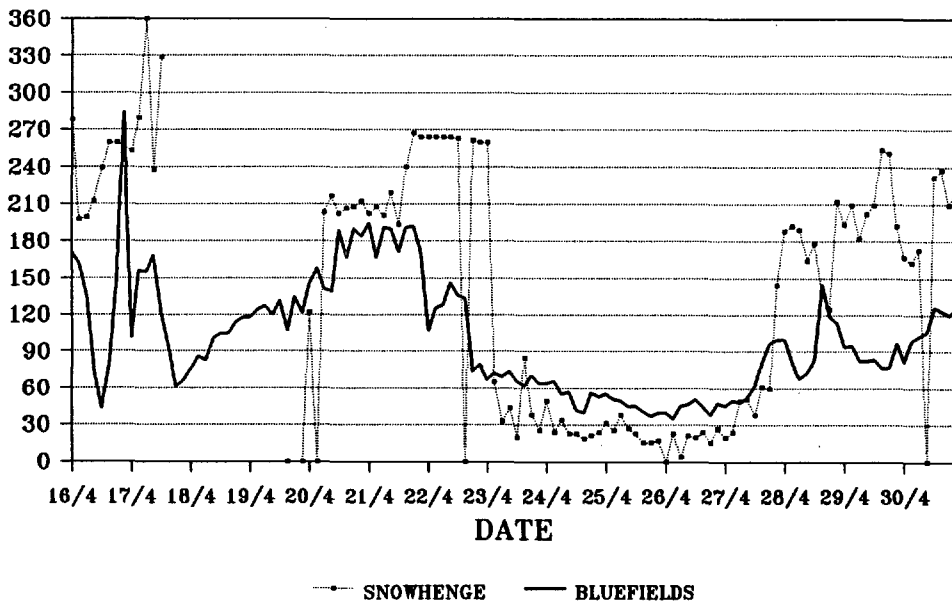
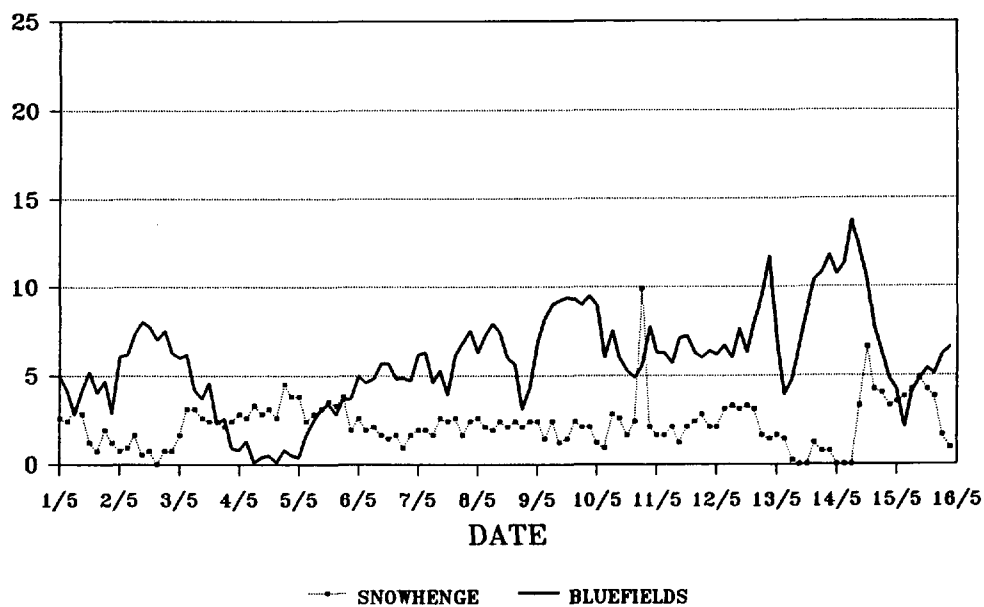


Figure 20. Time series of wind, April 16.-30. 1992.

1.-15. MAY 1992
WIND SPEED, M/S



1.-15. MAY 1992
WIND DIRECTION, DEGREES

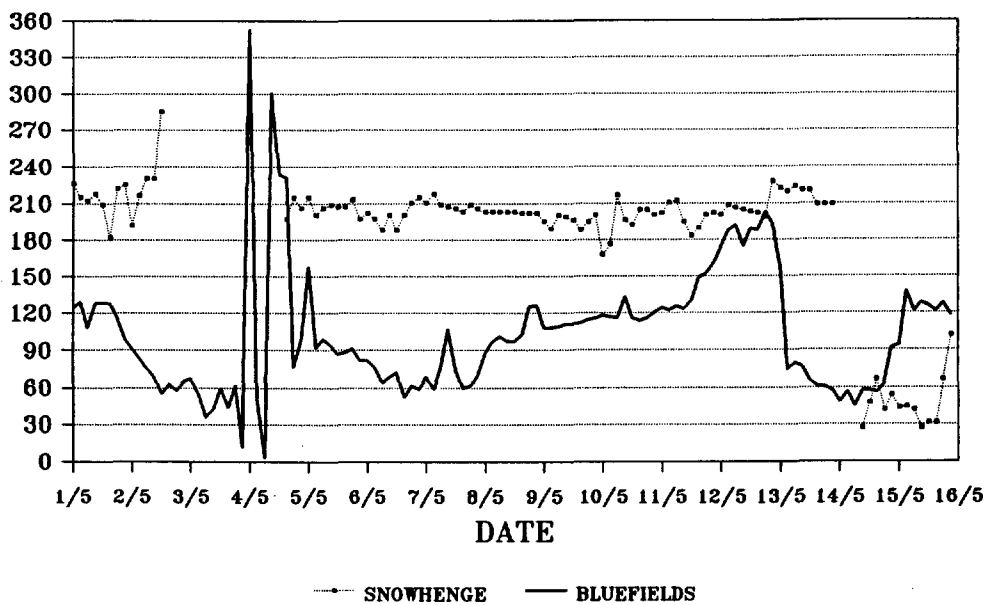
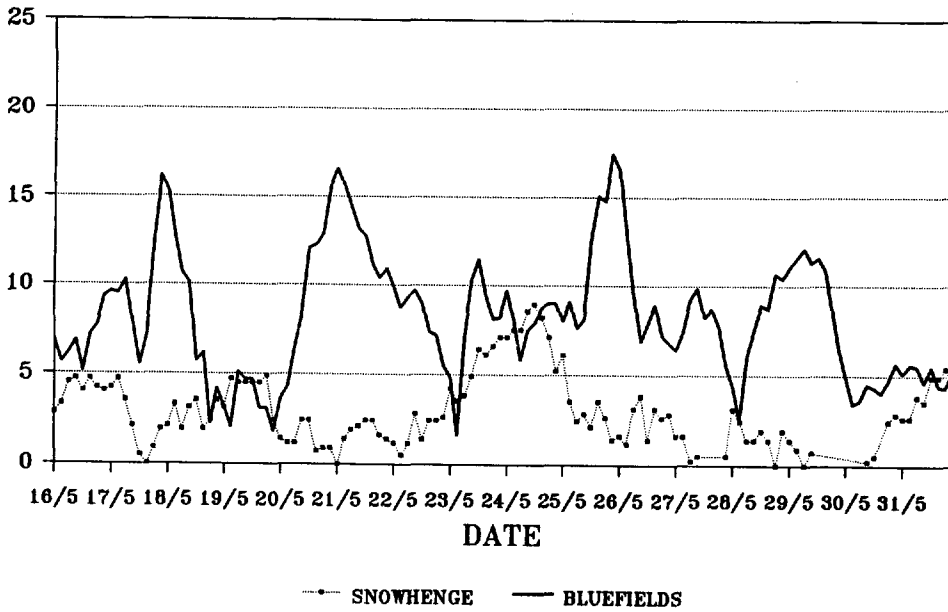


Figure 21. Time series of wind, May 1.-15. 1992.

16.-31. MAY 1992
WIND SPEED, M/S



16.-31. MAY 1992
WIND DIRECTION, DEGREES

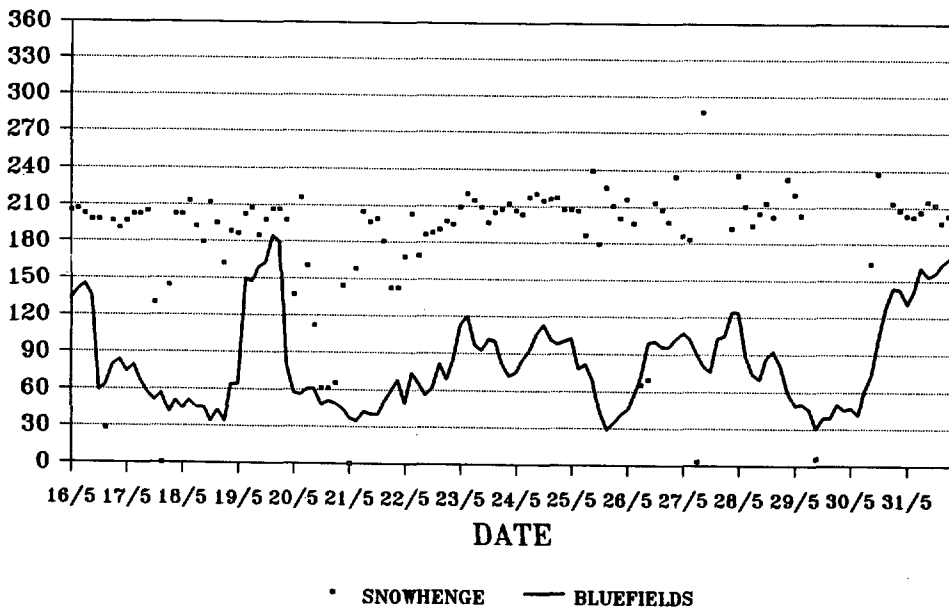
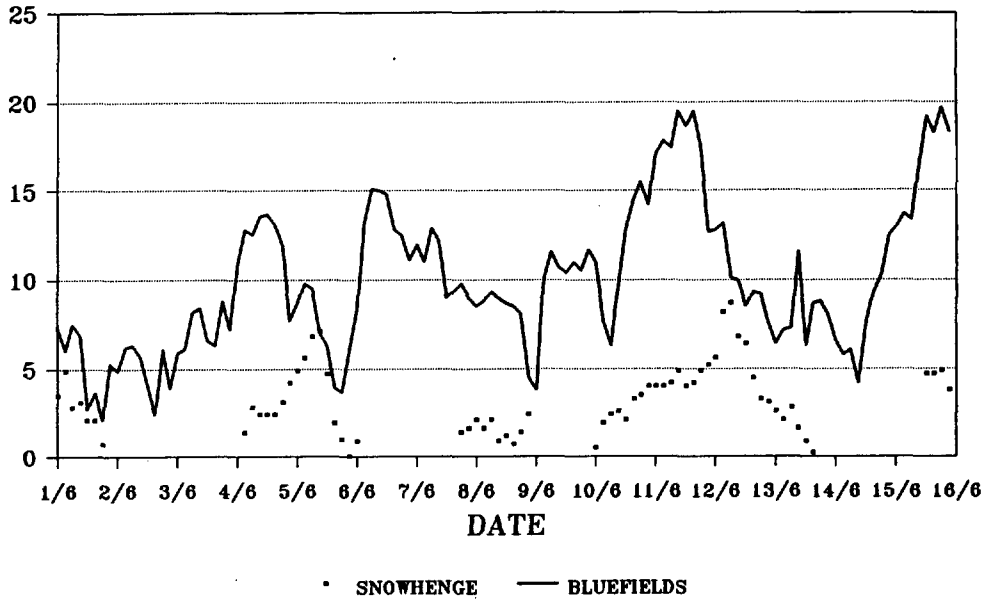


Figure 22. Time series of wind, May 16.-31. 1992.

1.-15. JUNE 1992 WIND SPEED, M/S



1.-15. JUNE 1992 WIND DIRECTION, DEGREES

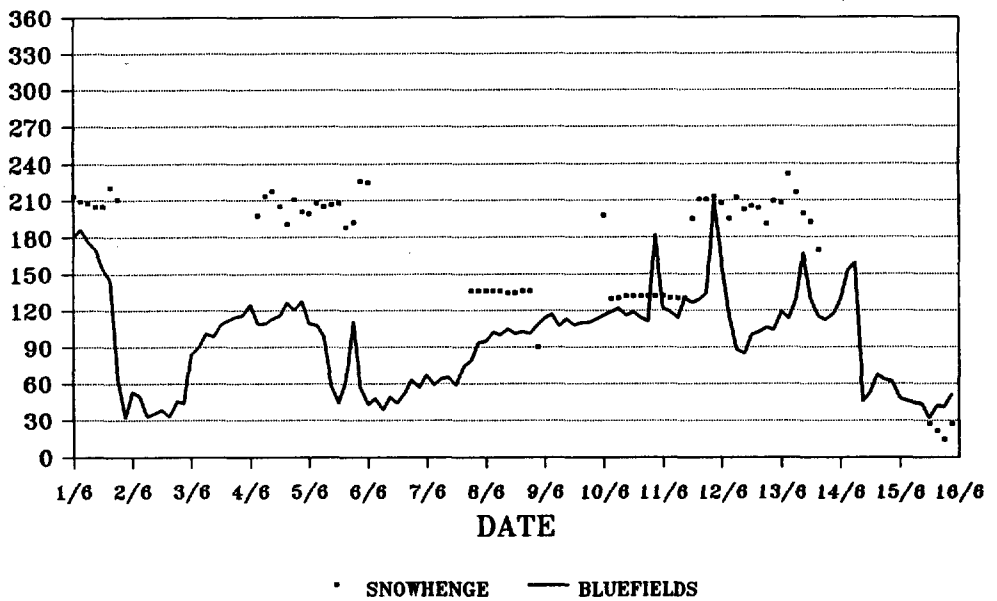
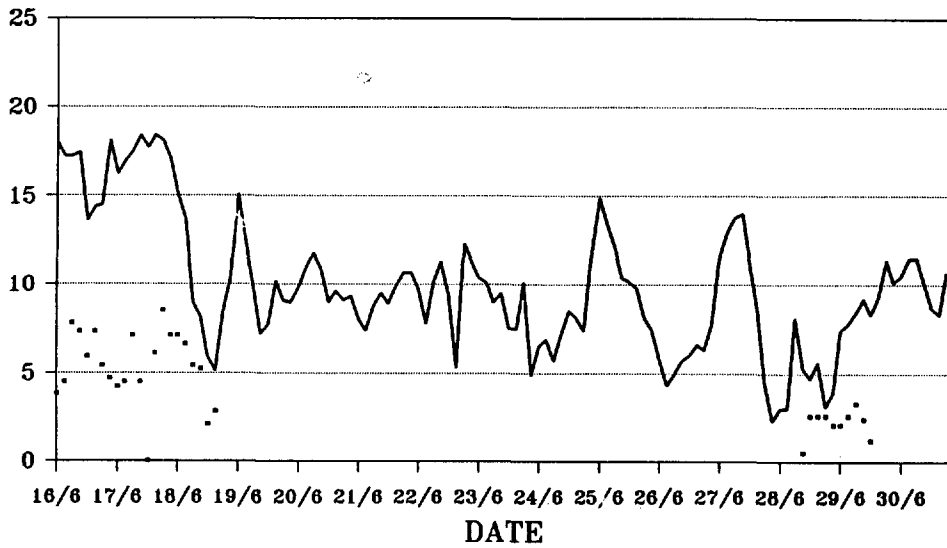


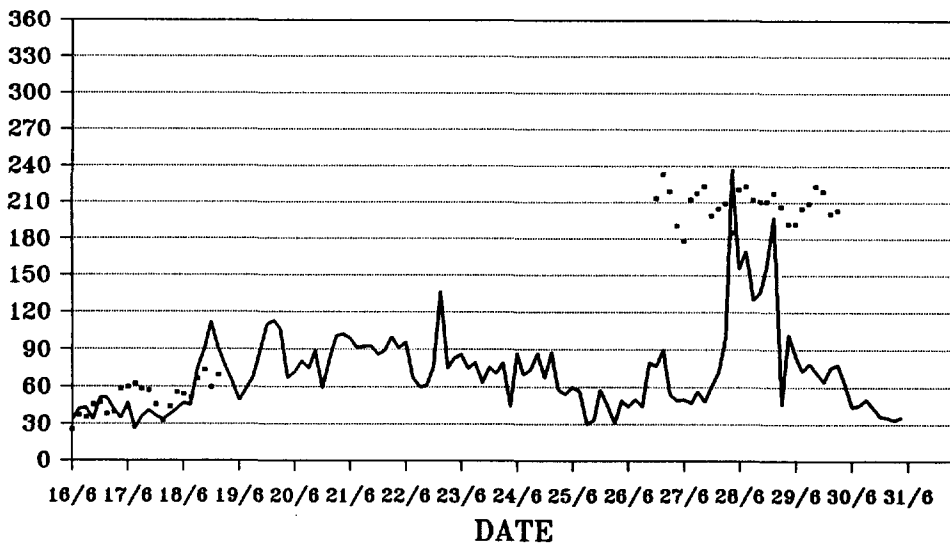
Figure 23. Time series of wind, June 1.-15. 1992.

16.-31. JUNE 1992
WIND SPEED, M/S



• SNOWHENGE — BLUEFIELDS

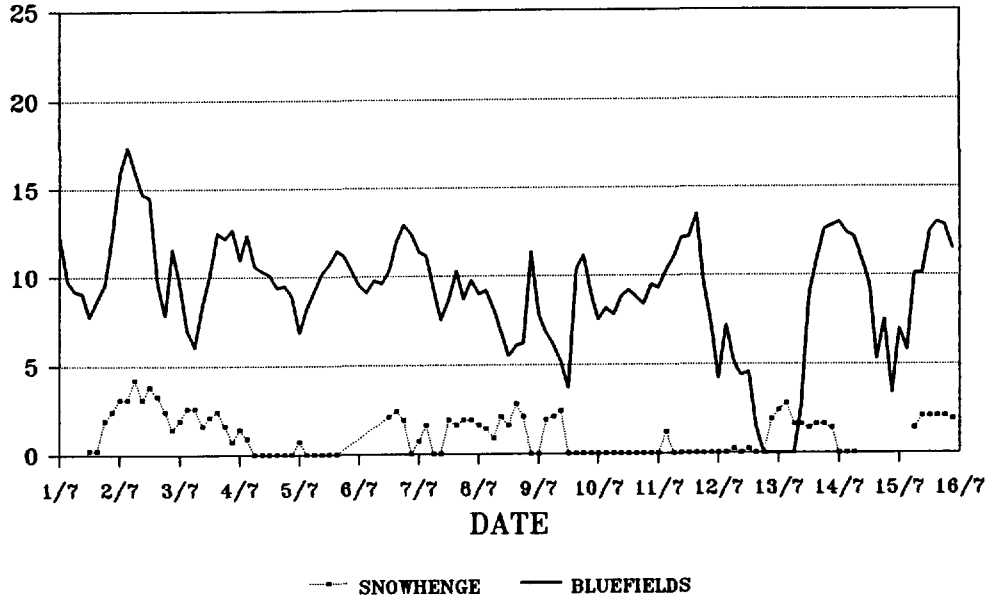
16.-31. JUNE 1992
WIND DIRECTION, DEGREES



• SNOWHENGE — BLUEFIELDS

Figure 24. Time series of wind, June 16.-30. 1992.

1.-15. JULY 1992
WIND SPEED, M/S



1.-15. JULY 1992
WIND DIRECTION, DEGREES

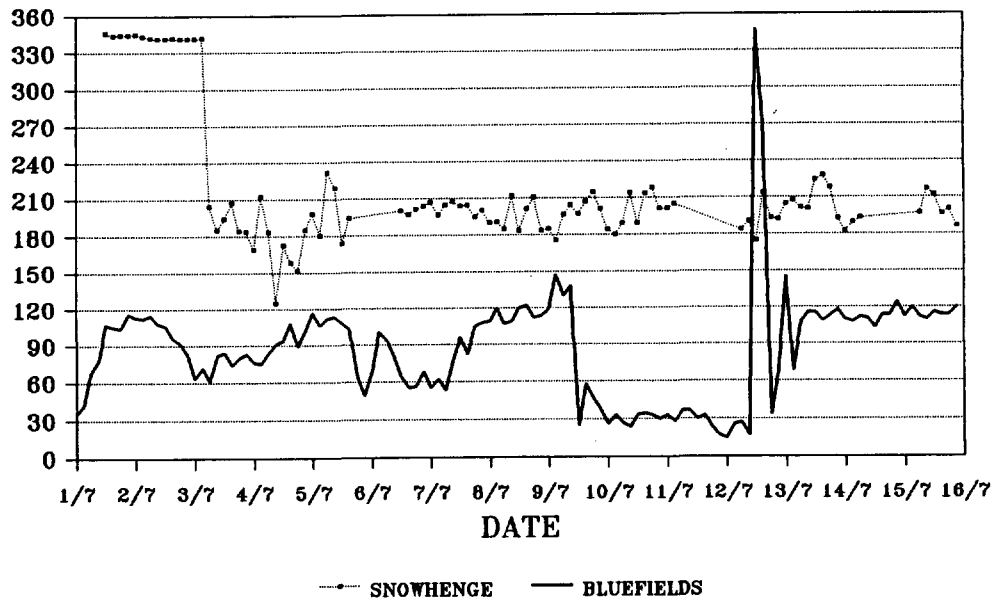
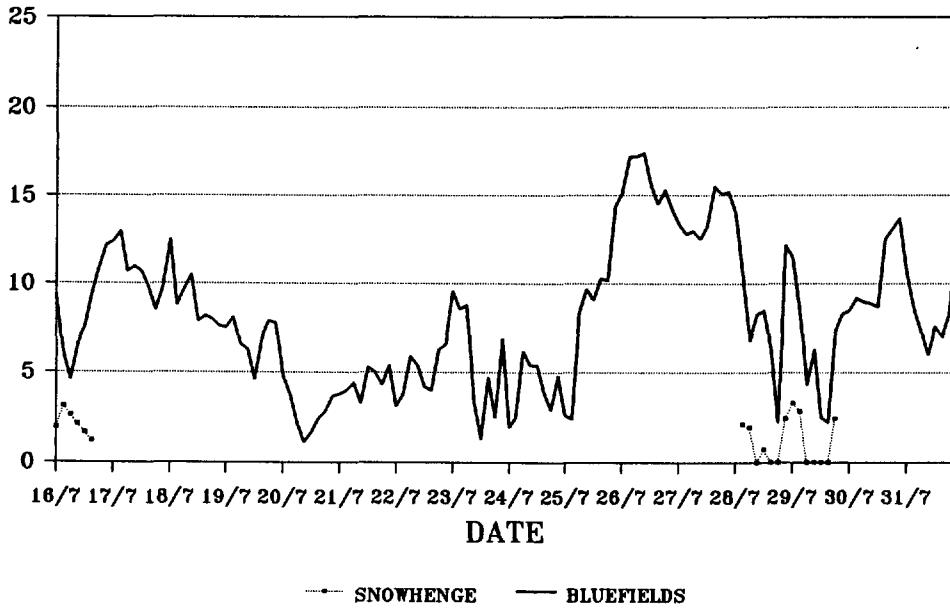


Figure 25. Time series of wind, July 1.-15. 1992.

16.-31. JULY 1992
WIND SPEED, M/S



16.-31. JULY 1992
WIND DIRECTION, DEGREES

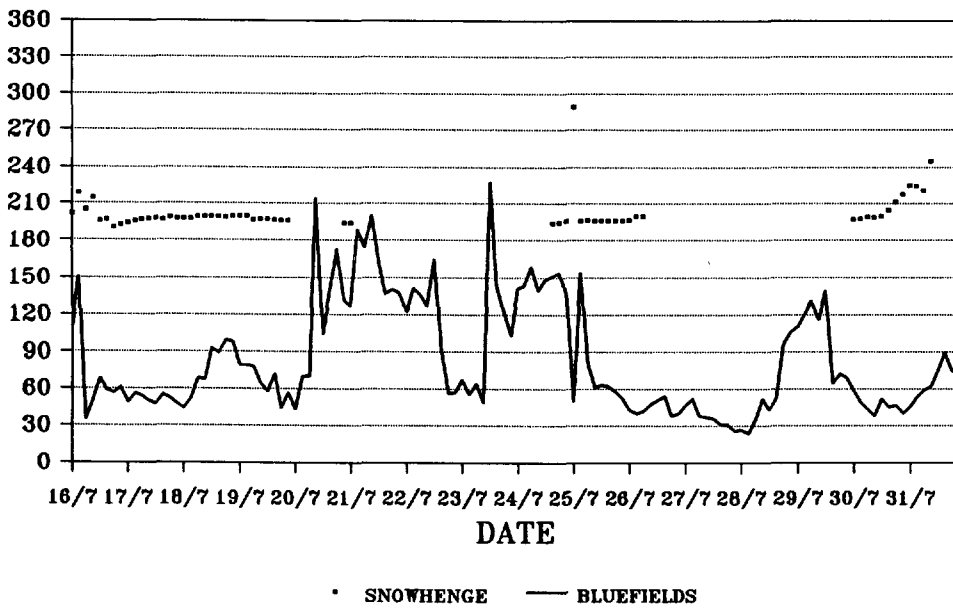
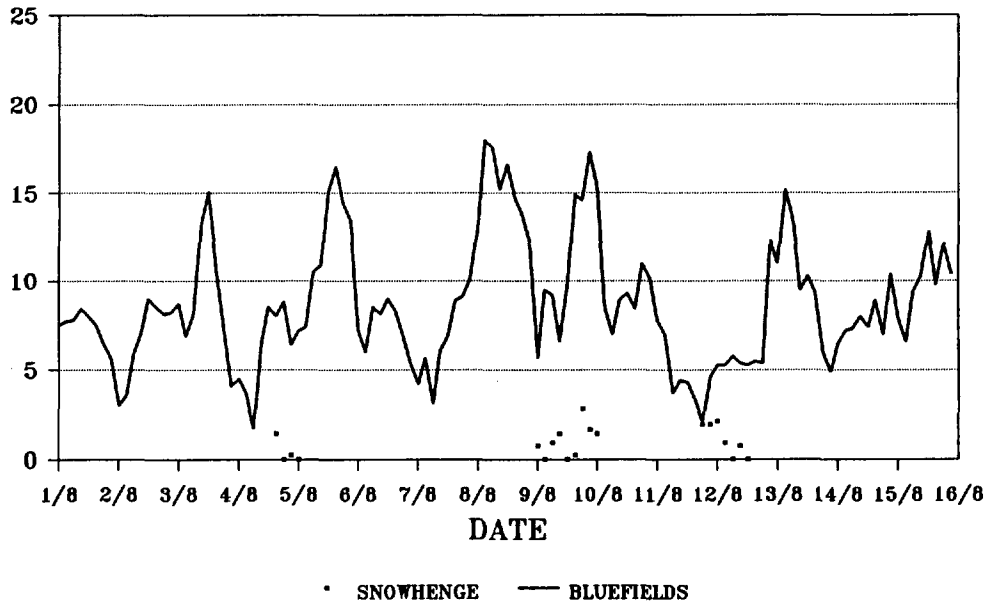


Figure 26. Time series of wind, July 16.-31. 1992.

1.-15. AUGUST 1992
WIND SPEED, M/S



1.-15. AUGUST 1992
WIND DIRECTION, DEGREES

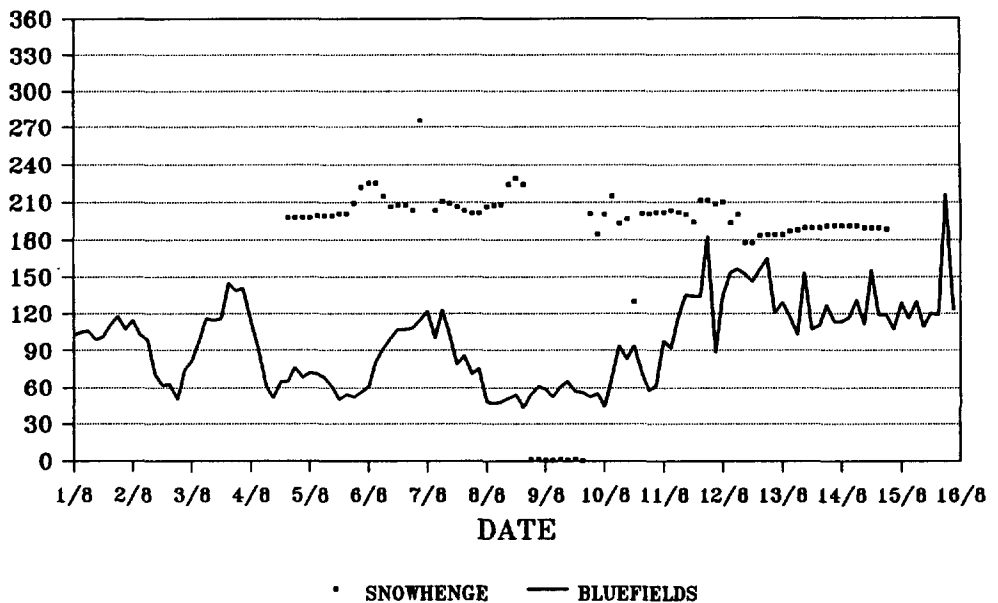
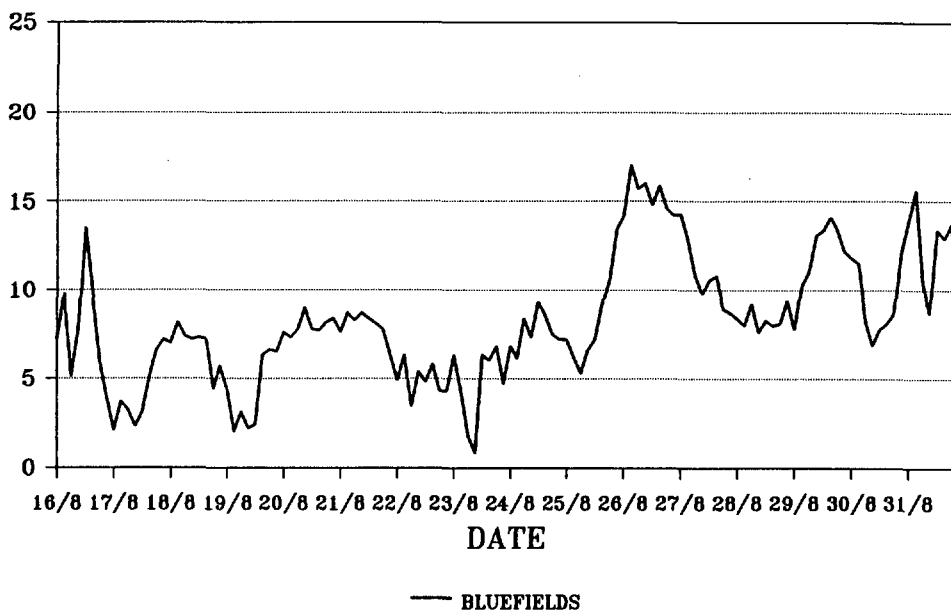


Figure 27. Time series of wind, August 1.-15. 1992.

16.-31. AUGUST 1992
WIND SPEED, M/S



16.-31. AUGUST 1992
WIND DIRECTION, DEGREES

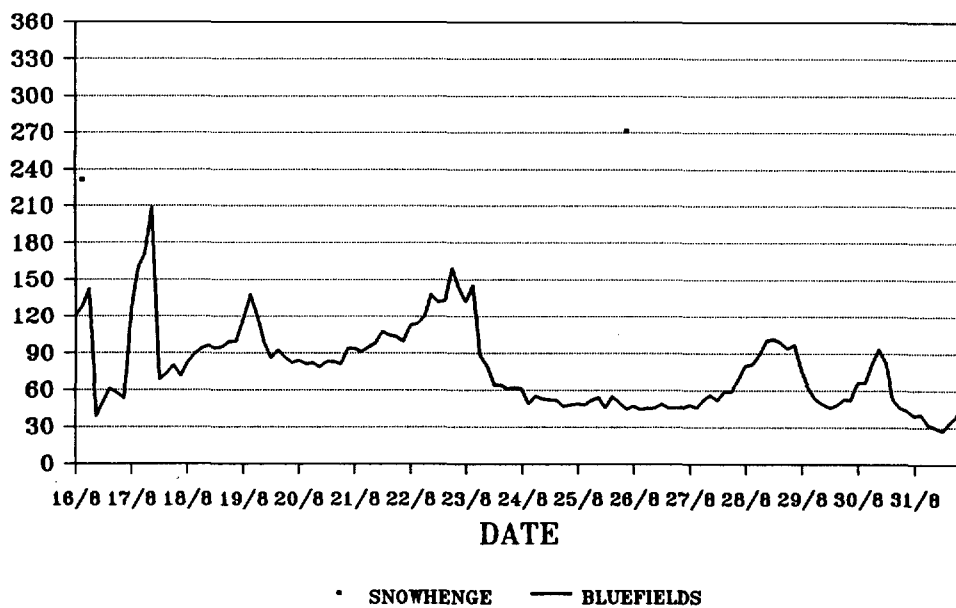
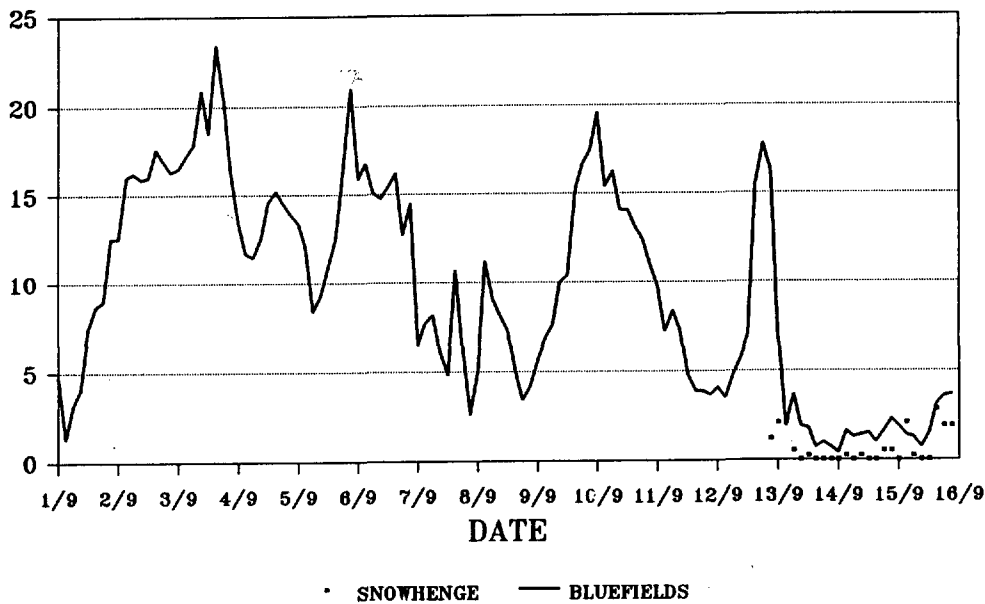


Figure 28. Time series of wind, August 16.-31. 1992.

1.-15. SEPTEMBER 1992
WIND SPEED, M/S



1.-15. SEPTEMBER 1992
WIND DIRECTION, DEGREES

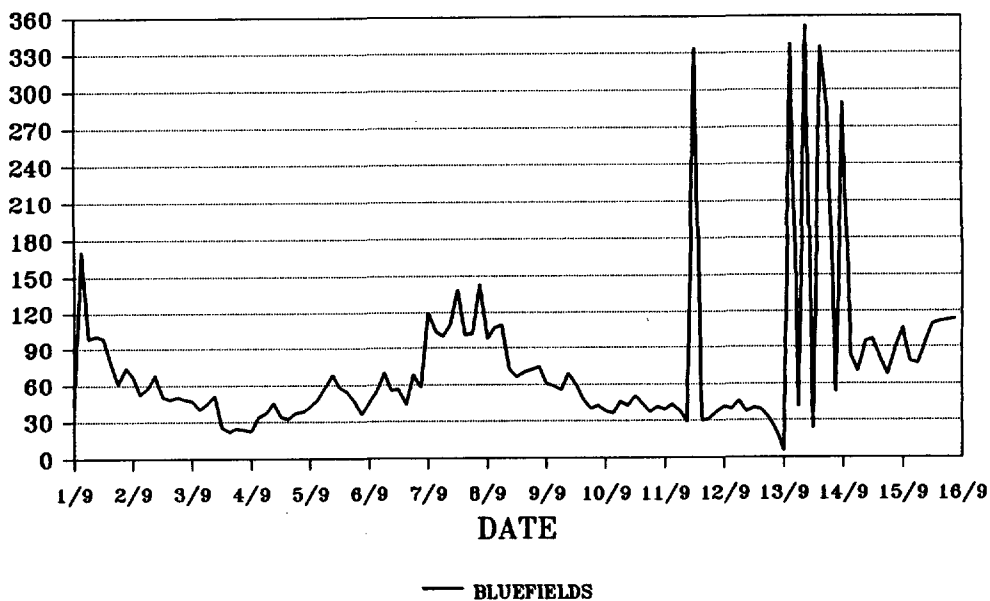
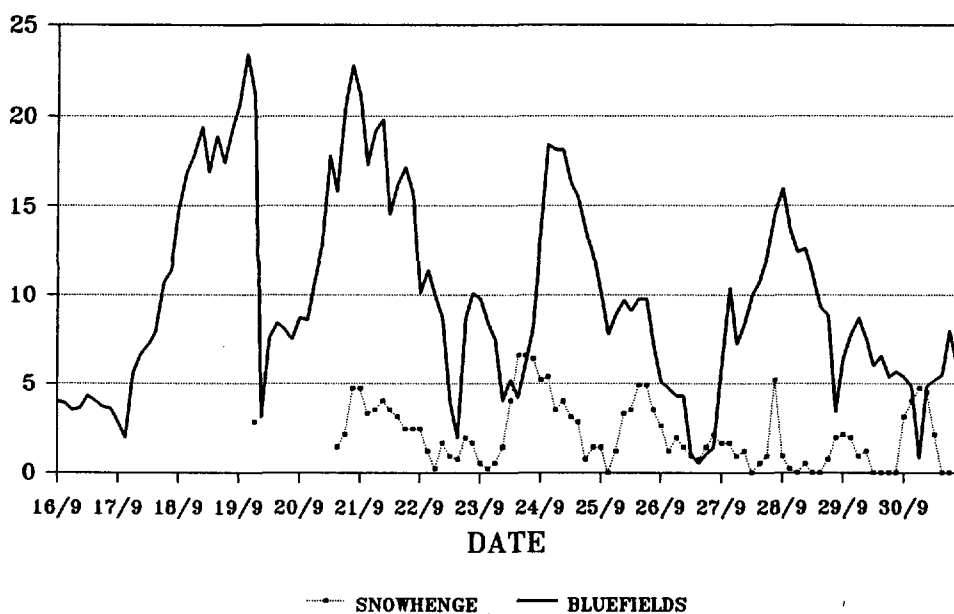


Figure 29. Time series of wind, September 1.-15. 1992.

16.-30. SEPTEMBER 1992
WIND SPEED, M/S



16.-30. SEPTEMBER 1992
WIND DIRECTION, DEGREES

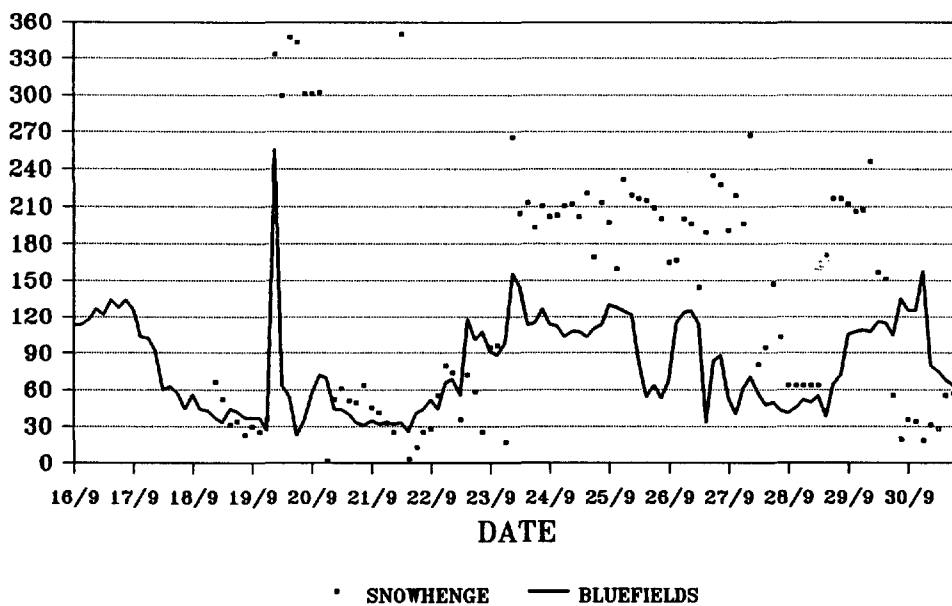
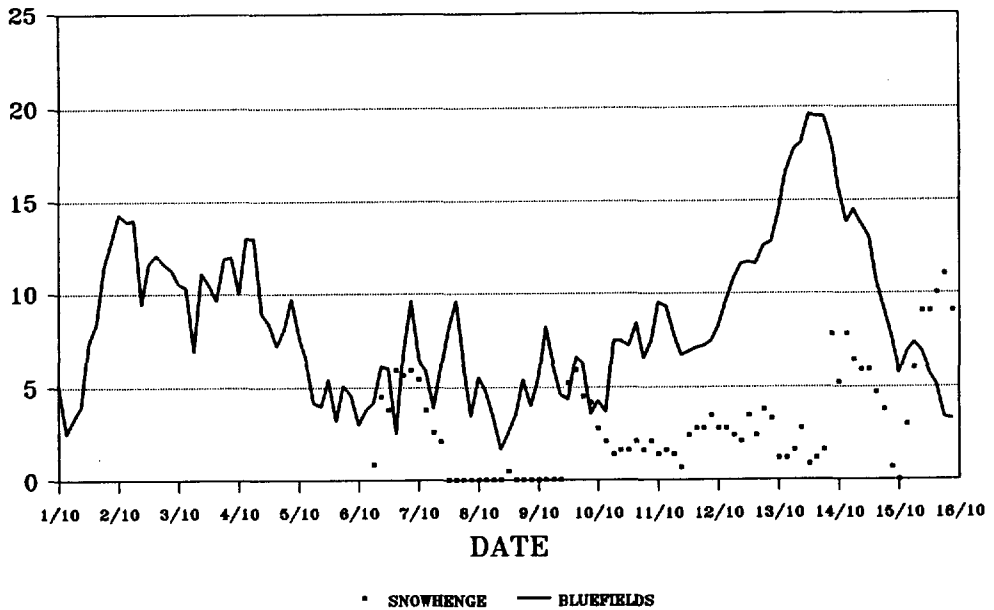


Figure 30. Time series of wind, September 16.-30. 1992.

1.-15. OCTOBER 1992
WIND SPEED, M/S



1.-15. OCTOBER 1992
WIND DIRECTION, DEGREES

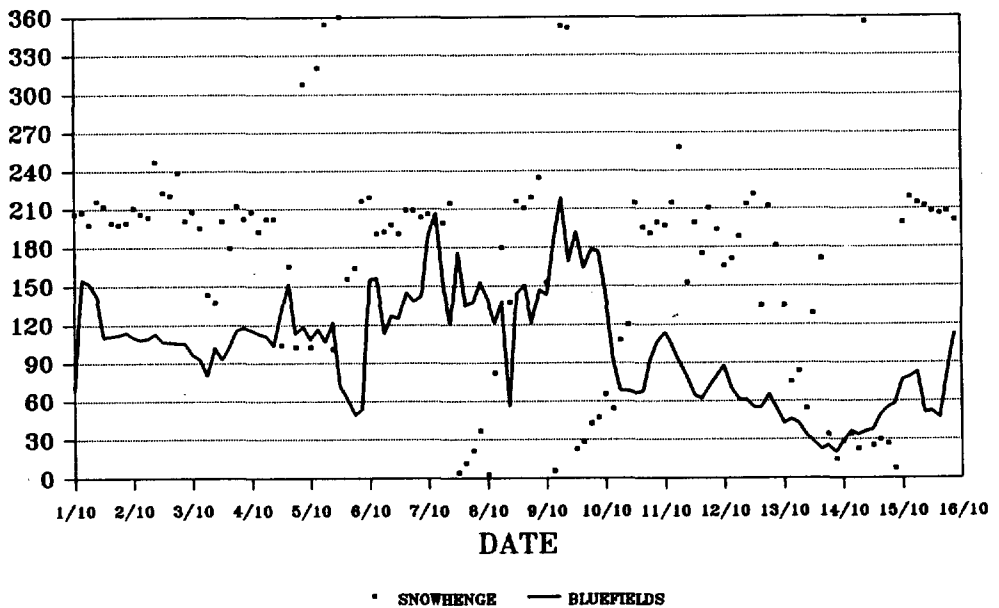
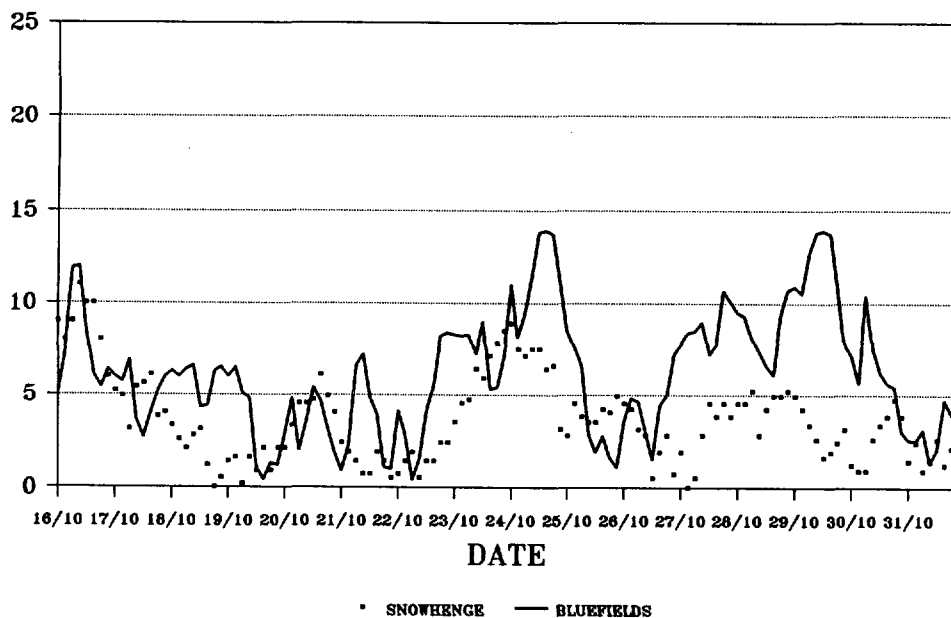


Figure 31. Time series of wind, October 1.-15. 1992.

16.-31. OCTOBER 1992
WIND SPEED, M/S



16.-31. OCTOBER 1992
WIND DIRECTION, DEGREES

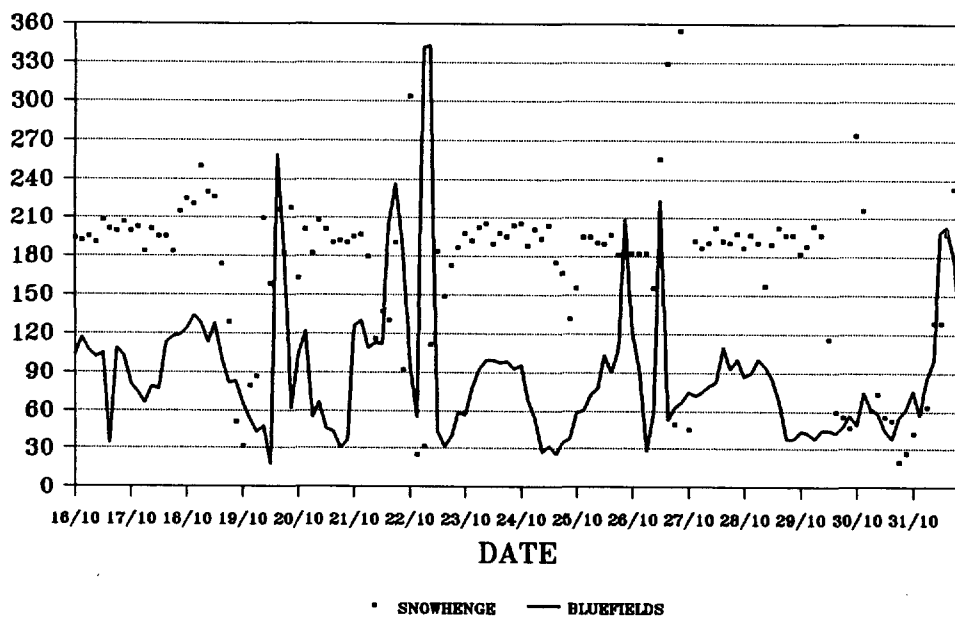
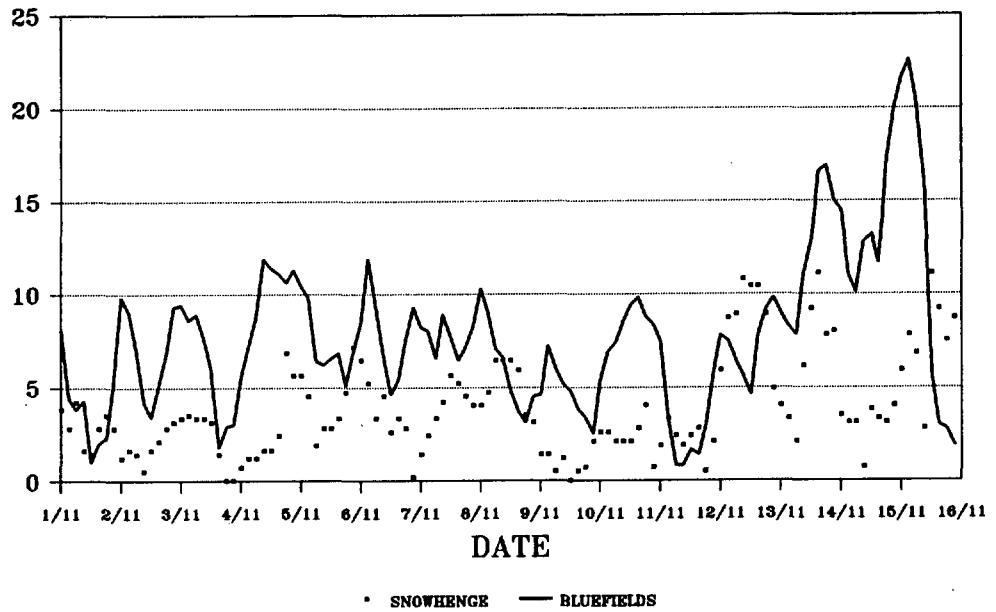


Figure 32. Time series of wind, October 16.-31. 1992.

1.-15. NOVEMBER 1992
WIND SPEED, M/S



1.-15. NOVEMBER 1992
WIND DIRECTION, DEGREES

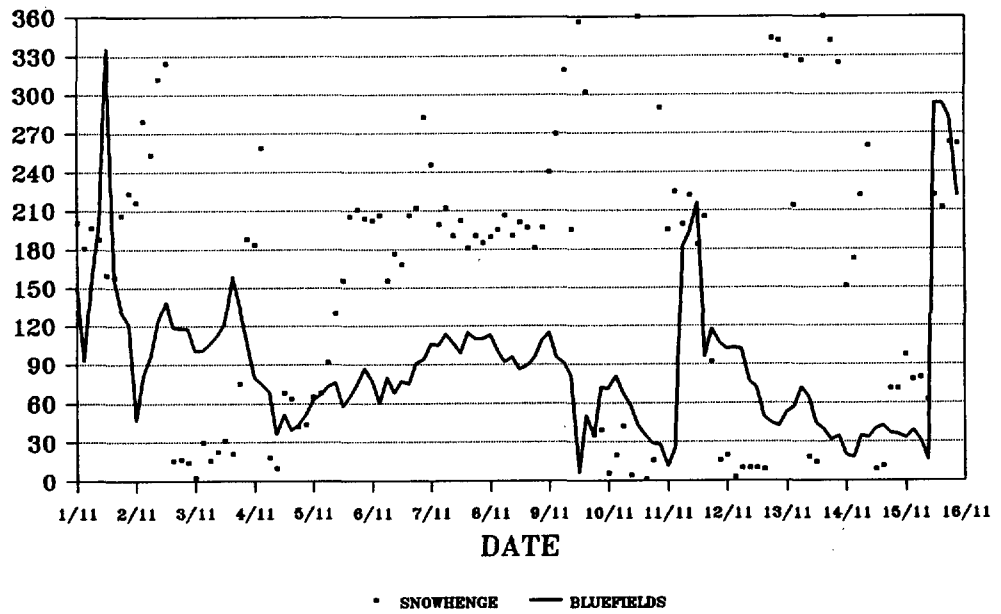
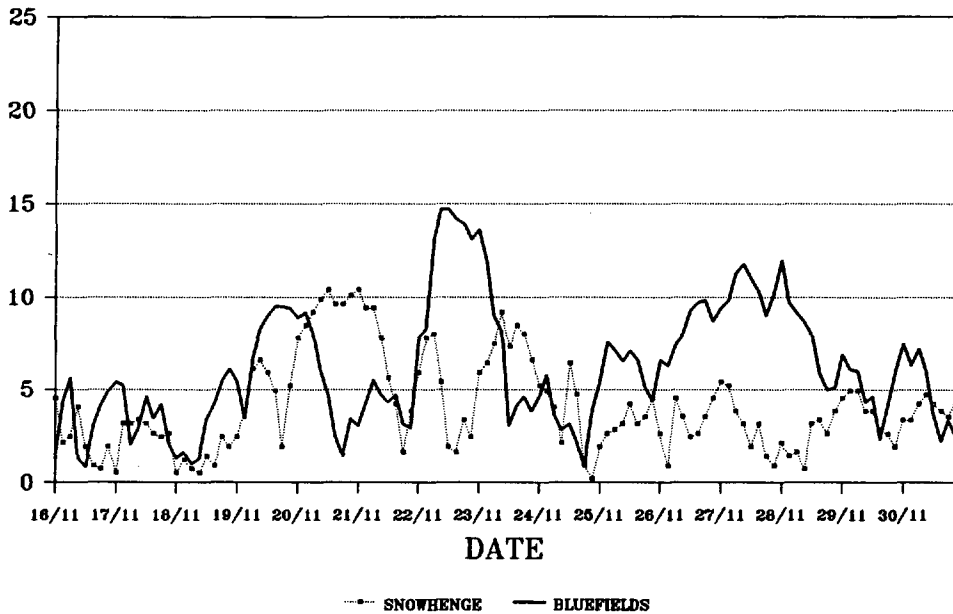


Figure 33. Time series of wind, November 1.-15. 1992.

16.-30. NOVEMBER 1992
WIND SPEED, M/S



16.-30. NOVEMBER 1992
WIND DIRECTION, DEGREES

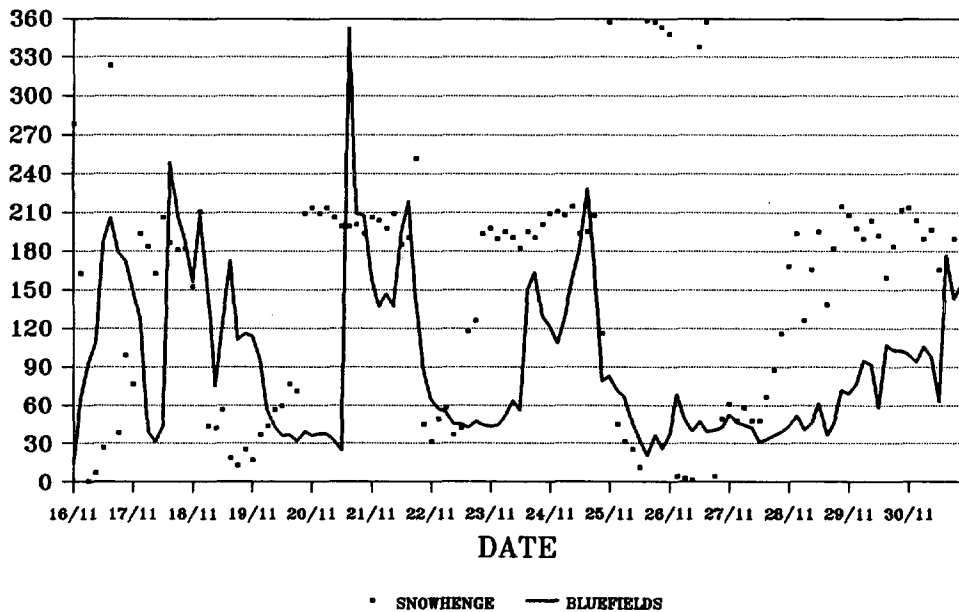
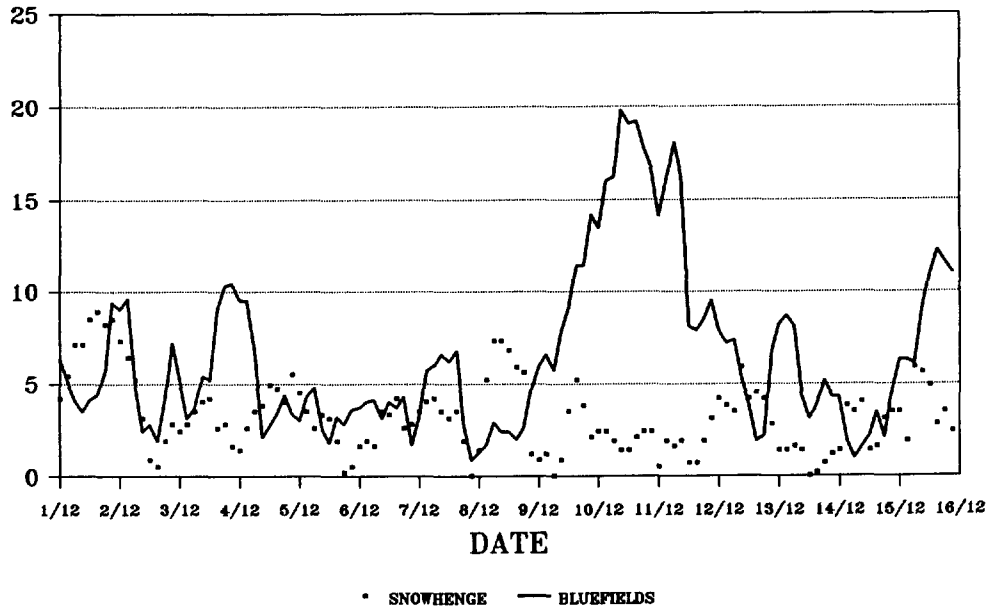


Figure 34. Time series of wind, November 16.-30. 1992.

1.-15. DECEMBER 1992
WIND SPEED, M/S



1.-15. DECEMBER 1992
WIND DIRECTION, DEGREES

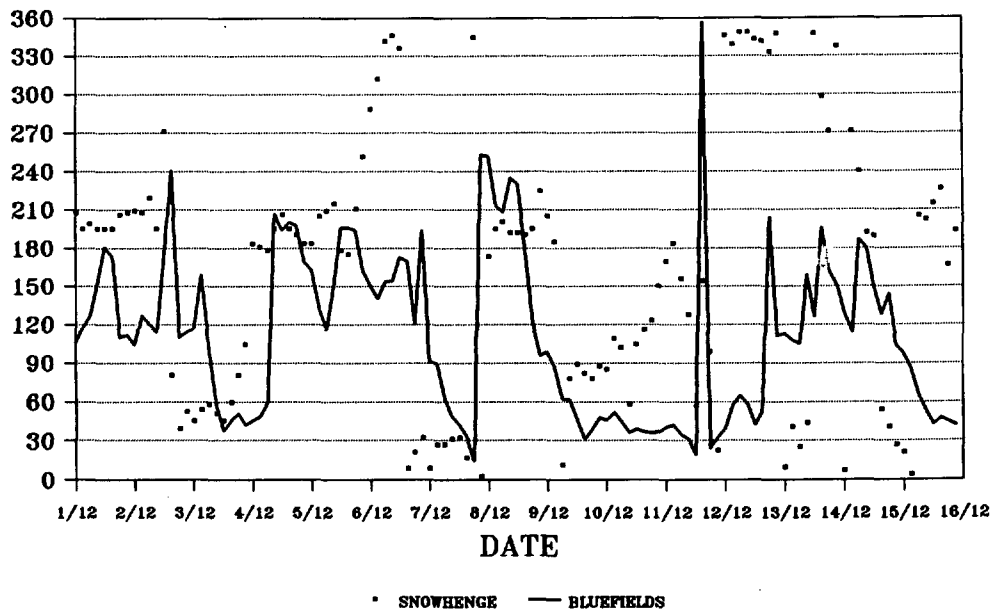
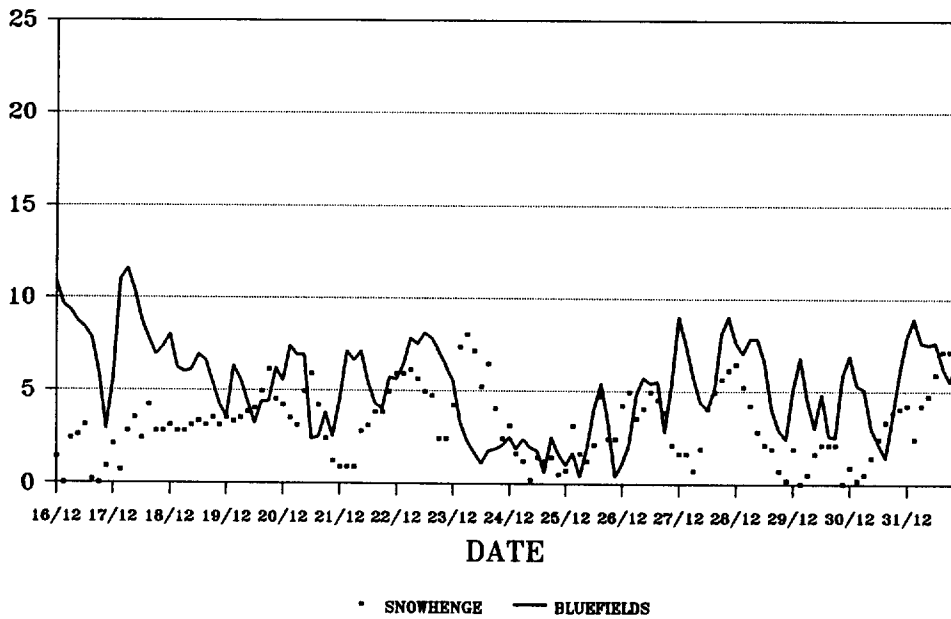


Figure 35. Time series of wind, December 1.-15. 1992.

16.-31. DECEMBER 1992
WIND SPEED, M/S



16.-31. DECEMBER 1992
WIND DIRECTION, DEGREES

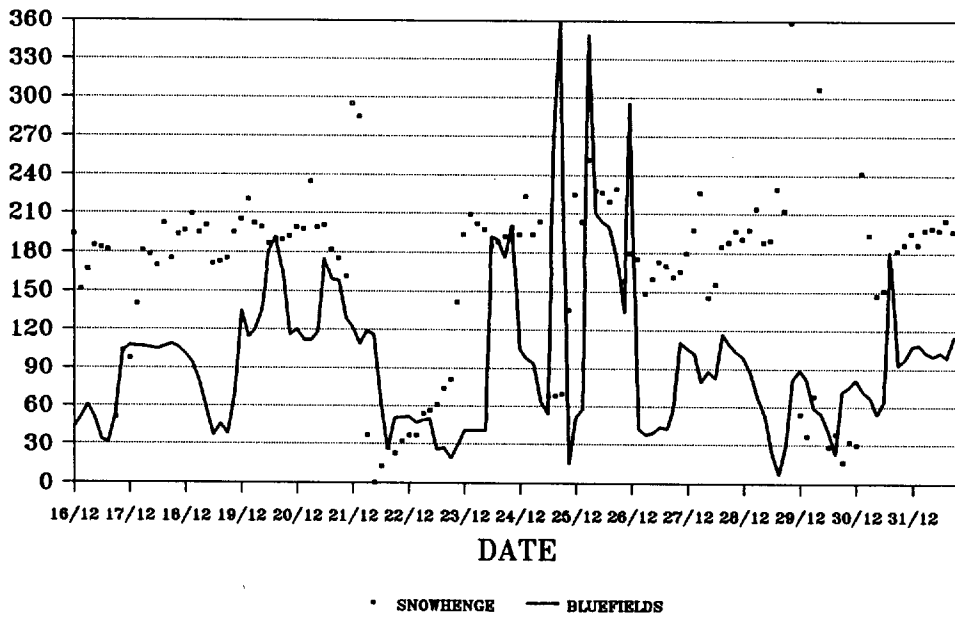


Figure 36. Time series of wind, December 16.-31. 1992.

APPENDIX

AUTOMATIC WEATHER STATION 2700

