



Report

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**Additional Wind and Stability Observations
at Sómastaðagerði in Reyðarfjörður III
May - August 2000**

Report prepared for Reyðarál hf.

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1. Introduction

From the beginning of May 1998 Veðurstofa Íslands – The Icelandic Meteorological Office – has carried out wind and stability observations in a 38 m high mast at Sómastaðagerði in Reyðarfjörður to provide necessary information in connection with plans for an aluminium plant at Hraun/Sómastaðagerði.

Three Reports have earlier been issued. The first one, Wind and Stability Observations at Sómastaðagerði in Reyðarfjörður (VÍ-G99018-TA04), presents data for the period May 1998 - April 1999 (Ref. 1). The second Report, Additional Wind and Stability Observations at Sómastaðagerði in Reyðarfjörður (VÍ-G00001-TA01), covers the six month period May 1999-October 1999 (Ref. 2). The third Report, Additional Wind and Stability Observations at Sómastaðagerði in Reyðarfjörður II (VÍ-G00007-TA03), contains results of observations carried out during the six month period November 1999-April 2000 as well as comparison between the two 12 month periods May 1998-April 1999 and May 1999-April 2000 (Ref. 3). According to a contract with Reyðarálf hf., it has now been decided to extend the observation period for a further 12 month period, and the present Report, Additional Wind and Stability Observations at Sómastaðagerði III, covers the period May- August 2000. As this new Report is required by Reyðarálf already in September 2000, it covers a shorter period of time than the earlier ones. According to the contract three new automatic wind and temperature observing stations were installed in Reyðarfjörður early in June 2000, and results from them are also reported. The stations are Vattarnes, Ljósá and Kollaleira 2.

It should be mentioned that three earlier Reports issued by Veðurstofa Íslands also contain meteorological information for the Reyðarfjörður area (Ref. 4-6).

The Meteorological Office operates an automatic weather station near sea level at the end of Eskifjörður; the Public Roads Administration an automatic road and weather station near Oddsskarð at 520 m above the fjord; and the Icelandic Maritime Administration an automatic weather station on the island Seley outside Reyðarfjörður. Some observations from these stations will be used in this report.

A map of Reyðarfjörður is shown in Fig. 1. Present and former observation stations in the Reyðarfjörður area are indicated on the map.

2. Observation Sites and Instrumentation

Sómastaðagerði

The 38 m observation mast at Sómastaðagerði is located on a low gravel platform (65° 02.0' N, 14° 06.7' W). Elevation of the platform: 32 m above mean sea level. The instruments used in the mast have been the same from the beginning of the observations. Platinum resistance thermometers Logan 100PRT have been used for air temperature observations at 3.0 m, 10.5 m and 36.5 m above the platform. For protection of the thermometers from radiation and precipitation 6-plate Gill radiation shields have been used. For observations of wind direction and wind velocity a Wind Monitor-MA 05106, Marine Model, from R.M. Young has been used at 10.3 m height. Two Gill UVW

anemometers are also installed in the mast at 10.8 m and 36.6 m and a Vaisala temperature and relative humidity sensor HMP-35D at 3.0 m, but data from these instruments are not used in this report. A Measurement and Control Module CR10X from Campbell Scientific, Inc. is used for collecting and storing the observation data and transmitting them over a telephone line to the Meteorological Office in Reykjavík. The observation mast is shown in Fig. 2, the instruments at the 10 m level in Fig. 3.

A recalibration of the temperature sensors on 1 July 1999 and again on 19 January 2000 indicated that the measurements at 3.0 m height were underestimating temperature by 0.1° C compared to the temperature sensors at 10.5 m and 36.5 m heights. Stability has accordingly been slightly overestimated. A new recalibration was made on 4 June 2000 when it was found that the temperature sensor at the 3.0 m level had drifted further and now underestimated temperature by 0.2° C compared with the sensors at 10.5 and 36.5 m heights.

Absolutely speaking, the temperature corrections at the 10.5 m and 36.5 m levels are believed to have been +0.1° C from the beginning of observations on 1 May 1998 and the same correction is believed to have been valid at the 3.0 m level until 30 April 1999. From 1 May 1999 to 30 April 2000 the correction at 3.0 m height is taken to have been +0.2° C, and from 1 May to 31 August 2000 the correction +0.3° C has been used at this level. These corrections have, as appropriate, been applied in the present report.

Vattarnes

The automatic station Vattarnes (64° 56.2' N, 13° 41.1' V) is located on a small peninsula extending northwards into the mouth of Reyðarfjörður. Ground elevation: 6 m above mean sea level. For observation of wind direction and wind speed a R.M. Young propeller anemometer of the same type as used at Sómastaðagerði was installed at 11.2 m above the ground. For temperature observations a platinum resistance thermometer Logan 100PRT with a 6-plate Gill radiation shield is used at 2.0 m above ground. A Measurement and Control Module CR10X from Campbell Scientific, Inc. is used for collecting and storing data and transmission to Reykjavík over a GSM communication module. Observations started at Vattarnes in the afternoon of 5 June 2000. The station Vattarnes is shown in Fig. 4 and 5.

Ljósá

The automatic station, here called Ljósá (65° 02.6' N, 14° 09.7' V), is located on a promontory, named Slægjubrýr, in the hillside above and north of Framnes and approx. 1½ km NW of Sómastaðagerði. Ground elevation: 280 m above mean sea level. Anemometer, thermometer and radiation shield are of the same type as at Vattarnes as also the instrumentation for data collection and transmission to Reykjavík. Height of anemometer above ground is 9.9 m and of thermometer 2.0 m. Observations started in the afternoon of 2 June 2000. The station Ljósá is shown in Fig. 6 and 7.

Kollaleira 2

The manned weather station Kollaleira was moved some 400 meters westwards on 5 April 1990. A mechanical wind recorder Woelfle Lambrecht 1482 was though left in operation at the old place. An automatic station Kollaleira 2 (65° 02.2' N, 14° 14.4' V) measuring wind direction, wind speed, temperature and humidity was installed at the manned station (in the new place) and became operational in the evening of 3 June 2000. Wind, temperature and data collection instrumentation is the same as at Vattarnes but data transmission is over a telephone line as at Sómastaðagerði. Ground elevation at the automatic station: 43.5 m a.m.s.l. Height of the anemometer above ground is 9.5 m and of thermometer 2.0 m. The automatic station Kollaleira 2 is shown in Fig. 8 and 9.

Eskifjörður

The automatic station Eskifjörður (65° 04.2' N, 14° 01.8' V) is located at the end of the fjord Eskifjörður a short way west of the small town with the same name. Ground elevation: approx. 2 m a.m.s.l. Anemometer, thermometer, radiation shield and data collecting equipment are of the same type as at Vattarnes. Data transmission is by telephone line. Humidity and precipitation are also measured at the station. Height of instruments above ground: anemometer 10.0 m, thermometer 2.0 m. The station Eskifjörður is shown in Fig. 10.

Oddsskarð

The automatic weather and road station Oddsskarð (65° 06' N, 13° 54' V) is located at 520 m height in the hillside of Eskifjörður at the road to the pass Oddsskarð. The station is owned by the Public Roads Administration. The station and the view over the outer part of Reyðarfjörður is shown in Fig. 11.

Seley

The automatic weather station Seley (65° 58.7' N, 13° 31.2' V) is located on an island approx. 5 km off Krossanes on the northern side of the mouth of Reyðarfjörður. The station is owned by the Icelandic Maritime Administration. Station ground elevation: 18 m a.m.s.l. The instruments at Seley are of the same type as at Vattarnes.

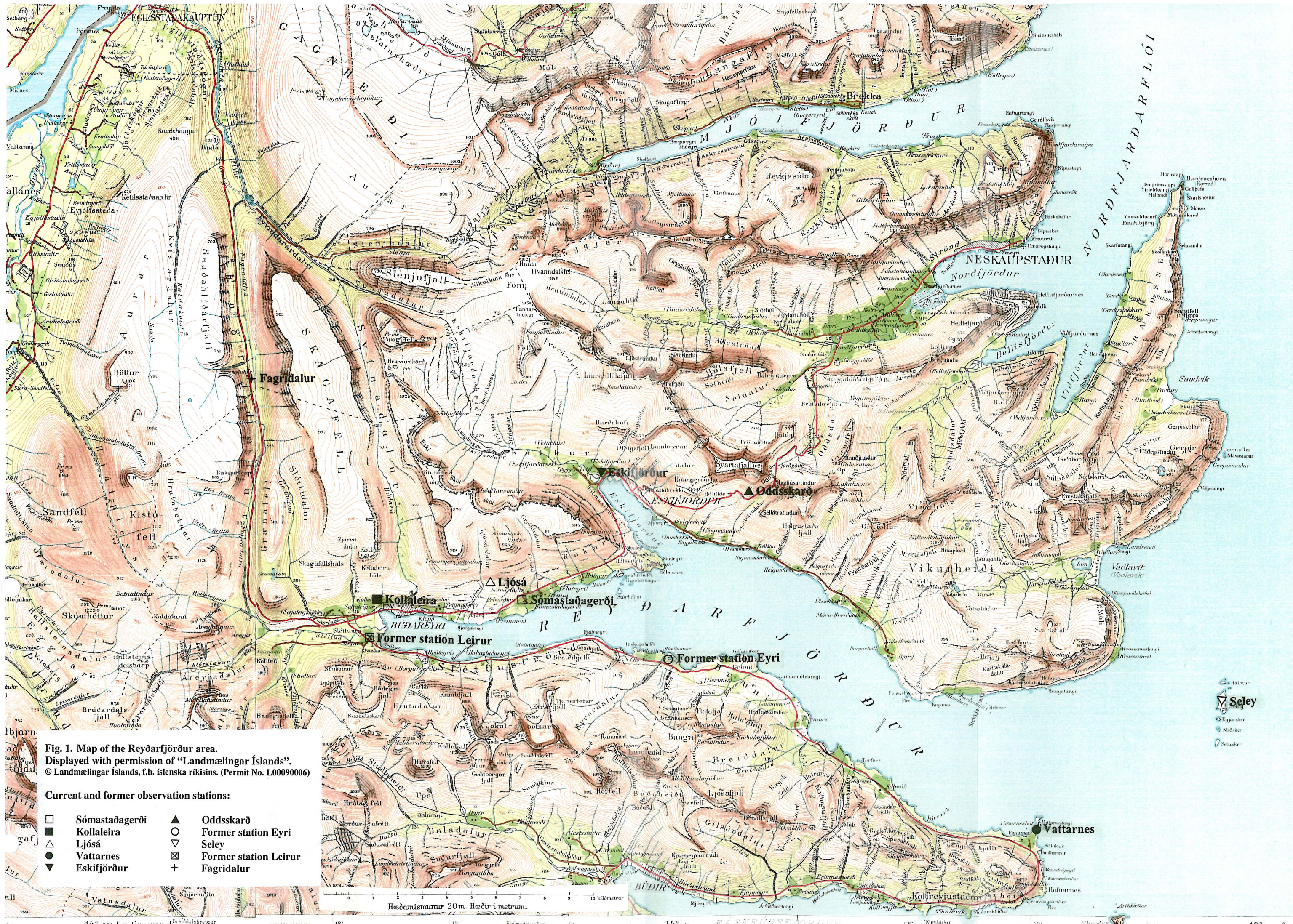


Fig. 1. Map of the Reyðarfjörður area. Displayed with permission of "Landmælingar Íslands". © Landmælingar Íslands, f.h. íslenska ríkisins. (Permit No. L00090006)

- Current and former observation stations:
- | | | | |
|---|----------------|---|-----------------------|
| □ | Sómastaðagerði | ▲ | Oddskarð |
| ■ | Kollaleira | ○ | Former station Eyri |
| △ | Ljósá | ▽ | Seley |
| ● | Vattarnes | ⊠ | Former station Leirur |
| ▼ | Eskifjörður | + | Fagridalur |



Fig. 2. The anemometer mast at Sómastaðagerði.
Photo: Flosi Hrafn Sigurðsson, 1999.



Fig. 3. Anemometers and thermometer at 10.3 - 10.8 m above the ground at Sómastaðagerði.
Photo: Flosi Hrafn Sigurðsson, 1999.



Fig 4. Station Vattarnes. View towards Eskifjörður.
Photo: Þórður Arason, 2000.



Fig 5. Vattarnes peninsula. View towards N.
Photo: Hallgrímur Marinósson, 2000.



**Fig 6. Automatic station Ljósá. View towards SW.
Photo: Þórður Arason, 2000.**



**Fig 7. Station Ljósá. View ESE-wards, towards the mouth of Reyðarfjörður.
Photo: Elvar Ástráðsson, 2000.**



**Fig. 8. Kollaleira. View towards S.
Photo: Þórður Arason, 2000.**



**Fig. 9. Automatic station Kollaleira. View towards E.
Photo: Þórður Arason, 2000.**



**Fig. 10. Automatic station Eskifjörður.
Photo: Þórður Arason, 2000.**



**Fig. 11. Automatic station Oddsskarð. View towards SSE.
Photo: Hallgrímur Marinósson, 2000.**

3. Wind Observations at Sómastaðagerði, May-August 2000

The frequency of the wind directions at Sómastaðagerði for each of the months May-August 2000 is presented in Table 1 and as wind roses in the upper part of Annexes 1-4. For comparison the corresponding frequency in 1998 and 1999 is also shown in Table 1. As seen in the table easterly and east-northeasterly winds are by far the most common at Sómastaðagerði during these months, followed by west-northwesterly and westerly winds. Variations from month to month and year to year are considerable. The highest monthly value observed for a single direction was 19.0 % in August 1998, the wind blowing from 70°. The second highest value was 15.9 % in June 2000 (80°), and the third highest 14.8% in June and July 2000 (90°). The highest value in westerly winds was 8.3 % in May 2000 (290°).

Table 1. Frequency of wind directions at Sómastaðagerði, May-August 1998, 1999 and 2000, %

Dir.	360	May			June			July			August		
		2000	1999	1998	2000	1999	1998	2000	1999	1998	2000	1999	1998
N	360	1.1	0.8	1.5	0.8	0.8	1.1	1.0	0.8	0.9	1.9	1.6	1.1
	10	0.7	0.8	1.1	0.5	1.3	1.3	1.0	0.7	0.8	1.2	1.3	1.0
	20	0.7	0.9	1.0	0.8	1.0	1.4	0.8	0.8	0.7	1.1	1.1	0.9
	30	0.9	1.2	1.0	1.0	1.3	1.3	1.3	1.1	0.9	1.1	1.7	1.3
	40	1.6	1.7	1.6	1.2	1.6	2.5	1.8	1.4	1.3	1.7	2.3	1.7
	50	2.4	2.9	3.0	2.1	2.4	3.9	3.4	2.1	2.6	2.9	4.1	3.1
	60	4.2	6.0	6.5	4.5	4.9	5.6	5.6	4.0	5.8	5.0	7.1	9.3
	70	8.3	9.2	9.9	8.8	8.9	8.2	10.1	8.5	9.0	9.0	9.9	19.0
	80	8.1	10.3	10.3	15.9	13.4	13.2	13.1	12.0	11.9	10.5	13.1	12.7
E	90	7.2	8.7	8.8	14.8	10.4	8.8	14.8	9.6	8.1	10.6	9.6	6.9
	100	4.6	6.5	4.8	7.7	5.7	4.2	5.8	6.4	3.9	6.1	6.0	2.8
	110	2.2	4.1	2.3	3.4	3.8	3.0	2.3	3.0	1.8	2.4	3.2	1.7
	120	1.1	2.3	2.0	3.3	3.7	2.9	2.2	2.8	1.3	1.8	2.9	1.0
	130	0.7	1.6	2.0	2.0	1.0	2.0	1.2	1.5	0.6	1.3	1.7	0.7
	140	0.5	0.9	1.0	0.9	0.6	1.2	1.0	1.0	0.6	1.1	1.1	0.3
	150	0.6	0.7	1.0	0.8	0.7	0.5	0.9	0.6	0.4	0.7	0.6	0.3
	160	0.4	0.9	0.6	0.4	0.6	0.1	0.5	0.5	0.2	0.6	0.5	0.4
	170	0.5	0.5	0.7	0.6	0.8	0.2	0.6	0.4	0.3	0.8	0.4	0.2
S	180	0.4	0.6	0.7	0.7	0.6	0.3	0.4	0.3	0.3	0.4	0.4	0.3
	190	0.5	0.7	0.9	0.5	0.4	0.1	0.4	0.4	0.2	0.5	0.4	0.3
	200	0.5	0.7	1.5	0.4	0.9	0.3	0.6	0.2	0.4	0.6	0.6	0.4
	210	1.0	0.6	1.2	0.5	0.9	0.6	0.7	0.5	0.3	0.9	0.6	0.4
	220	1.1	1.4	1.9	0.6	1.1	1.3	1.1	0.7	0.5	1.1	0.9	0.8
	230	1.8	2.4	2.1	1.0	1.9	2.0	1.4	1.4	1.4	1.9	1.7	1.0
	240	3.1	3.0	3.2	1.5	3.4	2.6	2.1	2.3	3.8	3.0	3.0	2.8
	250	3.5	4.1	3.8	3.1	4.7	3.9	2.7	4.1	5.4	3.7	3.4	3.4
	260	4.2	5.1	4.7	3.4	4.5	7.1	3.3	6.0	6.2	3.9	2.7	3.5
W	270	4.1	4.9	3.8	2.9	4.4	5.2	3.5	5.6	5.7	4.2	2.8	4.5
	280	6.2	3.6	3.9	3.0	3.9	4.6	2.1	5.7	6.5	2.9	3.0	4.8
	290	8.3	3.2	2.6	3.3	3.1	2.4	2.1	4.9	6.6	2.6	3.1	3.8
	300	5.8	1.7	1.8	2.1	2.2	1.2	2.2	3.5	2.5	2.0	1.8	1.6
	310	3.4	1.9	1.7	2.0	1.4	1.3	1.3	1.8	1.8	1.4	1.3	1.3
	320	2.8	1.1	1.1	1.2	1.2	0.8	1.0	1.3	1.4	1.4	1.0	1.0
	330	2.0	1.4	1.5	0.8	0.9	1.0	1.0	0.7	0.9	1.2	0.9	0.6
	340	1.6	1.7	1.5	0.8	0.6	1.0	1.1	0.6	1.0	1.6	0.9	0.7
	350	1.7	1.0	1.3	0.9	0.7	1.0	1.1	0.8	0.8	1.8	1.0	0.8
Calm		2,0	0,8	1,8	1,8	0,4	2,0	4,5	1,6	3,2	5,1	2,2	3,7

Calm is in this report defined as a 10 minute wind speed below or equal to 0.2 m/s.

Looking at the wind roses in Annexes 2-4 we see clearly how dominating easterly winds have been at Sómastaðagerði during the high summer months June, July and August 2000.

However, there is an important difference between night and day. This is shown in Annexes 5 and 6. The former presents a wind rose for the night hours 00-06 GMT and the latter for the day hours 12-18 GMT. Unlike the two preceding summers ENE-erly winds were now slightly more frequent at night than westerly winds. During the daytime easterly winds were completely dominating as they were also during the summers 1998 and 1999.

The average 10 minute wind velocity for each of the months May-August 2000 is shown in Table 2 and for each wind direction during these months in the lower part of Annexes 1-4. For comparison the averages for the months May-August 1998 and 1999 are also presented in Table 2.

Table 2. Average wind velocity at Sómastaðagerði, 10.3 m height, May-August 1998, 1999 and 2000, m/s.

May			June			July			August		
2000	1999	1998	2000	1999	1998	2000	1999	1998	2000	1999	1998
4.6	3.7	3.6	4.0	4.0	3.6	2.9	3.8	4.4	2.8	2.6	3.7

The lowest monthly average 2.6 m/s occurred in August 1999. The second lowest value 2.8 m/s was observed in August 2000 and the third lowest 2.9 m/s in July 2000.

For the months May, June, July and August 2000 the frequency of the 10 minute wind velocity in selected velocity intervals is presented in Table 3.

Table 3. Frequency of 10 minute wind velocity for selected intervals, Sómastaðagerði, May-August 2000, %.

m/s	0.0 - 0.9	1.0 - 1.9	2.0 - 2.9	3.0 - 3.9	4.0 - 4.9	0.0 - 4.9	5.0 - 9.9	10.0 - 14.9	15.0 - 19.9	20.0 - 24.9	>25.0
May	11.5	14.9	13.8	10.6	10.9	61.6	28.4	7.5	2.4	0.0	
June	9.4	13.9	14.3	13.6	13.3	64.6	34.0	1.4			
July	19.1	20.6	15.9	13.7	13.3	82.6	17.3	0.1			
August	23.1	22.3	15.6	13.0	9.8	83.8	14.7	1.6			

Attention is drawn to the high frequency of low wind velocities in July and August 2000. In the latter month the 10 minute wind speed was below 2.0 m/s in 45.4 % and below 5.0 m/s in 83.8 % of all cases. In August 1999 the frequency of 10 minute wind speed below 5.0 m/s was even higher or 87.1 % of all cases.

4. Temperature and Stability Observations at Sómastaðagerði, May-August 2000

The monthly average temperature at 3.0 m, 10.5 m and 36.5 m above the ground is shown in Table 4 for the months May-August 2000. For comparison the table also includes values for the same months during 1998 and 1999 as well as the monthly mean

temperature at 2.0 m above the ground at the manned weather station Kollaleira, and the automatic stations Kollaleira 2, Vattarnes and Ljósá. As the automatic stations came into use during the first days of June 2000 the observed values have been corrected to be valid for the whole month. This was done by comparison with the manned station Kollaleira.

At Sómastaðagerði the temperature sensor correction $+0.1^{\circ}\text{C}$ has been used at 10.5 and 36.5 m heights. The same correction $+0.1^{\circ}\text{C}$ has until 30 April 1999 been used at 3.0 m height. From 1 May 1999 to 30 April 2000 this correction was, however, increased to $+0.2^{\circ}\text{C}$ and from 1 May 2000 to $+0.3^{\circ}\text{C}$.

Table 4. Monthly average temperature at 3.0 m, 10.5 m 36.5 m heights, Sómastaðagerði, May-August 1998- 2000, $^{\circ}\text{C}$.

	May			June			July			August		
	2000	1999	1998	2000	1999	1998	2000	1999	1998	2000	1999	1998
$T_{3.0}$	6.23	5.32	5.84	6.54	8.64	6.21	10.32	10.36	8.36	10.26	10.06	9.05
$T_{10.5}$	6.23	5.39	5.81	6.38	8.64	6.10	10.13	10.31	8.33	10.19	10.12	9.17
$T_{36.5}$	6.17	5.28	5.71	6.17	8.55	5.89	10.09	10.20	8.26	10.19	10.08	9.14
$T_{36.5}-T_{3.0}$	-0.06	-0.04	-0.13	-0.37	-0.09	-0.32	-0.23	-0.16	-0.10	-0.07	0.02	0.09
$T_{36.5}-T_{10.5}$	-0.06	-0.11	-0.10	-0.21	-0.09	-0.21	-0.04	-0.11	-0.07	0.00	-0.04	-0.03
Kollaleira	6.2	5.7	6.5	7.3	9.3	6.8	11.0	10.9	8.6	10.5	10.5	9.8
Kollaleira 2				6.9			10.6			10.3		
Vattarnes				5.4			8.6			9.4		
Ljósá				5.4			10.0			9.9		

The temperature difference between 36.5 m and 3.0 m heights and 36.5 m and 10.5 m heights are also presented in Annexes 7-10 for each day of each of the months May-August 2000. The data for the first day of the month begin where 1 is marked on the x-axis of the diagrams, the data for the second day where 2 is marked etc. The regularity of the diurnal variation is noteworthy, with a strong tendency to instability during the day and stability during the night.

The diurnal variation of the mean temperature difference between the observation levels is shown in Annexes 11-12. On average the air is stable in the evening and night during these months but unstable during most of the day. From day to day the diurnal variation is though naturally quite variable as seen in Annexes 7-10.

5. Temperature Difference Kollaleira 2-Vattarnes, June-August 2000

As seen in Table 4 the mean air temperature during the summer months is considerably higher at Kollaleira than at Sómastaðagerði. On the other hand at Vattarnes at the mouth of Reyðarfjörður the mean summer temperatures are considerably lower. The temperature difference between Kollaleira and Vattarnes is, however, quite variable from day to day, and from night to day, as presented in Annex 13, based on hourly observations. As seen in Annex 13 the main rule is that the temperature is considerably higher at Kollaleira during the summer months than at Vattarnes. However, due to greater nighttime cooling at Kollaleira, the temperature is not unfrequently lower there at night. The distance between Kollaleira and Vattarnes is approx. 28 km. The highest positive difference presented is approx. 8°C , but the largest negative difference is approx. -4°C .

The mean diurnal variation of the temperature difference between Kollaleira 2 and Vattarnes is also of interest and is presented in Annex 14 for each of the months June, July and August 2000. The mean difference was small during the night, but started to increase near 06 GMT in the morning and reached a maximum of 2-4° C during several hours around noon.

This temperature difference is the cause for the strong and semiregular sea breeze during the day in summer in the Reyðarfjörður area.

6. Data Comparison between the Periods May-August 1998, 1999 and 2000 at Sómastaðagerði

Wind and temperature data for each of the months May, June, July and August can be compared in Tables 1, 2 and 4 for the years 1998, 1999 and 2000. For the period May-August as a whole the frequency of the wind directions during each of these three years is also presented in Fig. 12. Similarly the mean wind speed for each wind direction is presented in Fig. 13. For the period as a whole the curves for the three years follow relatively closely although data for singular months in some cases show a marked variation from year to year.

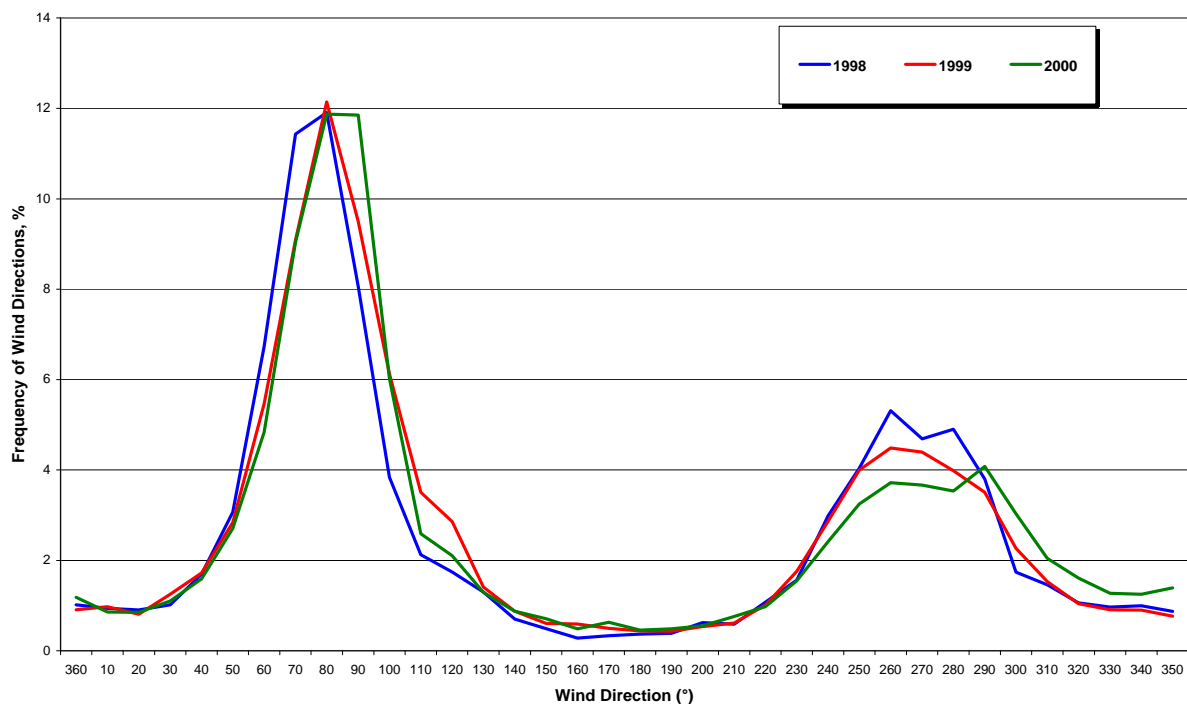


Fig. 12. Comparison of the frequency of wind directions during May-August for the three years 1998, 1999 and 2000.

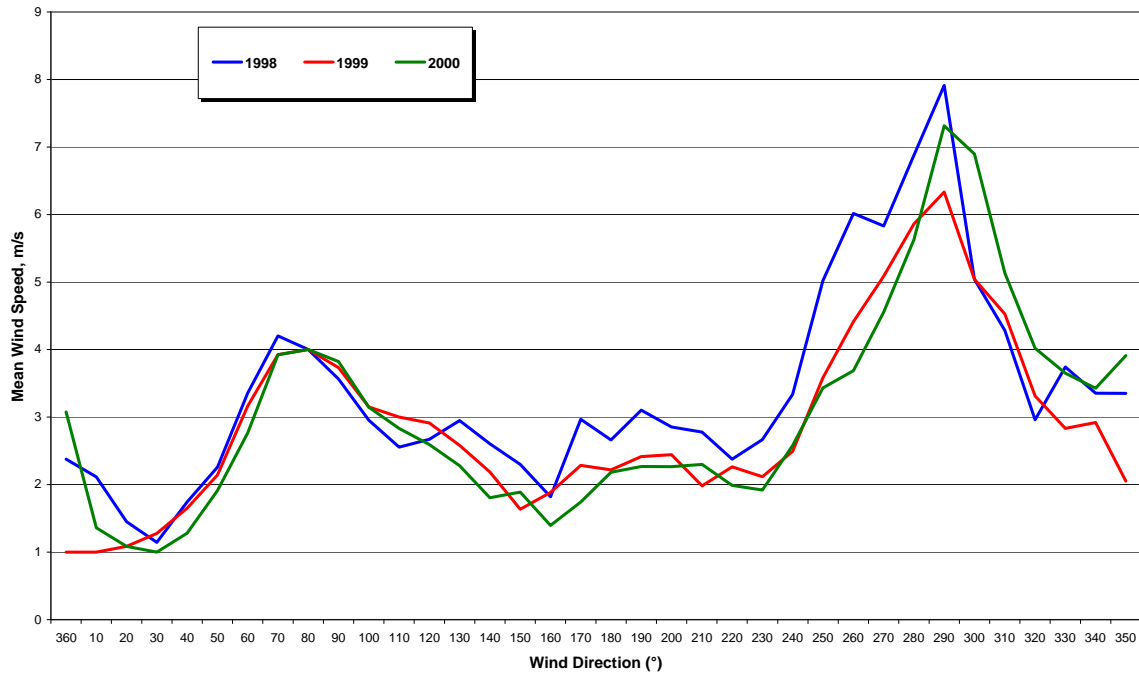


Fig. 13. Comparison of the mean wind speed for the different wind directions, May-August, for the three years 1998, 1999 and 2000.

A comparison of the diurnal variation of the mean temperature difference between the 36.5 m and 3.0 m levels in the mast at Sómastaðagerði (i.e. the stability conditions) during the period May-August for each of the years 1998, 1999 and 2000 is presented in Annex 15. The difference between the graphs for 1998 and 1999 is small and mainly of the same order of magnitude as the accuracy of the temperature observations. The graph for 2000 follows the others quite well during the evening and night, but shows a slightly greater instability during the day.

7. Wind Observations at Ljósá, 280 m a.m.s.l., June-August 2000

The frequency of the wind directions and the average wind speed in each direction at station Ljósá during each of the months June, July and August 2000 are presented in Annexes 16-18. Compared with the corresponding wind roses for Sómastaðagerði, the wind roses for Ljósá seem to be rotated approx. 10° clockwise. This is probably mainly due to different orientation of the contours of the land near the stations.

We draw attention to the relatively high frequency of calm at Ljósá, 9.6 % in June, 14.1 % in July and 16.0 % in August 2000. Corresponding figures for Sómastaðagerði are respectively 1.8 %, 4.5 % and 5.1 %.

The mean wind speed at Ljósá was 3.4 m/s from 2-30 June, 2.5 m/s in July and 2.5 m/s in August.

8. Wind Observations at Vattarnes, June-August 2000

The frequency of the wind directions and the average wind speed in each wind direction at Vattarnes during each of the months June, July and August 2000 are presented in Annexes 19-21. Attention is drawn to the great difference between the wind roses for Vattarnes and the ones for Sómastaðagerði and Ljósá. The easterly winds dominating at Sómastaðagerði and Ljósá during the high summer have much lower frequency at Vattarnes where SSE-erly winds are most common with NE-erly winds in the second place for the period as a whole.

The frequency of calm was low at Vattarnes, 2.5 % in June, 2.2 % in July and 2.0 % in August 2000.

The mean wind speed at Vattarnes was 4.6 m/s from 5-30 June, 4.7 m/s in July and 4.0 m/s in August.

9. Wind Observations at Kollaleira 2, June-August 2000

The frequency of the wind directions and the average wind speed in each direction at Kollaleira 2 during each of the months June, July and August are presented in Annexes 22-24. Due to a westwards movement of the observation place the wind roses for Kollaleira 2 show an important difference from earlier published wind roses for Kollaleira (Ref. 5). The dominating northerly wind from Svínadalur, so frequently observed at the old wind observing place, is quite rare at the new place which is in lee of the mountain Kollur.

As for Ljósá we emphasize the relatively high frequency of calm at Kollaleira 2: 9.2 % in June, 11.4 % in July and 13.0 % in August 2000.

At Kollaleira 2 the mean wind speed was 3.5 m/s from 3-30 June, 2.2 m/s in July and 2.4 m/s in August.

10. Wind Observations at Seley, May-August 2000

The frequency of the wind directions and the average wind speed in each direction at Seley during May, June, July and August 2000 are presented in Annexes 25-28. The most common wind direction at Seley during this period has been SSW-erly. Attention is drawn to how relatively rare easterly winds have been compared to Sómastaðagerði and Ljósá.

We point out the very low frequency of calm at Seley, 0.3 % in May, 0.7 % in June, 1.9 % in July and 0.8 % in August.

At Seley the mean wind speed was 7.1 m/s in May, 5.3 m/s in June, 5.5 m/s in July and 5.3 m/s in August.

11. Simultaneous Observations of Wind Direction at Sómastaðagerði, Ljósá,

Oddsskarð, Vattarnes and Seley, June-August 2000

Simultaneous observations of wind direction at the automatic stations Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley for each of the months June, July and August 2000 are presented in Annexes 29-34.

As shown by the graphs in these Annexes a similar wind direction is usually observed at Sómastaðagerði, Ljósá and Oddsskarð. However, at Vattarnes and Seley at the mouth of the fjord other directions are frequently observed at the same time. The easterly wind directions, so dominating at Sómastaðagerði and Ljósá, especially during the daytime in the period in question, were relatively rare at both Vattarnes and Seley. This seems strongly to indicate a frequent closed daytime circulation inside Reyðarfjörður with relatively warm air rising at the mountains closing the Reyðarfjörður-valley in west and sinking down over the outermost part of the fjord during the summer days. The westerly wind needed to close the circulation and keep up the easterly wind at Sómastaðagerði, however, seems usually to be higher than approx. 500 m (the approx. elevation of station Oddsskarð).

12. Simultaneous Observations of Wind Speed at Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley, June-August 2000

Simultaneous observations of wind speed at the automatic stations Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley for each of the months June, July and August 2000 are presented in Annexes 35-40. The different wind conditions and the diurnal variation of the wind speed during summer are clearly shown in the Annexes.

Attention is drawn to periods of very low wind speeds at Sómastaðagerði and also at Ljósá and Oddsskarð.

13. Temperature Difference Ljósá-Sómastaðagerði and Oddsskarð-Eskifjörður, June-August 2000

For the three months June-August 2000 the temperature difference between the stations Ljósá and Sómastaðagerði is presented in Annex 41 and between the station Oddsskarð and Eskifjörður in Annex 42. The difference in thermometer elevation for the former pair of stations is 247 m and 518 m for the latter. Several times each of these summer months and simultaneously at both station pairs the observed temperature was considerably higher at the higher station, indicating strong air stability, a ground based or low level inversion.

14. Remarks

From 1 May 1998 the Icelandic Meteorological Office, IMO, has made wind and stability observations at Sómastaðagerði to provide a basis for dispersion calculations for the proposed aluminium smelter at Sómastaðagerði/Hraun. From the beginning of June 2000 three automatic stations with wind and temperature observations have been added in Reyðarfjörður for further clarification of the meteorological conditions.

The dispersion calculations are carried out by the Norwegian Institute for Air Research, NILU, an institution of great experience and expertise in such matters.

IMO has earlier emphasized the need of dispersal calculations for the Reyðarfjörður area, not only for long periods, half and whole years, for comparison with official norms, but also for relatively short critical periods, especially during the summer. As examples of difficult dispersion conditions we have selected three periods, one from each of the months June, July and August 2000. All the three periods show low level inversions and very low wind speed, at least for considerable part of the time. The wind direction observed at Sómastaðagerði has mainly been easterly but partly also westerly or variable with very low wind speeds. During these periods the observations in the mast at Sómastaðagerði usually showed stable conditions during the night, but unstable air at the ground during the day, indicating mixing under a low level inversion and a possibility of fumigation during the morning.

The longest period, from 21-25 July, is described in Annex 43 and the two shorter ones, 28-30 June and 1-3 August, in Annex 44.

15. References

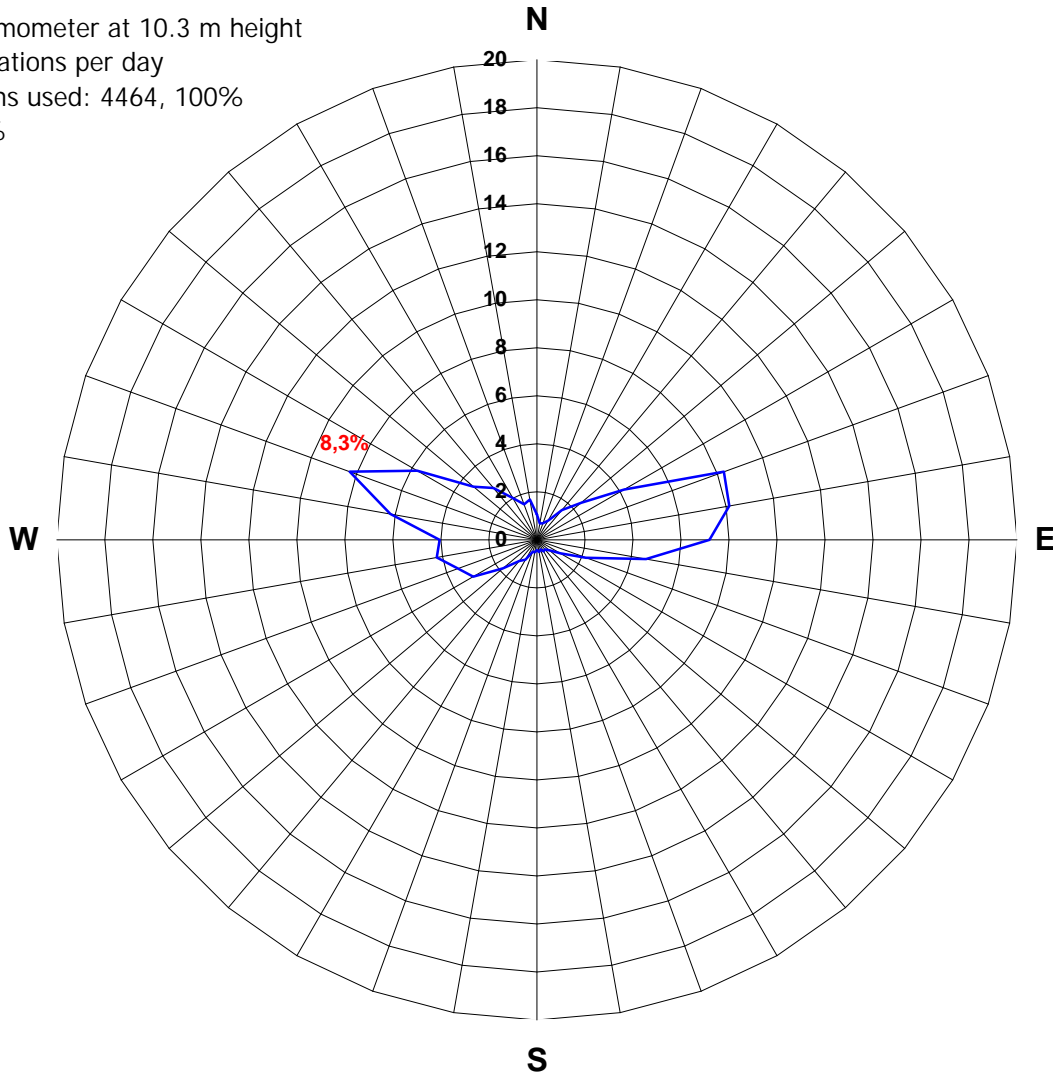
1. Flosi Hrafn Sigurðsson, Hreinn Hjartarson, Torfi Karl Antonsson and Þórður Arason: Wind and Stability Observations at Sómastaðagerði in Reyðarfjörður, May 1998-April 1999. Veðurstofa Íslands, Report VÍ-G99018-TA04, Reykjavík, October 1999, 55 p.
2. Flosi Hrafn Sigurðsson, Hreinn Hjartarson, Torfi Karl Antonsson and Þórður Arason: Additional Wind and Stability Observations at Sómastaðagerði in Reyðarfjörður. (May-October 1999). Veðurstofa Íslands, Report VÍ-G00001-TA01, Reykjavík, January 2000, 36 p.
3. Flosi Hrafn Sigurðsson, Hreinn Hjartarson, Torfi Karl Antonsson and Þórður Arason: Additional Wind and Stability Observations at Sómastaðagerði in Reyðarfjörður II, November 1999-April 2000. Veðurstofa Íslands, Report VÍ-G00007-TA03, May 2000, 33 p.
4. Flosi Hrafn Sigurðsson, Hreinn Hjartarson, Torfi Karl Antonsson and Þórður Arason: Wind Observations at Eyri and Leirur in Reyðarfjörður. Veðurstofa Íslands, Report VÍ-G99015-TA03, Reykjavík, August 1999, 32 p.
5. Flosi Hrafn Sigurðsson, Hreinn Hjartarson, and Torfi Karl Antonsson: Vindmælingar að Kollaleiru (Wind Observations at Kollaleira). Veðurstofa Íslands, Greinargerð VÍ-G99009-TA02, Reykjavík, June 1999, 41 p. (In Icelandic).
6. Flosi Hrafn Sigurðsson and Hreinn Hjartarson: Veðurathuganir á Reyðarfjarðarsvæðinu (Weather Observations in the Reyðarfjörður Area). Veðurstofa Íslands, Reykjavík 1986, 116 p. (In Icelandic).

Annexes 1 - 44

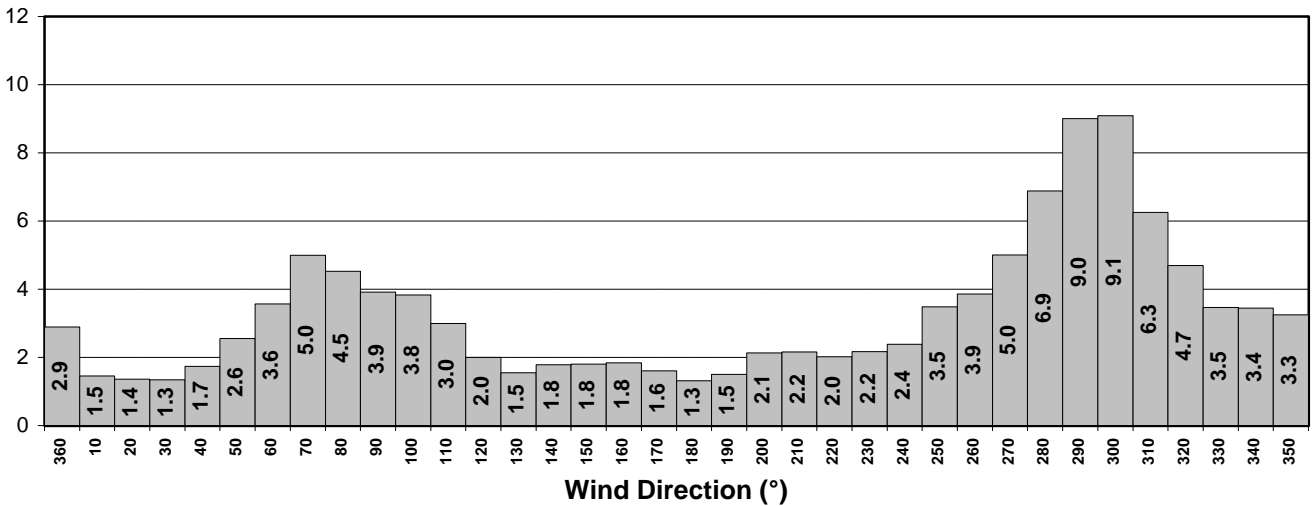
Sómastaðagerði

Frequency of Wind Directions, % May 2000

Young Anemometer at 10.3 m height
144 observations per day
Observations used: 4464, 100%
Calm: 2.0%



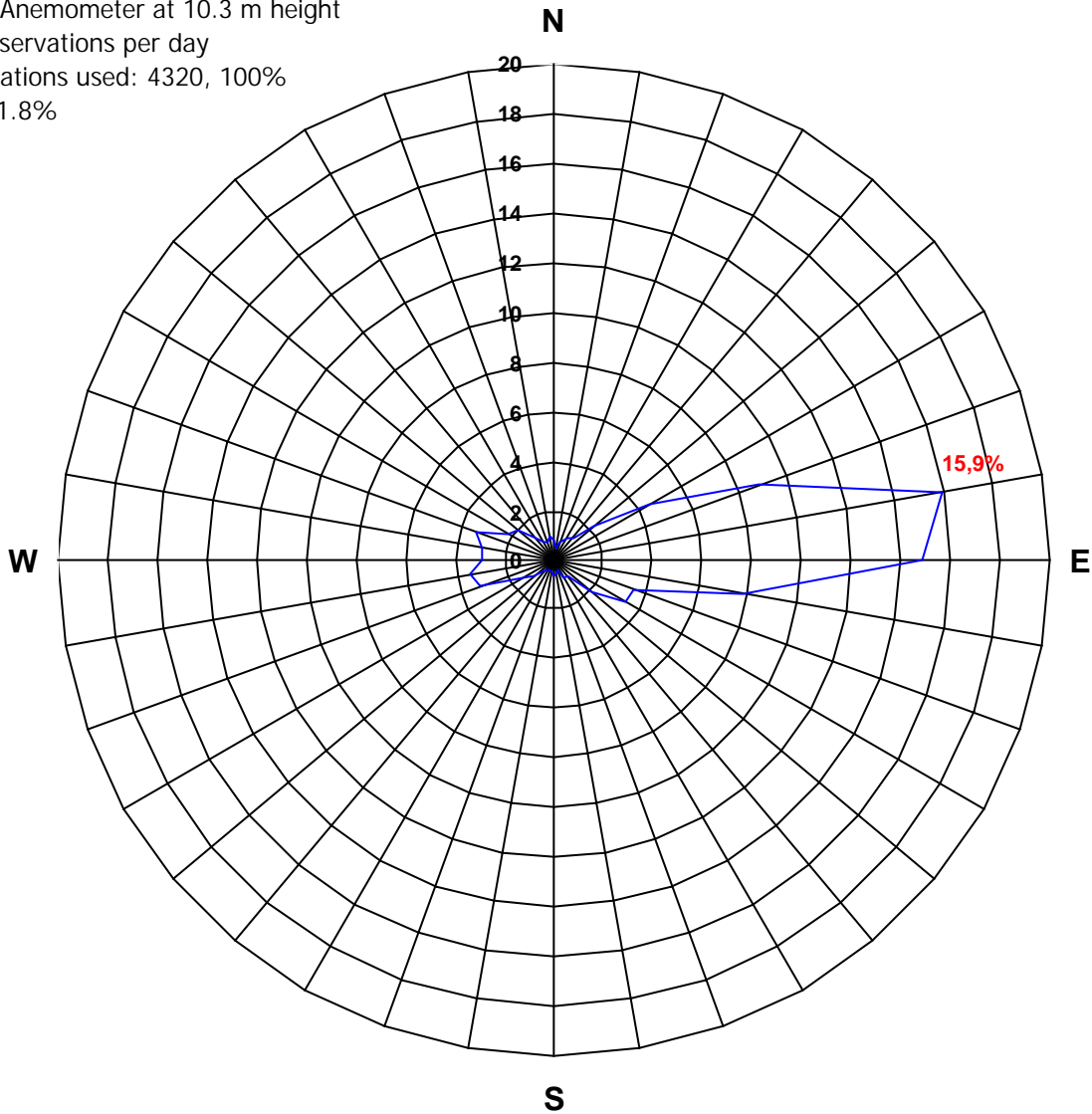
Average Wind Velocity for Wind Directions, m/s



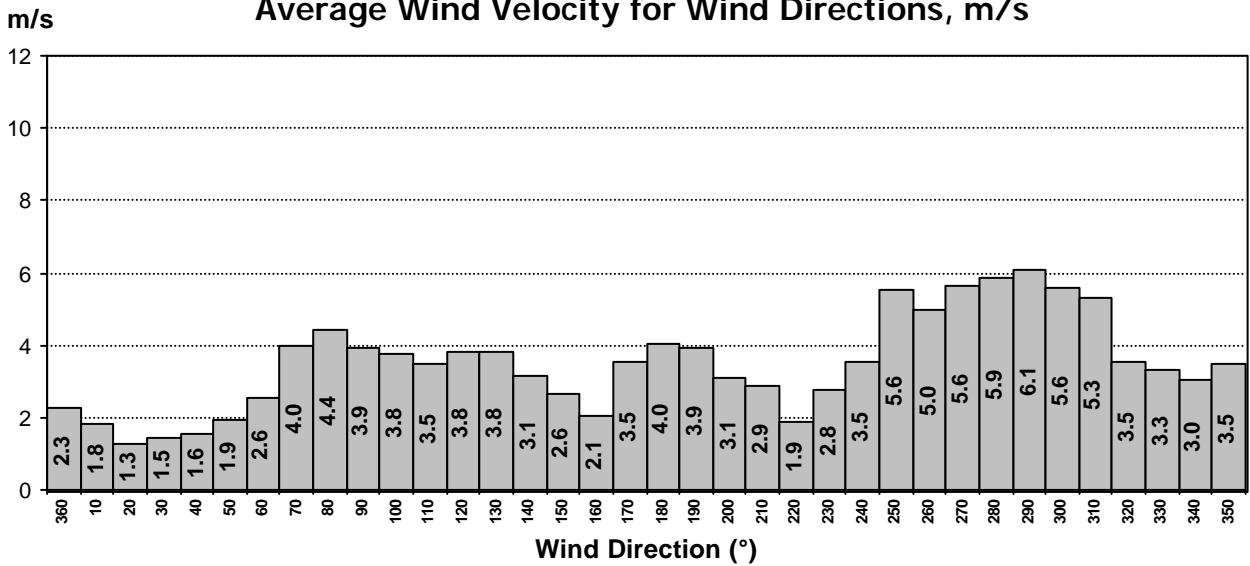
Sómastaðagerði

Frequency of Wind Directions, % June 2000

Young Anemometer at 10.3 m height
 144 observations per day
 Observations used: 4320, 100%
 Calm: 1.8%



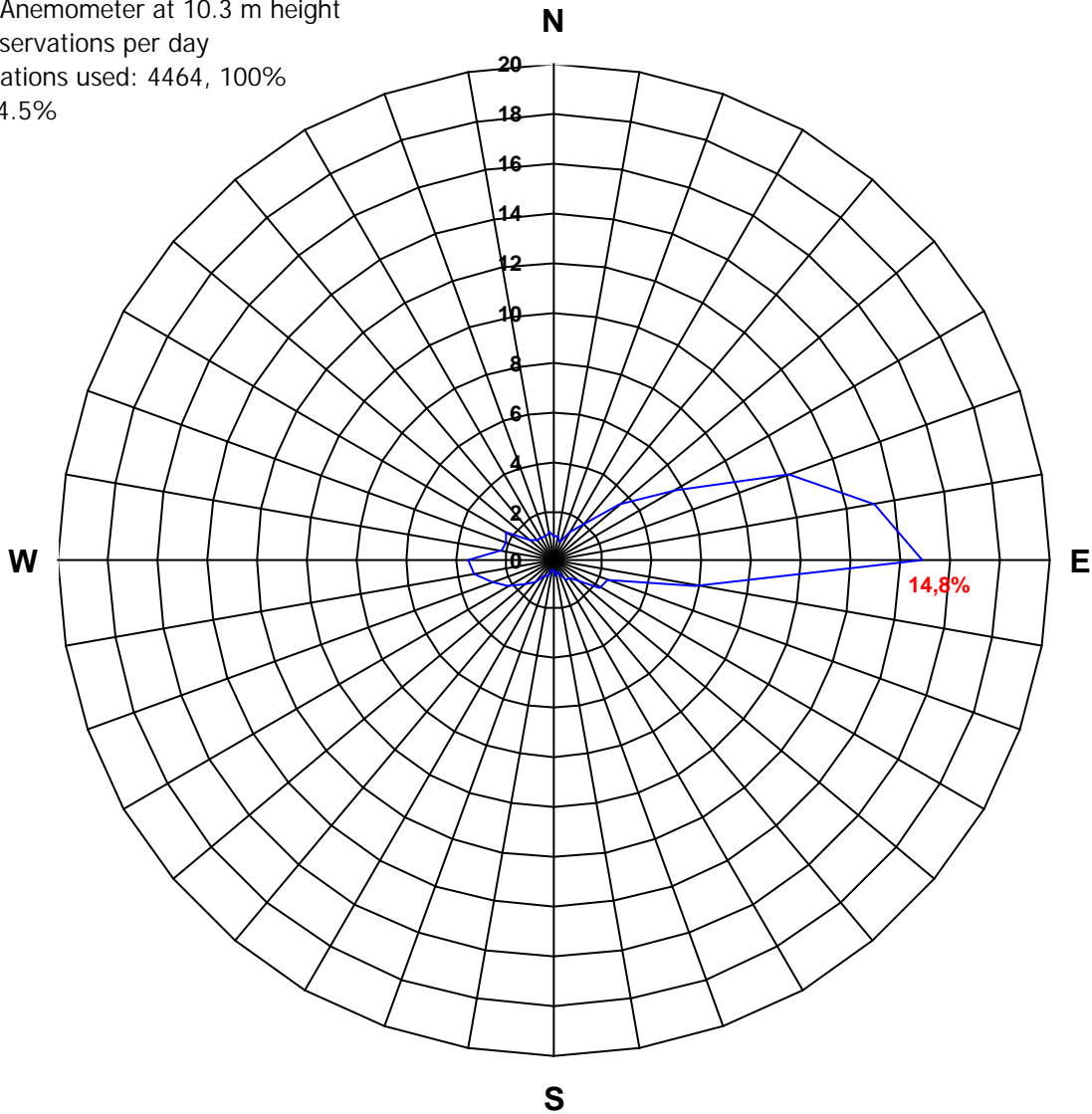
Average Wind Velocity for Wind Directions, m/s



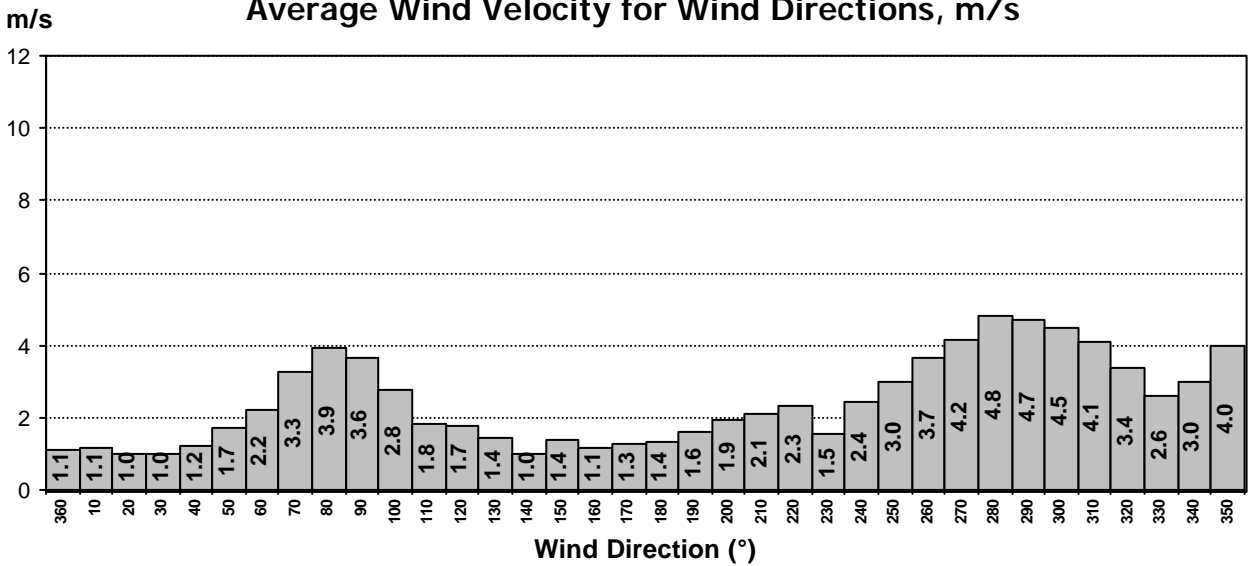
Sómastaðagerði

Frequency of Wind Directions, % July 2000

Young Anemometer at 10.3 m height
 144 observations per day
 Observations used: 4464, 100%
 Calm: 4.5%



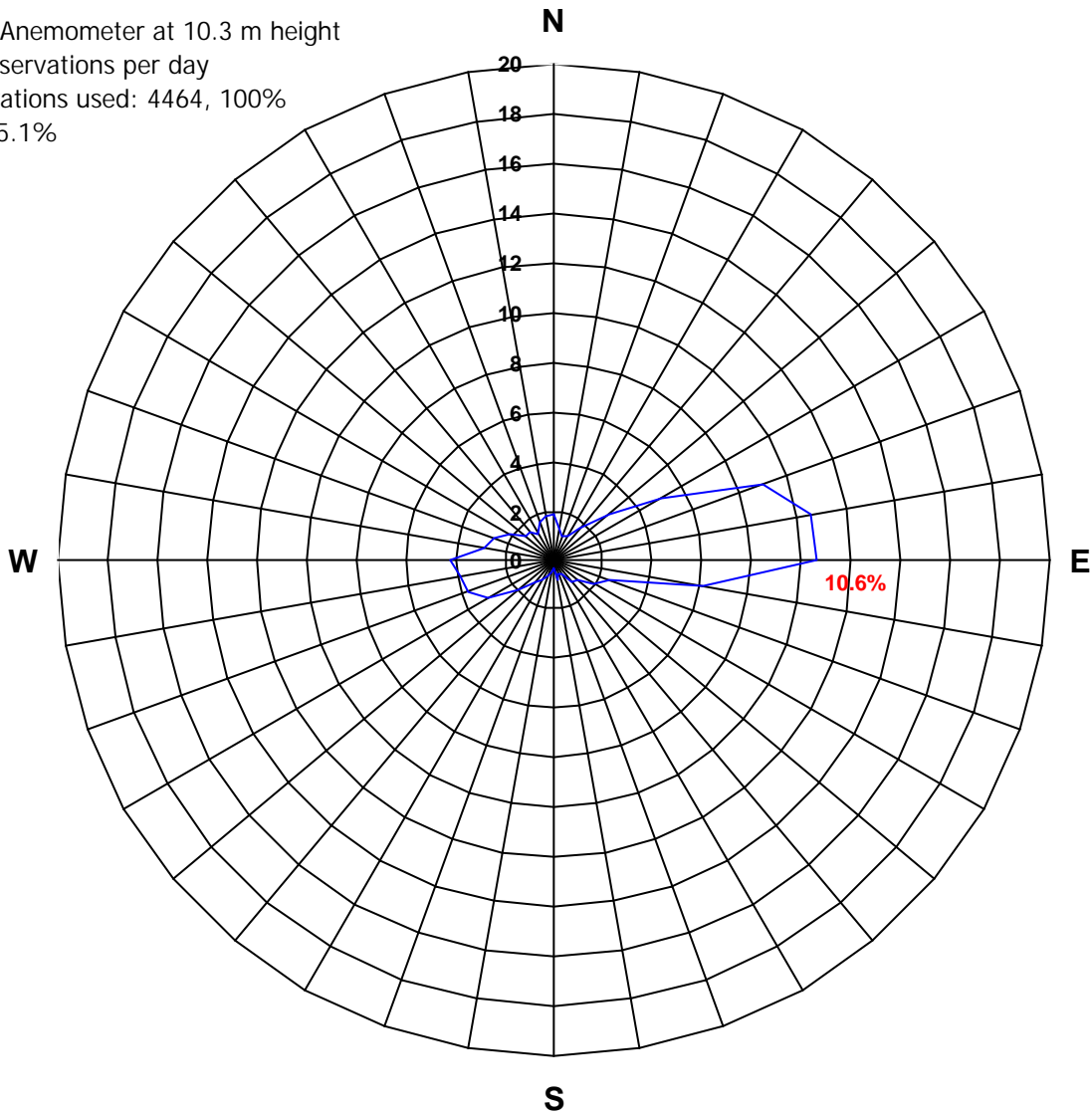
Average Wind Velocity for Wind Directions, m/s



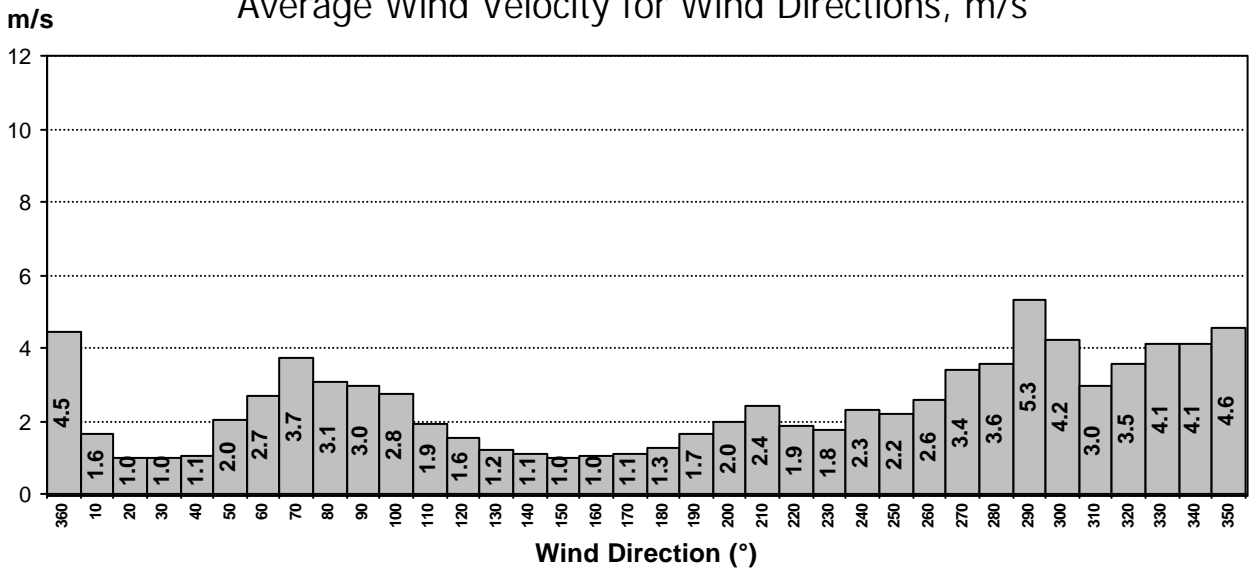
Sómastaðagerði

Frequency of Wind Directions, % August 2000

Young Anemometer at 10.3 m height
 144 observations per day
 Observations used: 4464, 100%
 Calm: 5.1%



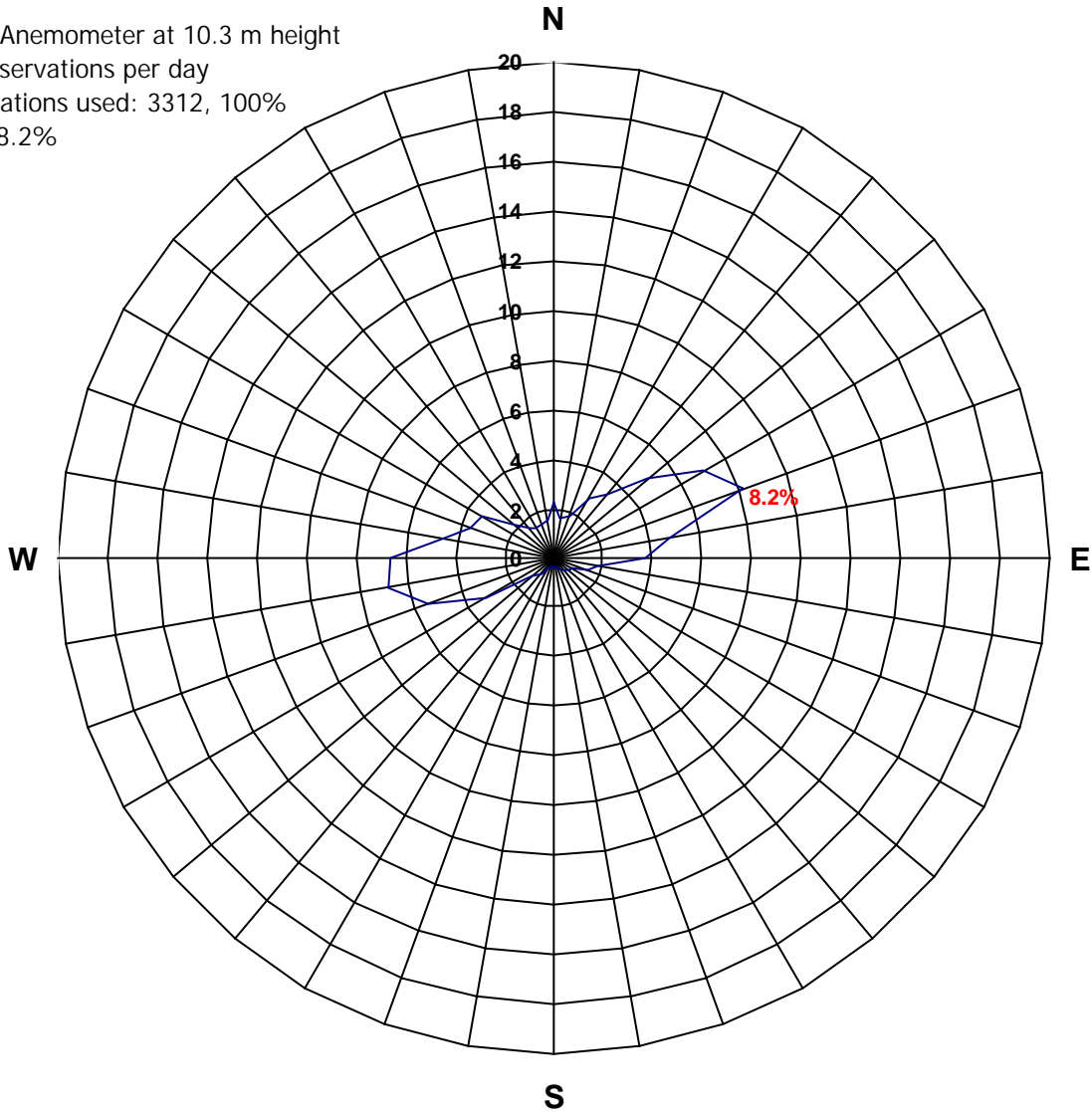
Average Wind Velocity for Wind Directions, m/s



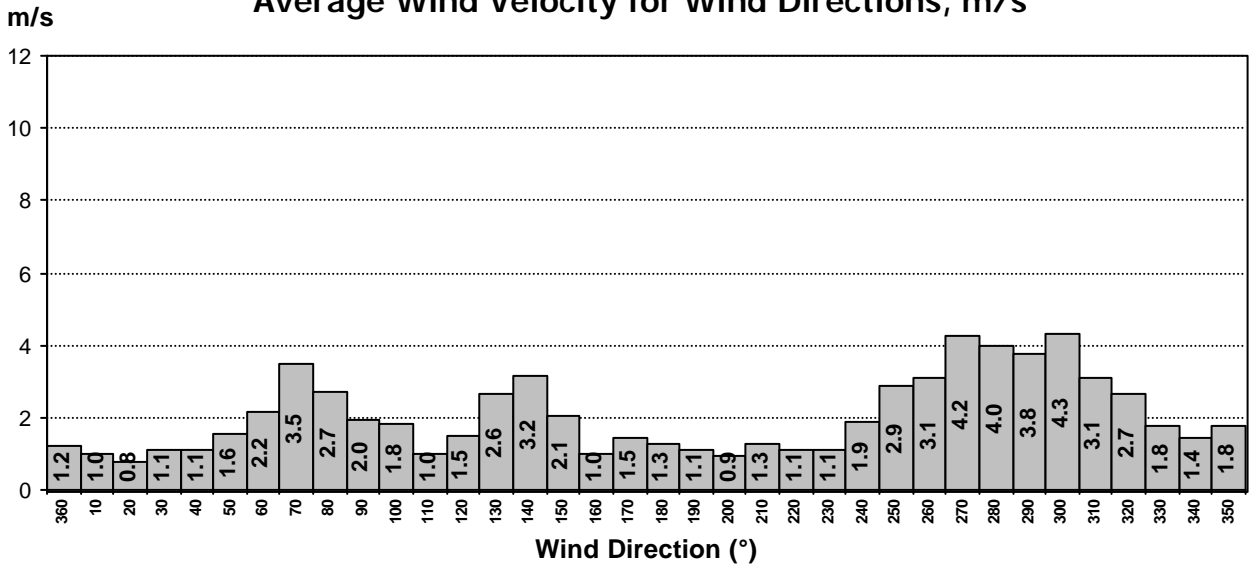
Sómastaðagerði

Frequency of Wind Directions, % High Summer, June - August 2000, Night Hours 00 - 06 GMT

Young Anemometer at 10.3 m height
 144 observations per day
 Observations used: 3312, 100%
 Calm: 8.2%



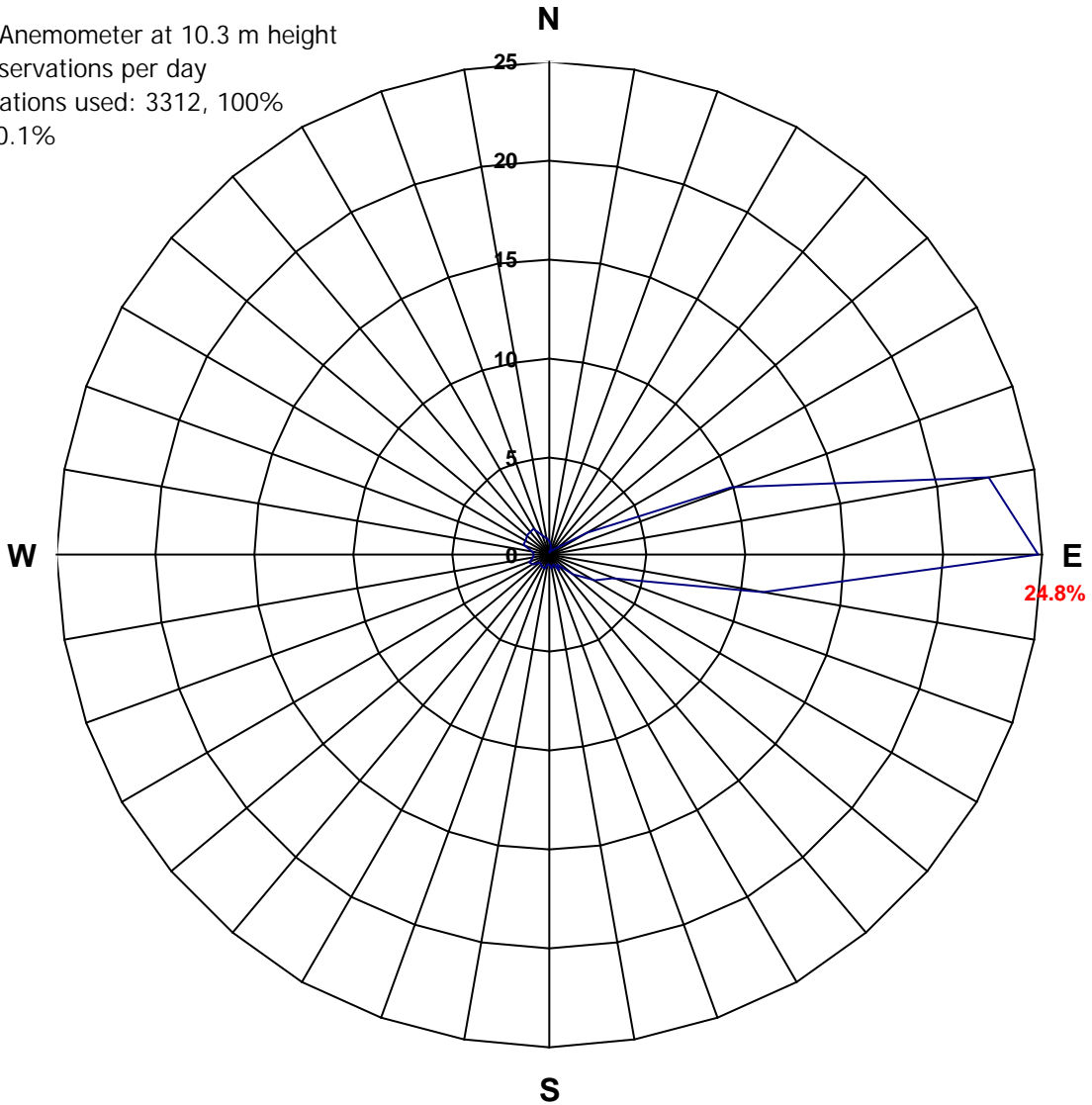
Average Wind Velocity for Wind Directions, m/s



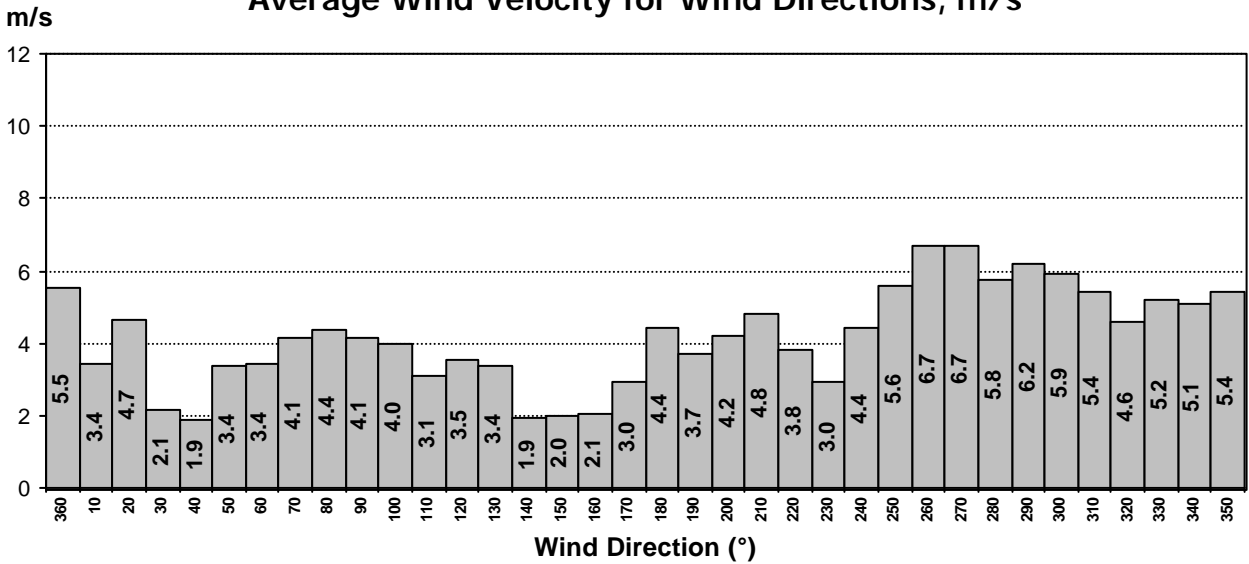
Sómastaðagerði

**Frequency of Wind Directions, %
High Summer, June - August 2000, Day Hours 12 - 18 GMT**

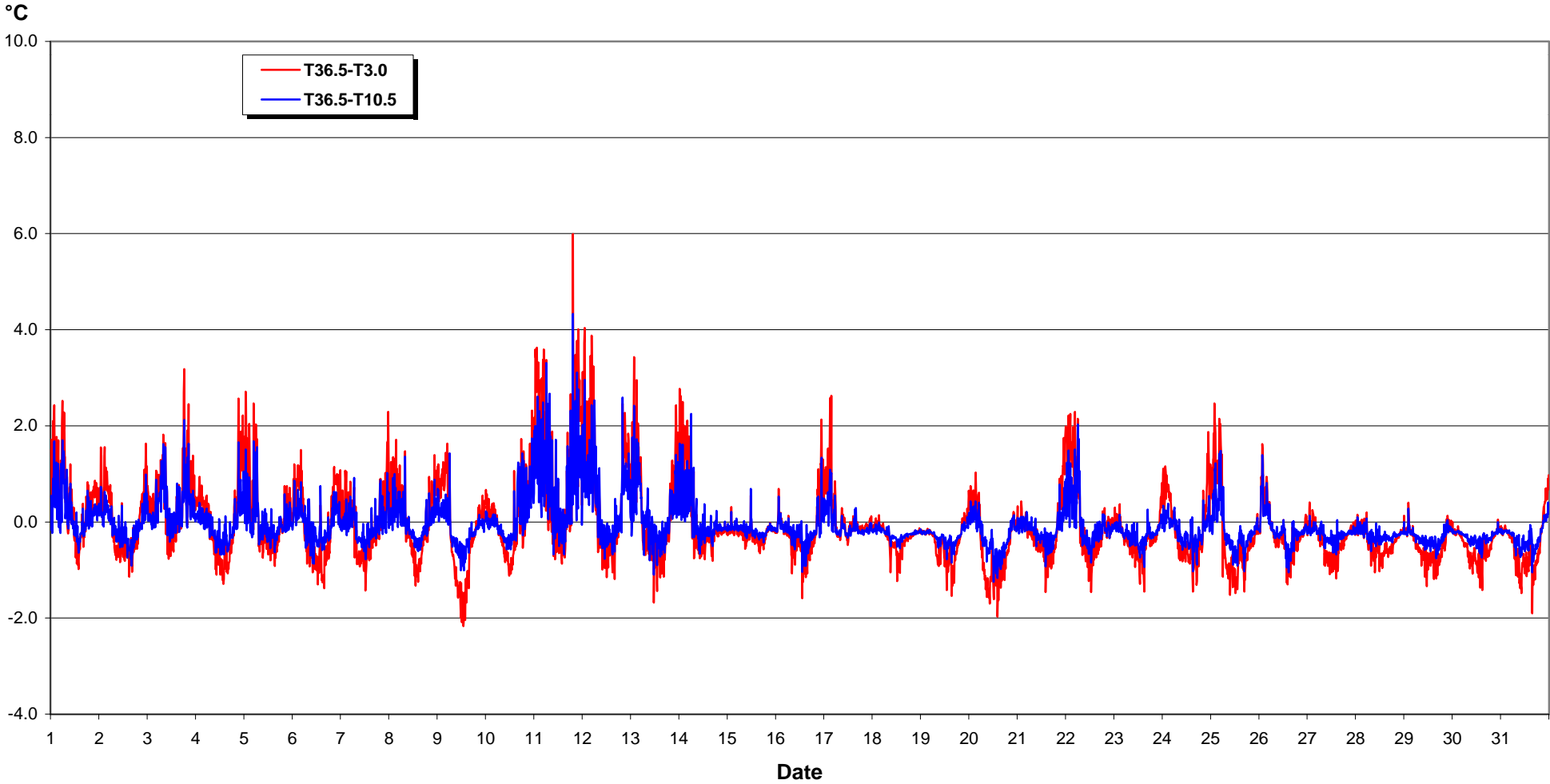
Young Anemometer at 10.3 m height
144 observations per day
Observations used: 3312, 100%
Calm: 0.1%



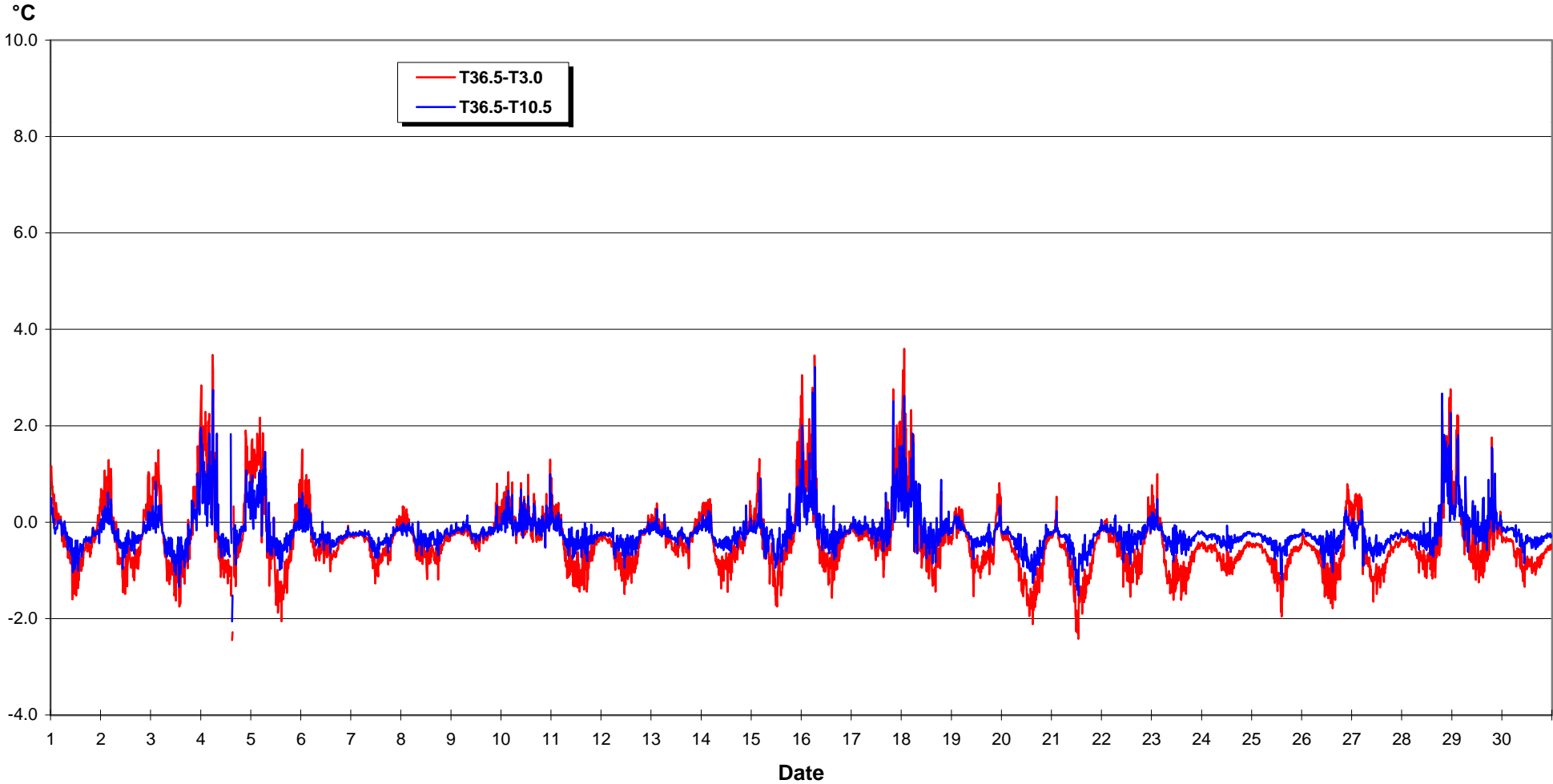
Average Wind Velocity for Wind Directions, m/s



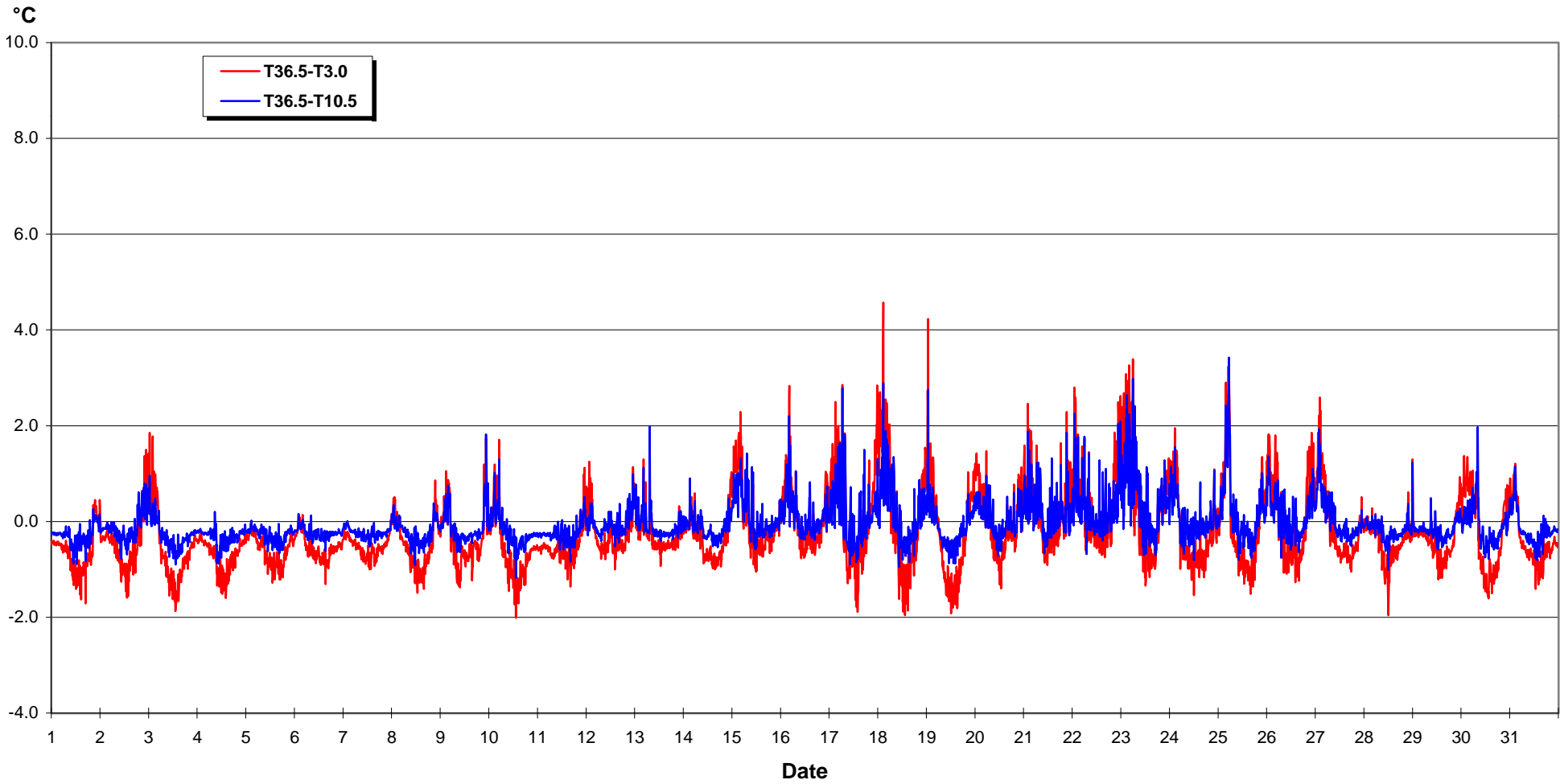
Sómastaðagerði
Vertical Temperature Gradient, °C
May 2000



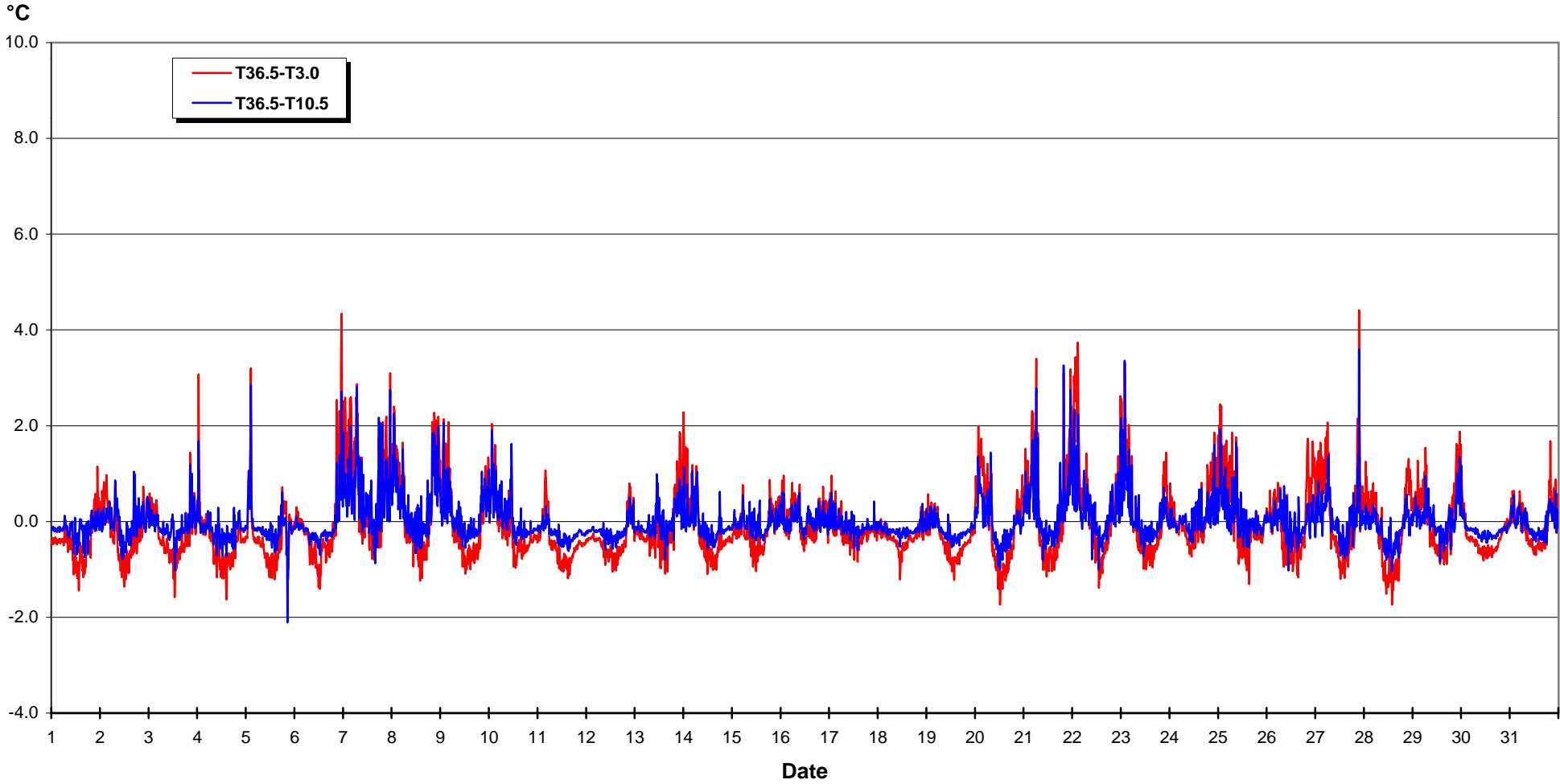
Vertical Temperature Gradient, °C
June 2000



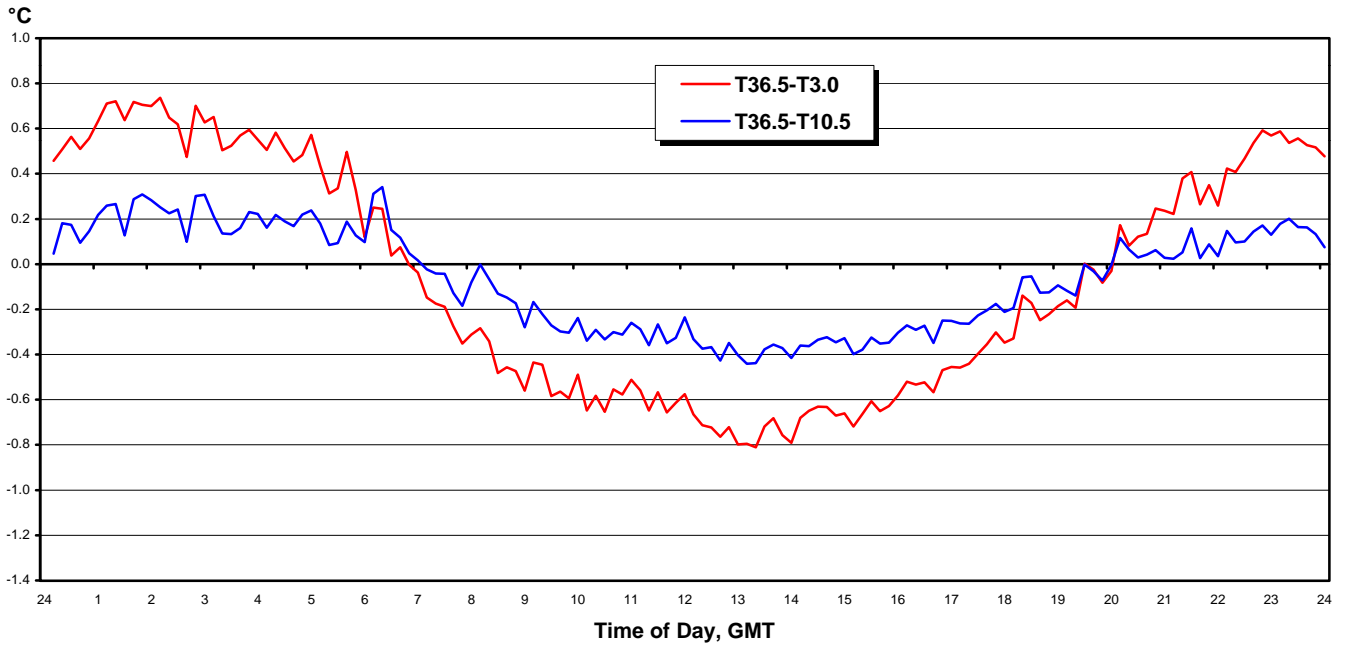
Vertical Temperature Gradient, °C
July 2000



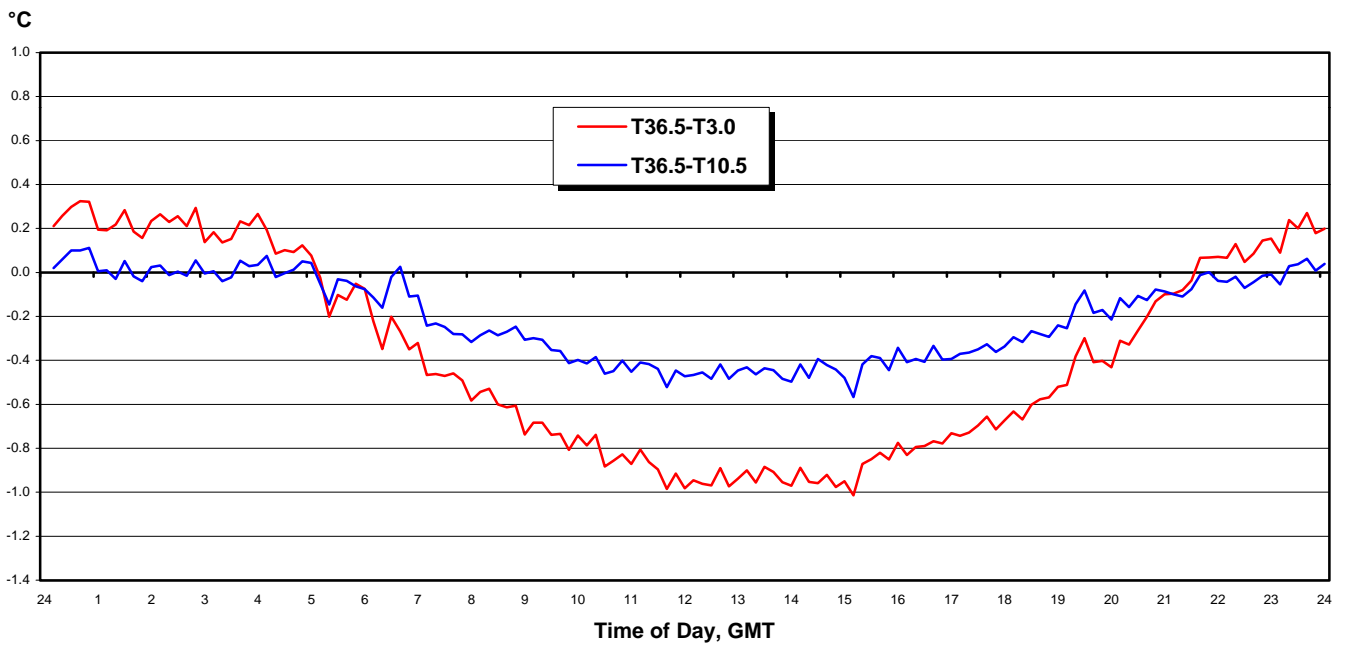
Vertical Temperature Gradient, °C
August 2000



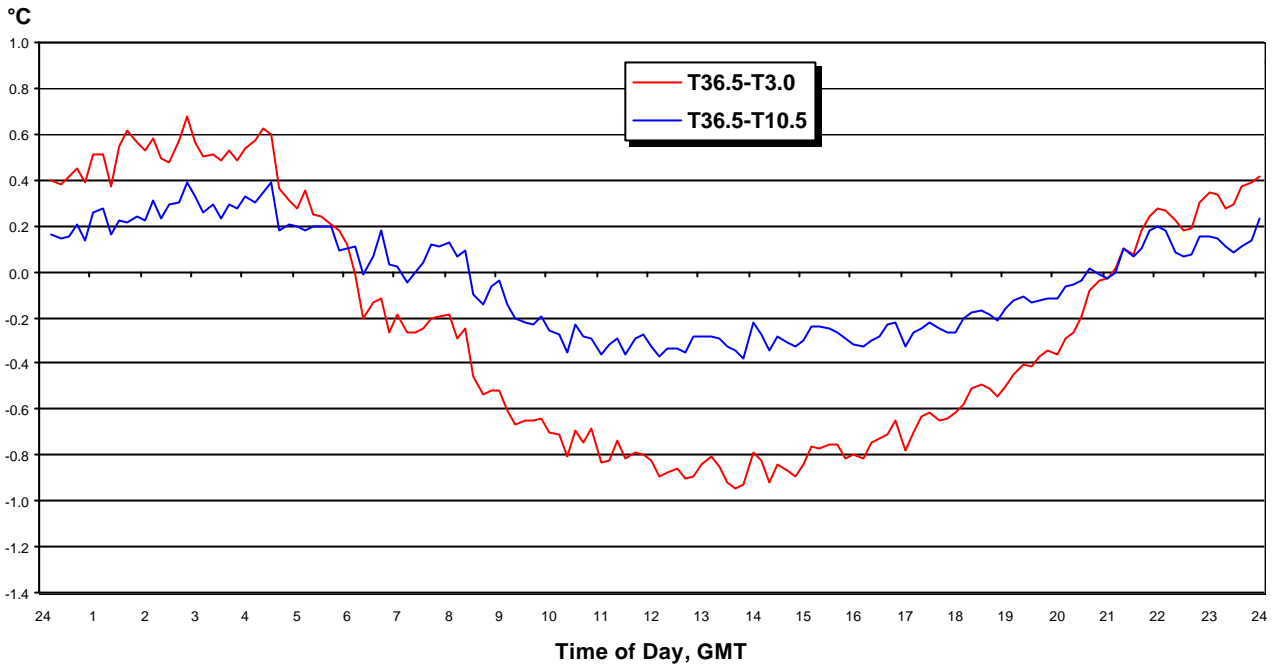
Average Vertical Temperature Gradient, °C
Diurnal Variation, May 2000



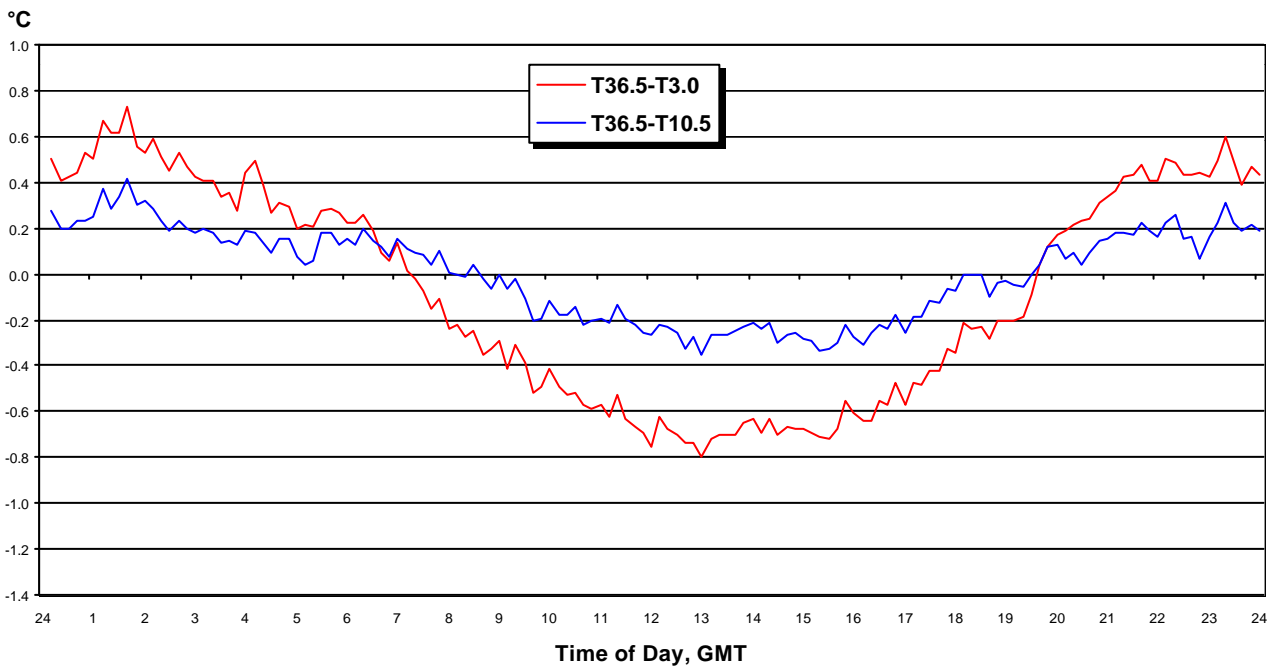
Average Vertical Temperature Gradient, °C
Diurnal Variation, June 2000



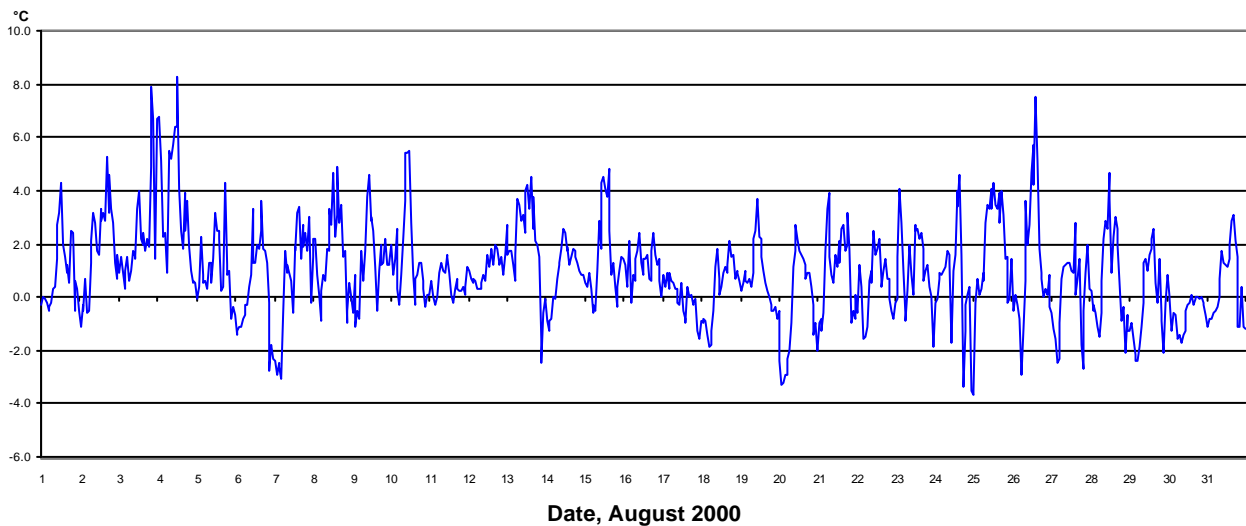
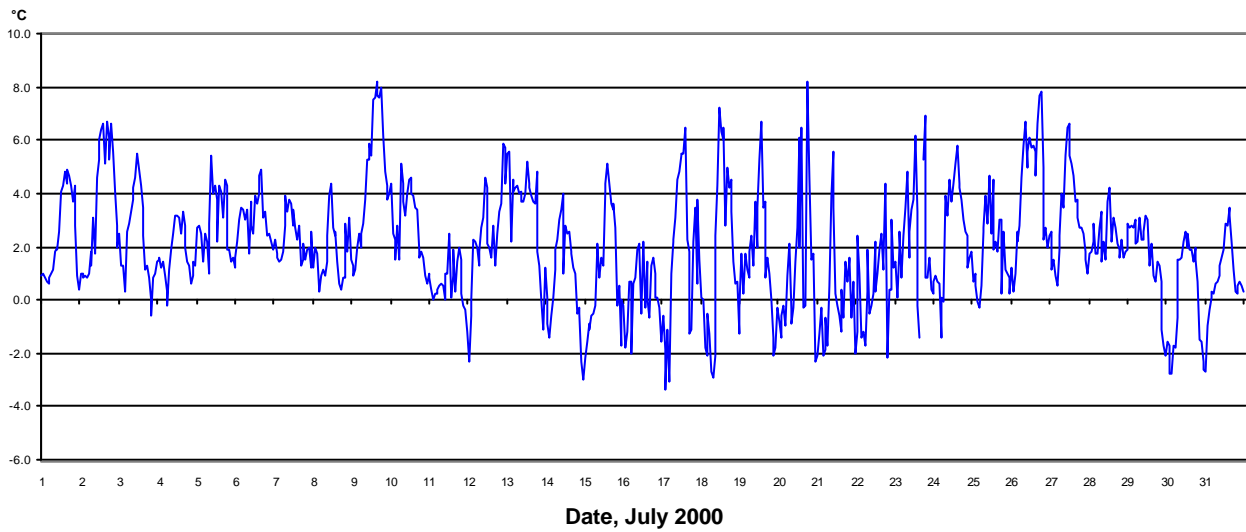
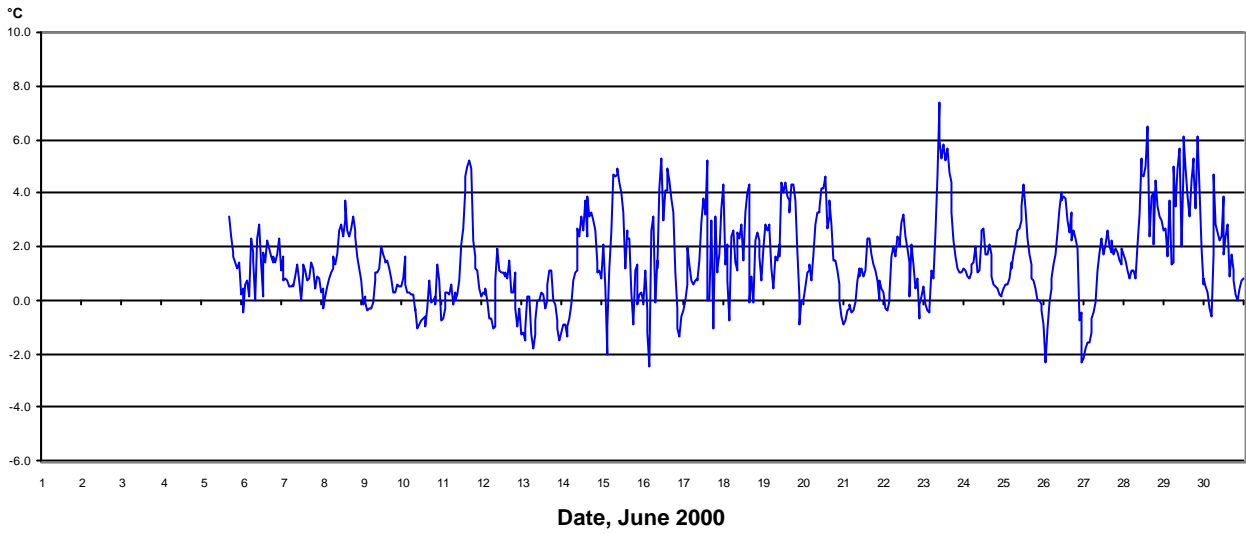
Average Vertical Temperature Gradient, °C
Diurnal Variation, July 2000



Average Vertical Temperature Gradient, °C
Diurnal Variation, August 2000

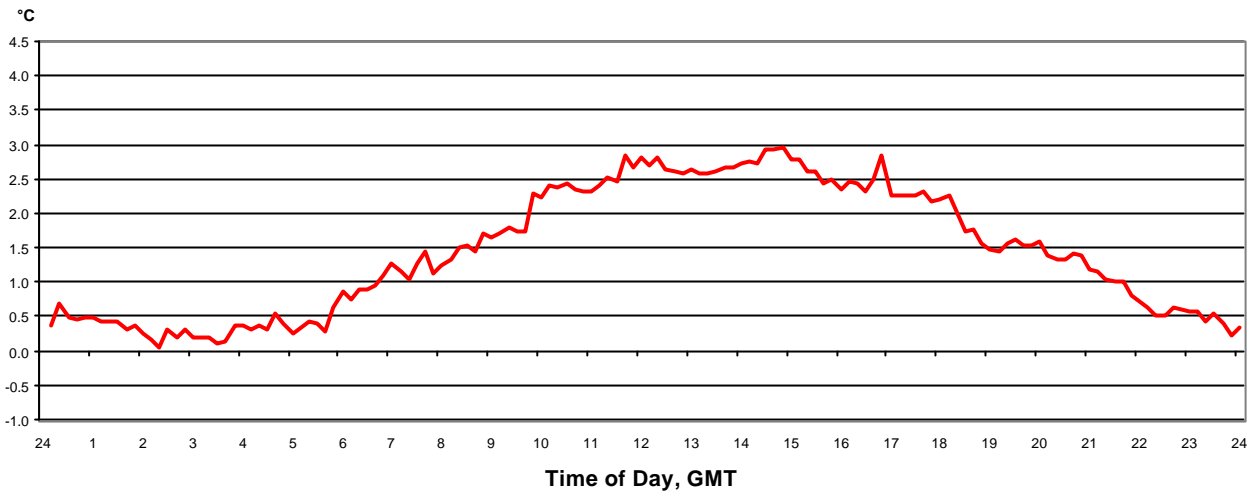


Temperature Difference Kollaleira 2 - Vattarnes, °C

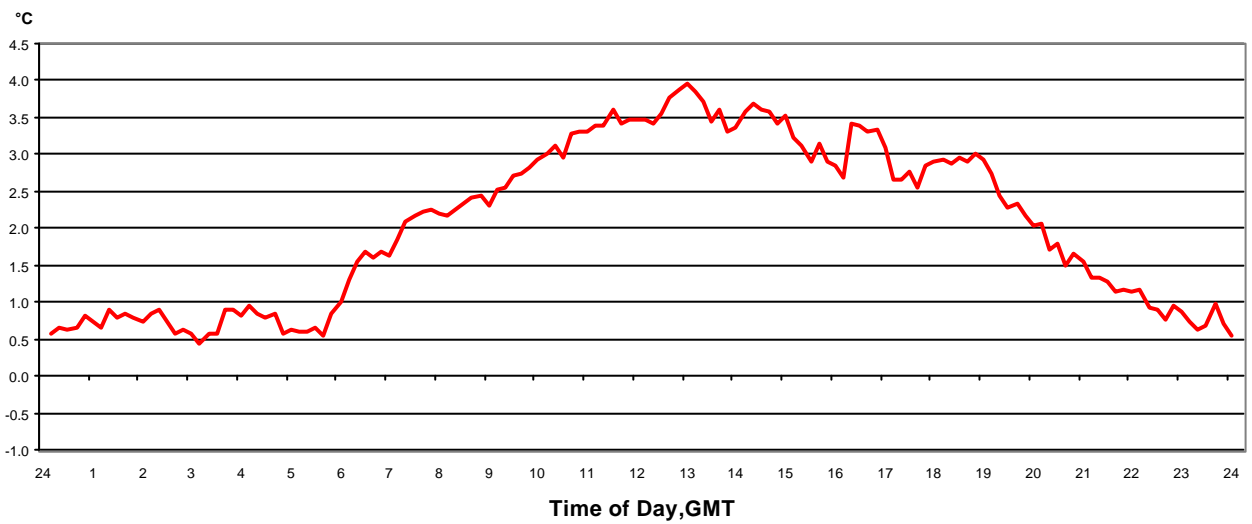


Temperature Difference Kollaleira 2 - Vattarnes, °C Diurnal Variation

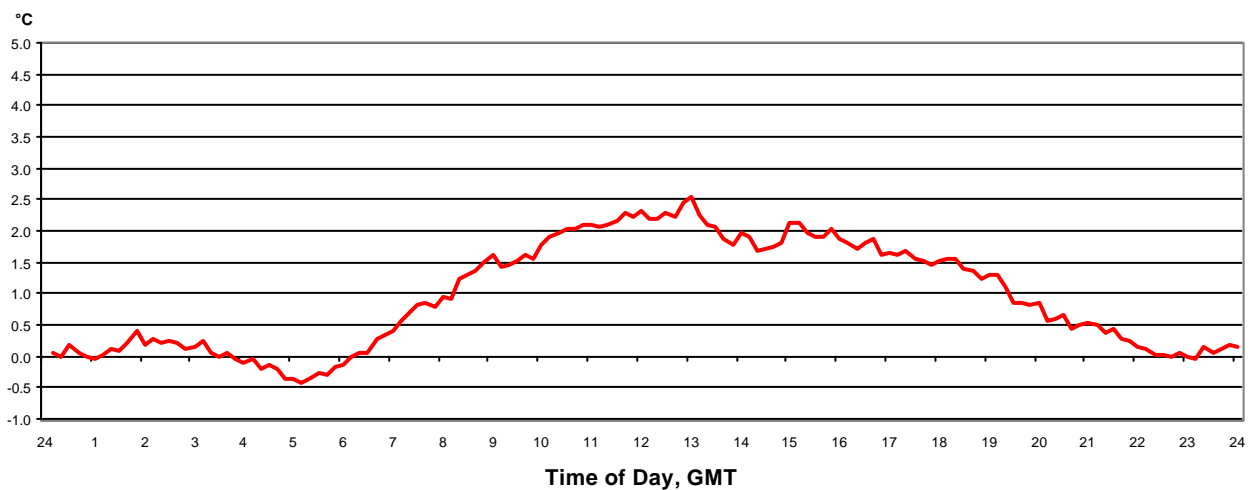
6 - 30 June 2000



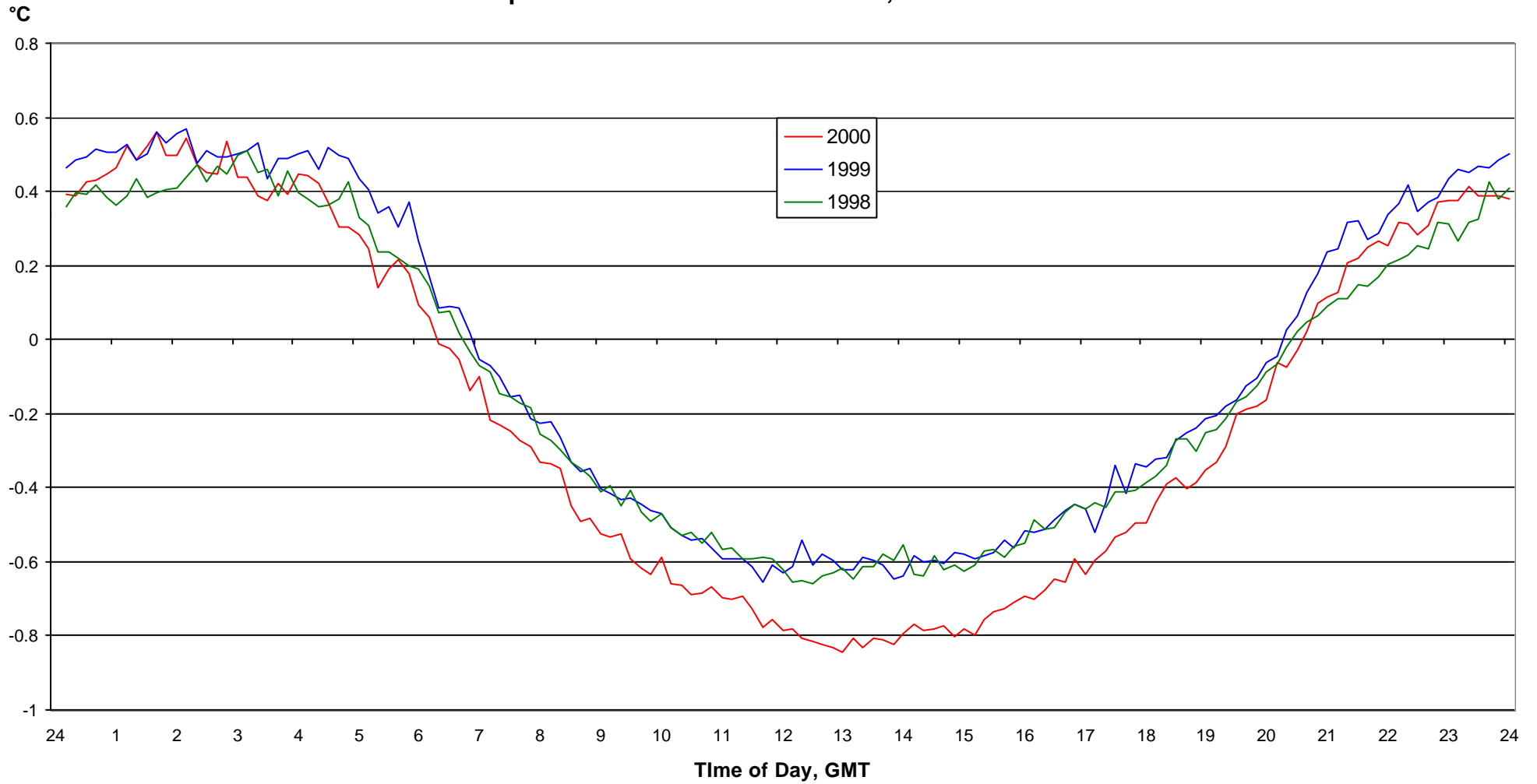
July 2000



August 2000

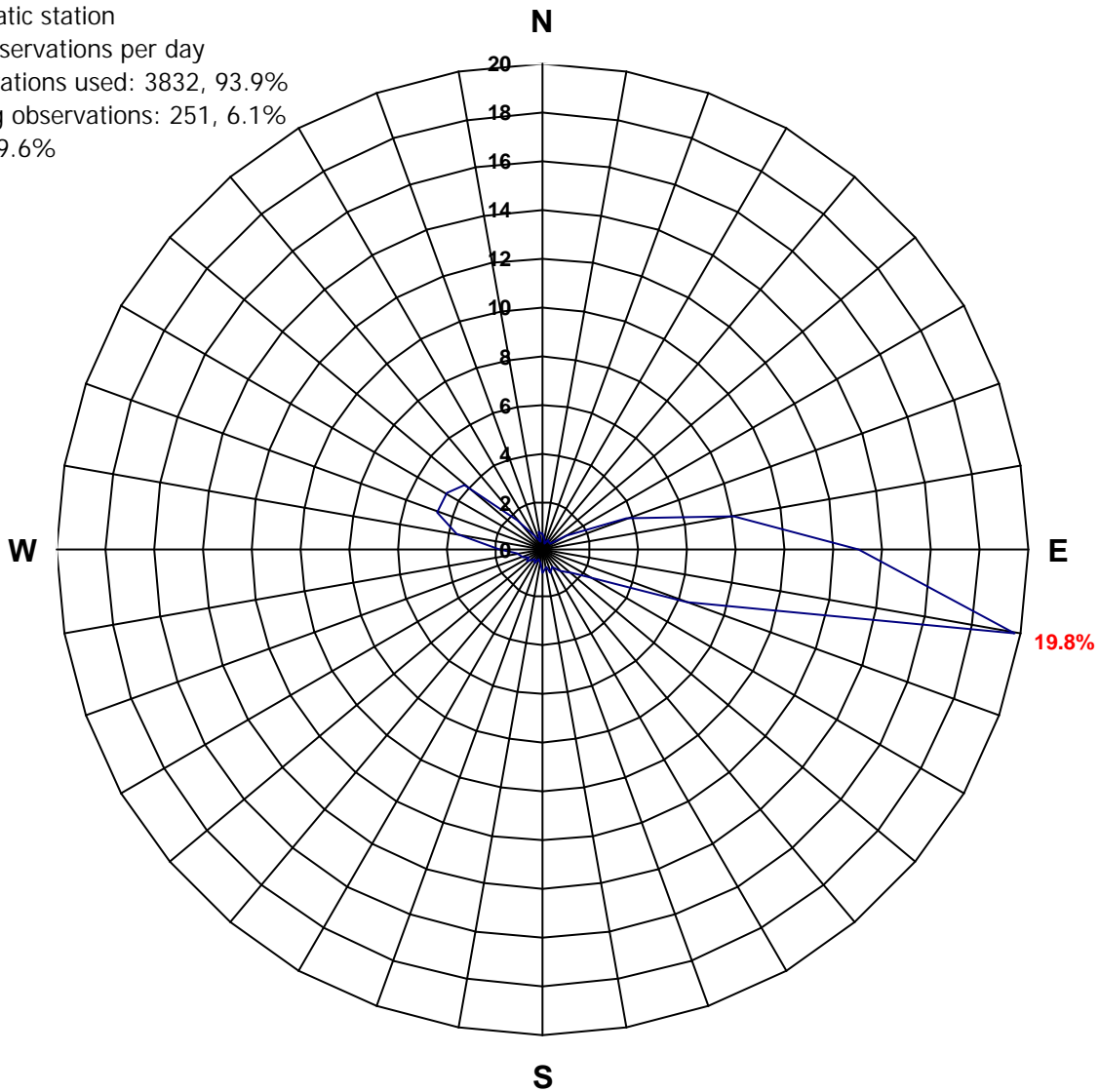


**Diurnal Variation of the mean Temperature Difference T36.5 - T3.0 during the Period May - August
Comparison between the Years 1998, 1999 and 2000**

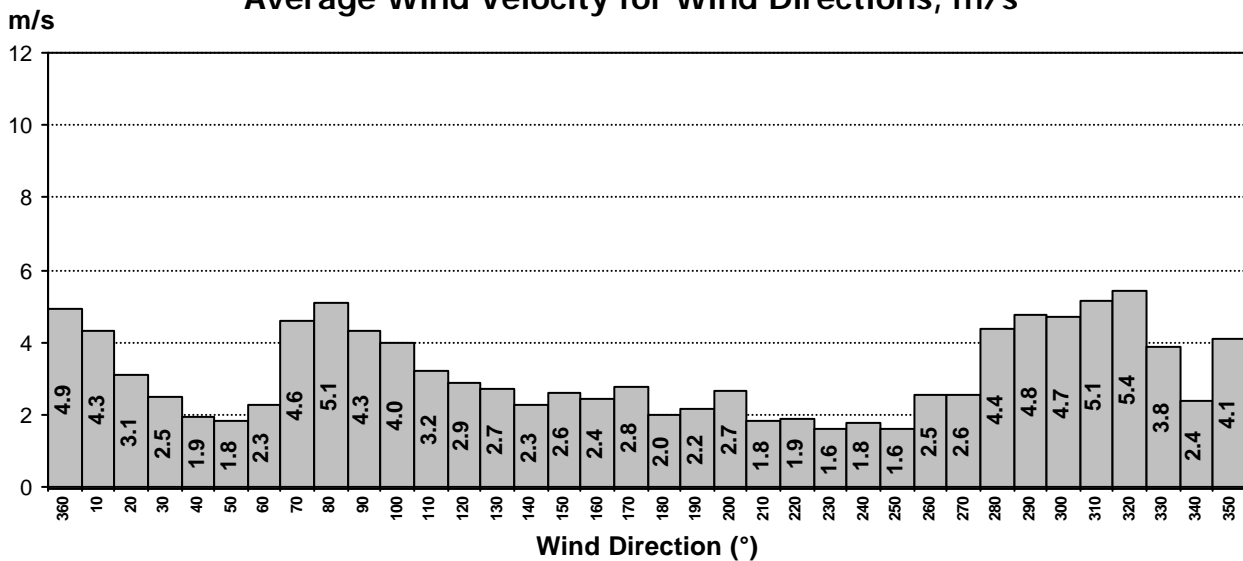


Frequency of Wind Directions, % 2 - 30 June 2000

Automatic station
 144 observations per day
 Observations used: 3832, 93.9%
 Missing observations: 251, 6.1%
 Calm: 9.6%

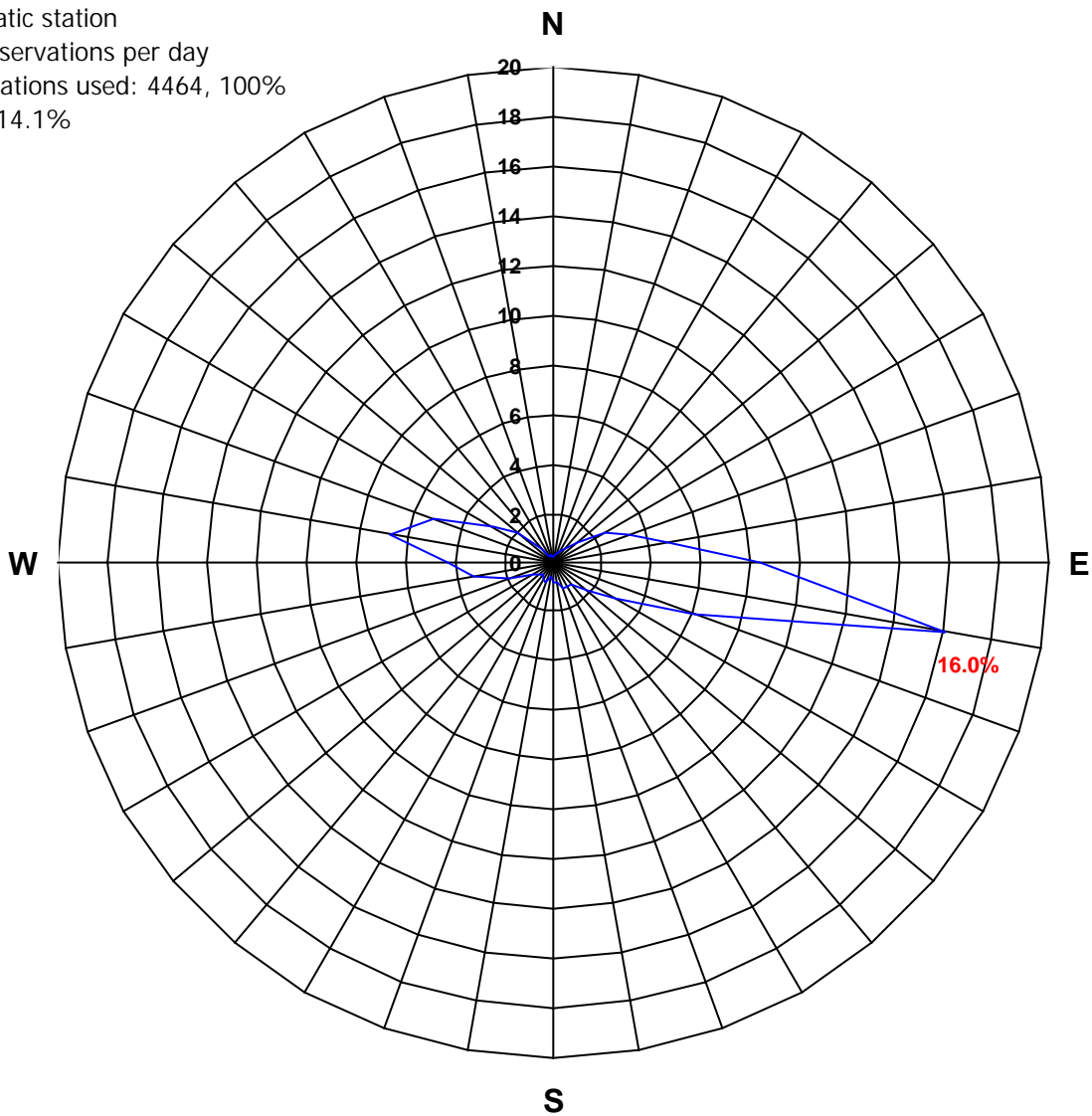


Average Wind Velocity for Wind Directions, m/s

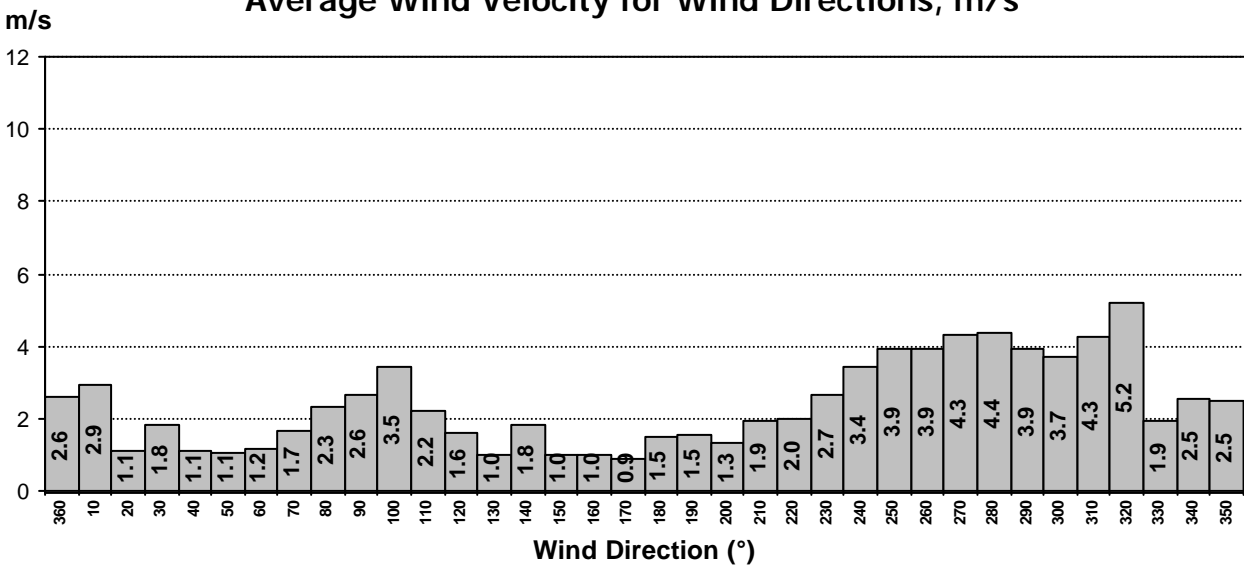


Frequency of Wind Directions, % July 2000

Automatic station
144 observations per day
Observations used: 4464, 100%
Calm: 14.1%

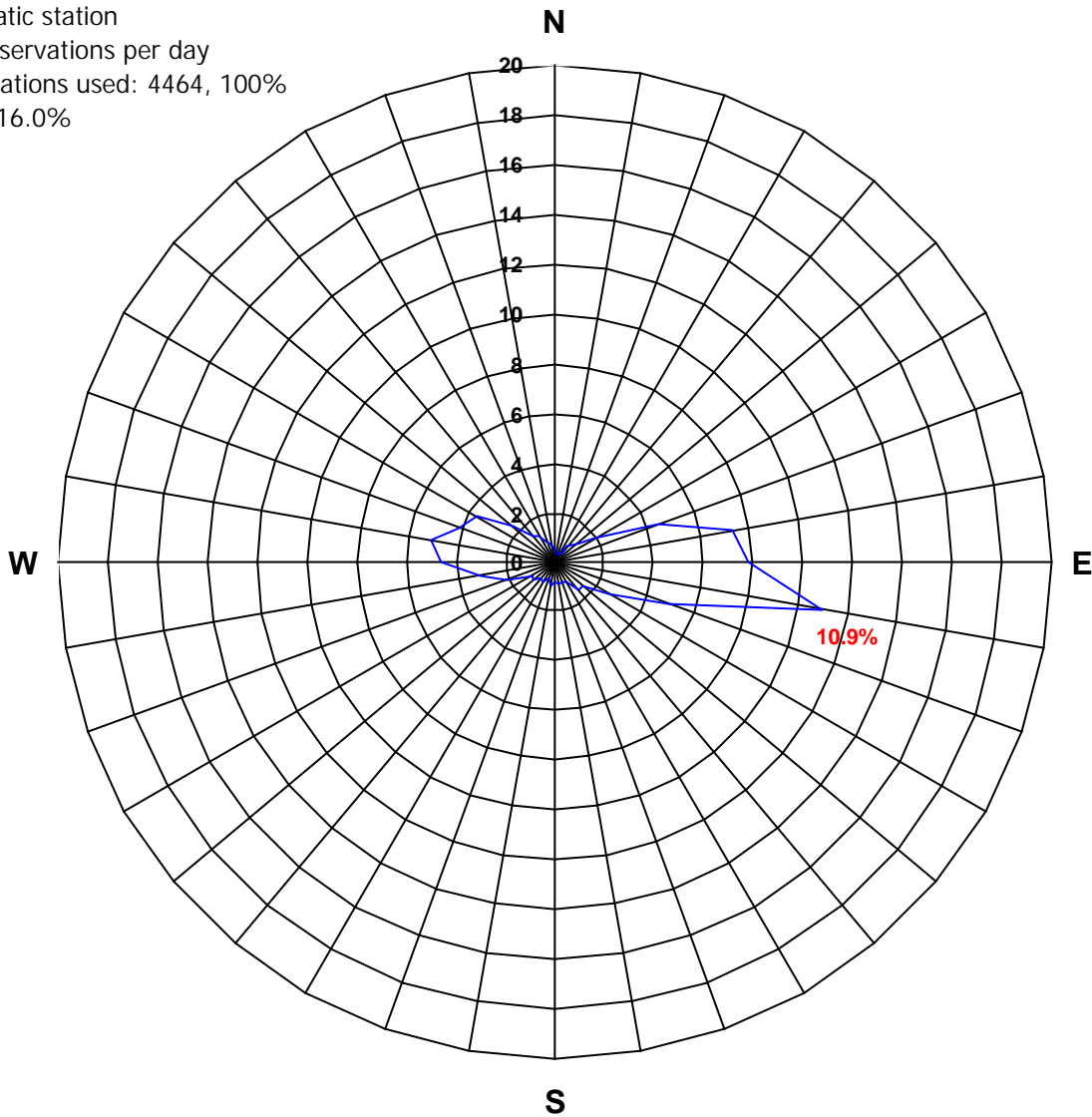


Average Wind Velocity for Wind Directions, m/s

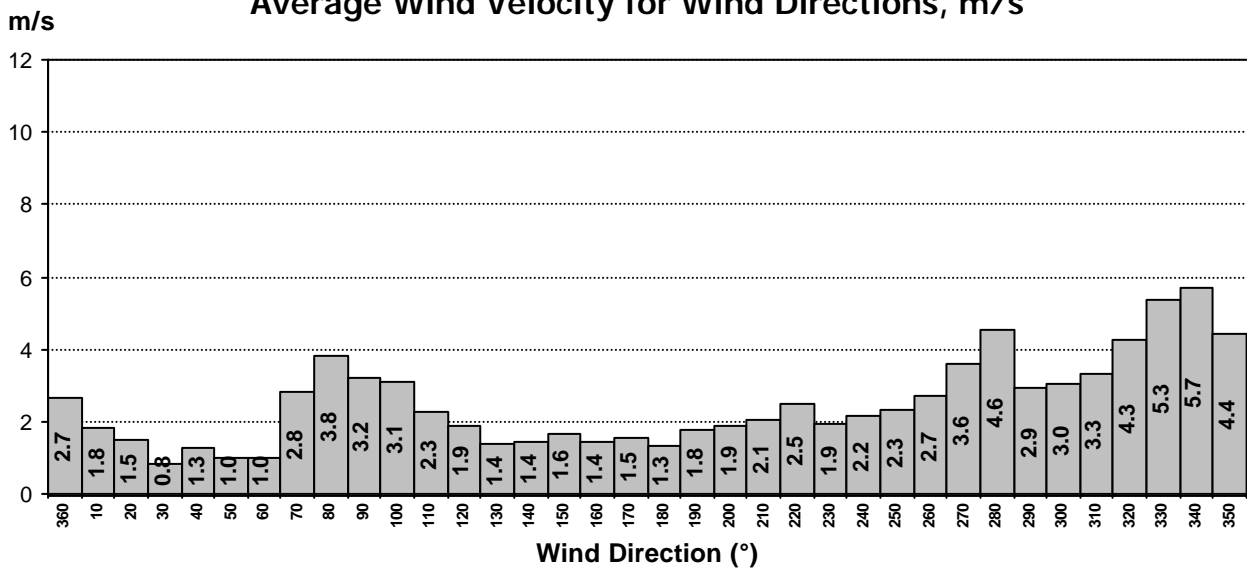


Frequency of Wind Directions, % August 2000

Automatic station
144 observations per day
Observations used: 4464, 100%
Calm: 16.0%

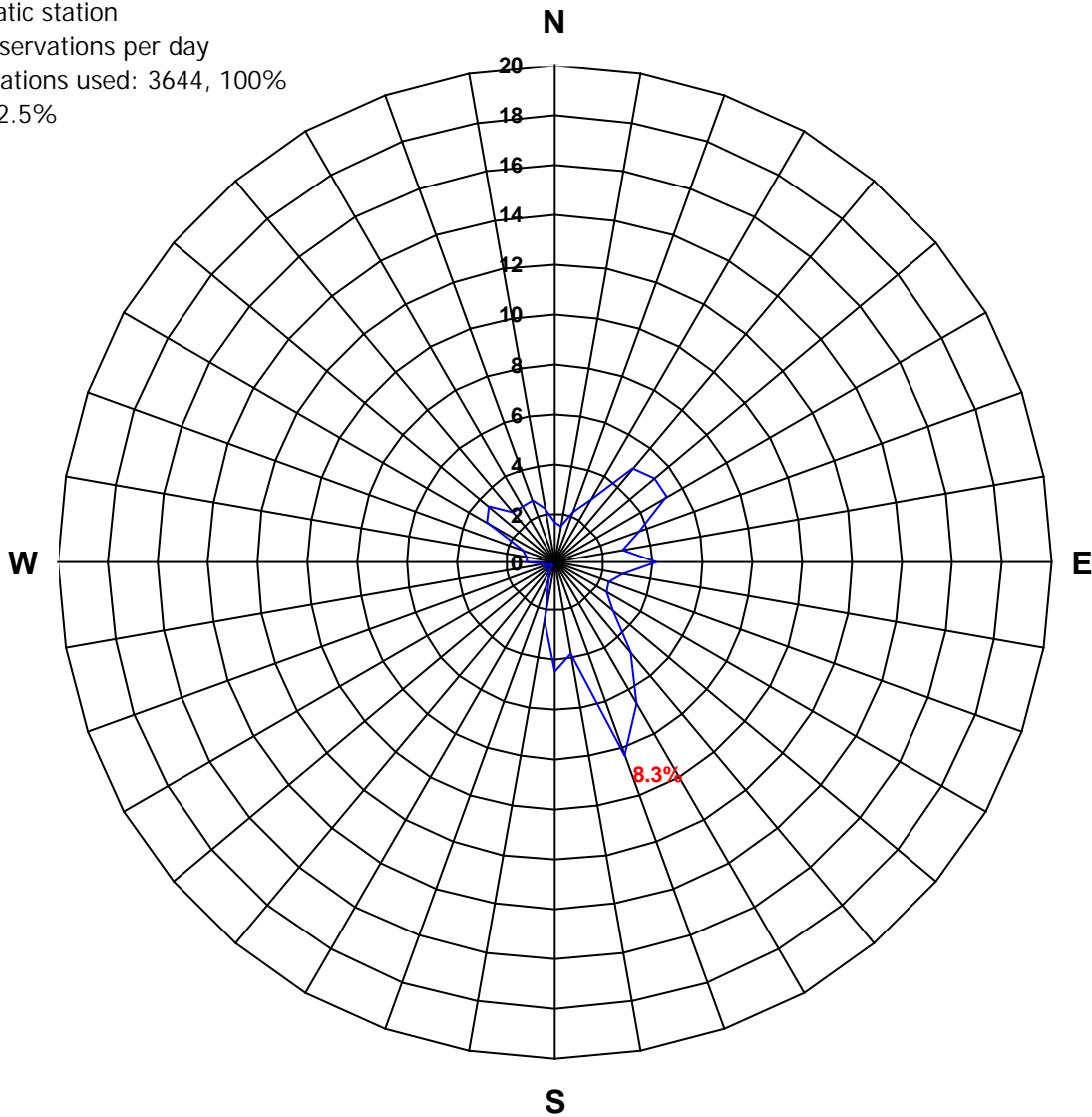


Average Wind Velocity for Wind Directions, m/s

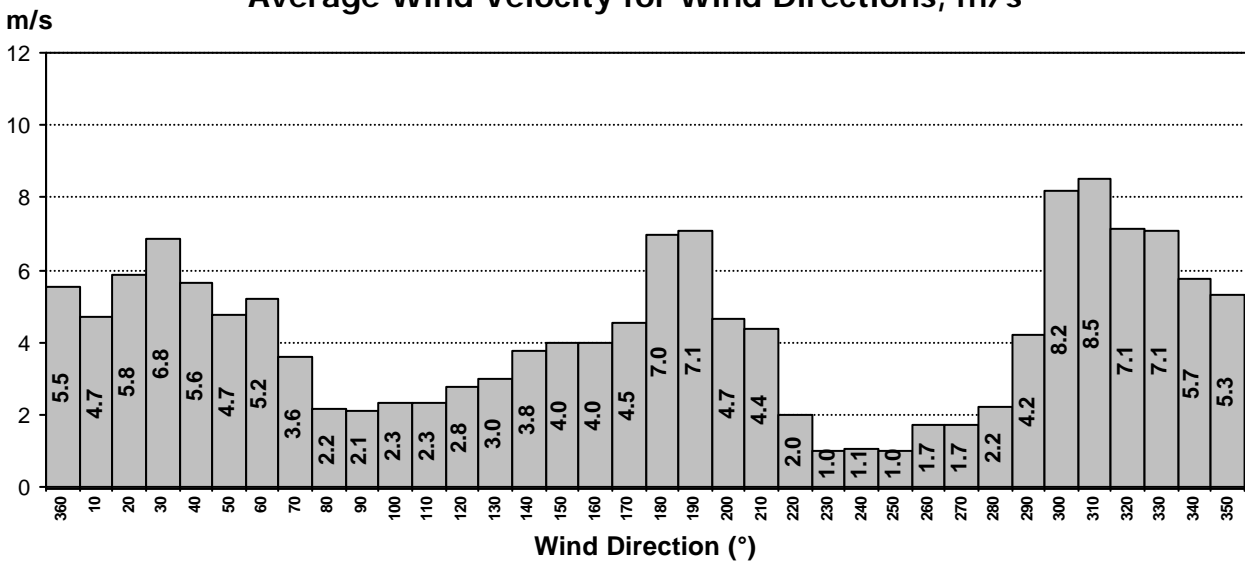


Frequency of Wind Directions, % 5 - 30 June 2000

Automatic station
144 observations per day
Observations used: 3644, 100%
Calm: 2.5%

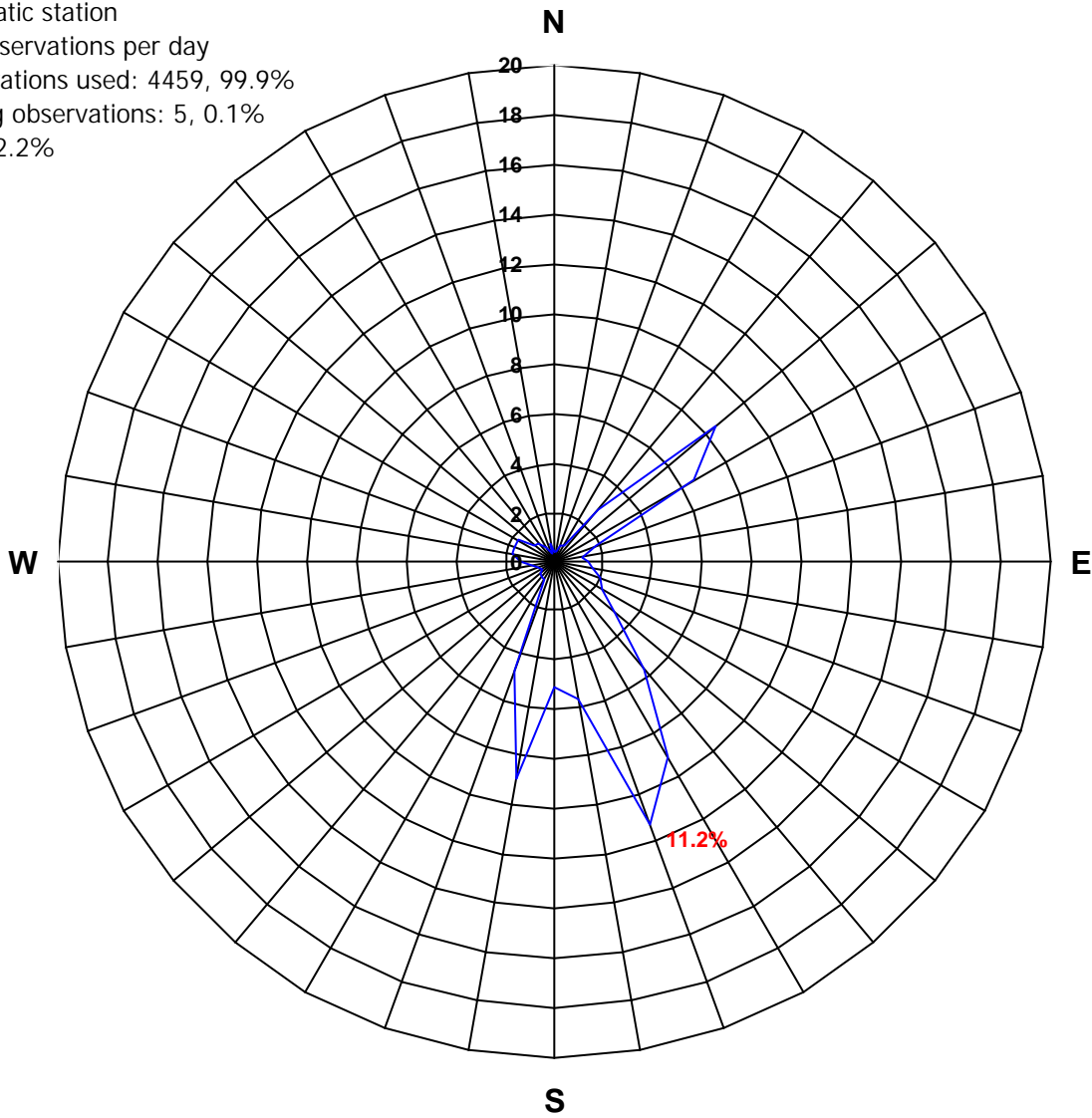


Average Wind Velocity for Wind Directions, m/s

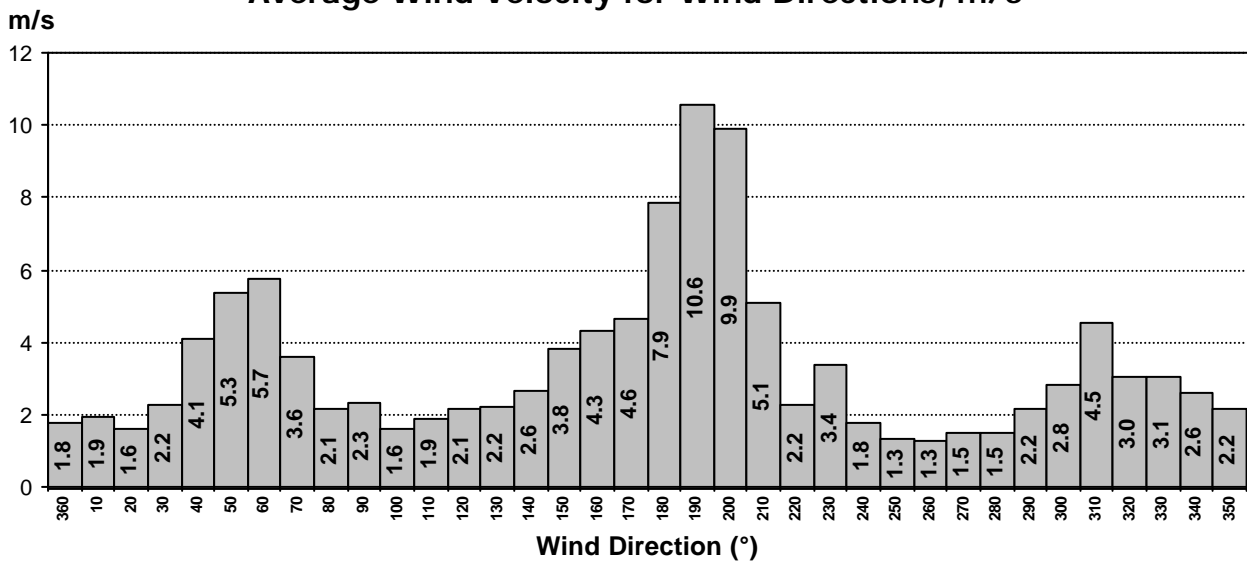


Frequency of Wind Directions, % July 2000

Automatic station
 144 observations per day
 Observations used: 4459, 99.9%
 Missing observations: 5, 0.1%
 Calm: 2.2%

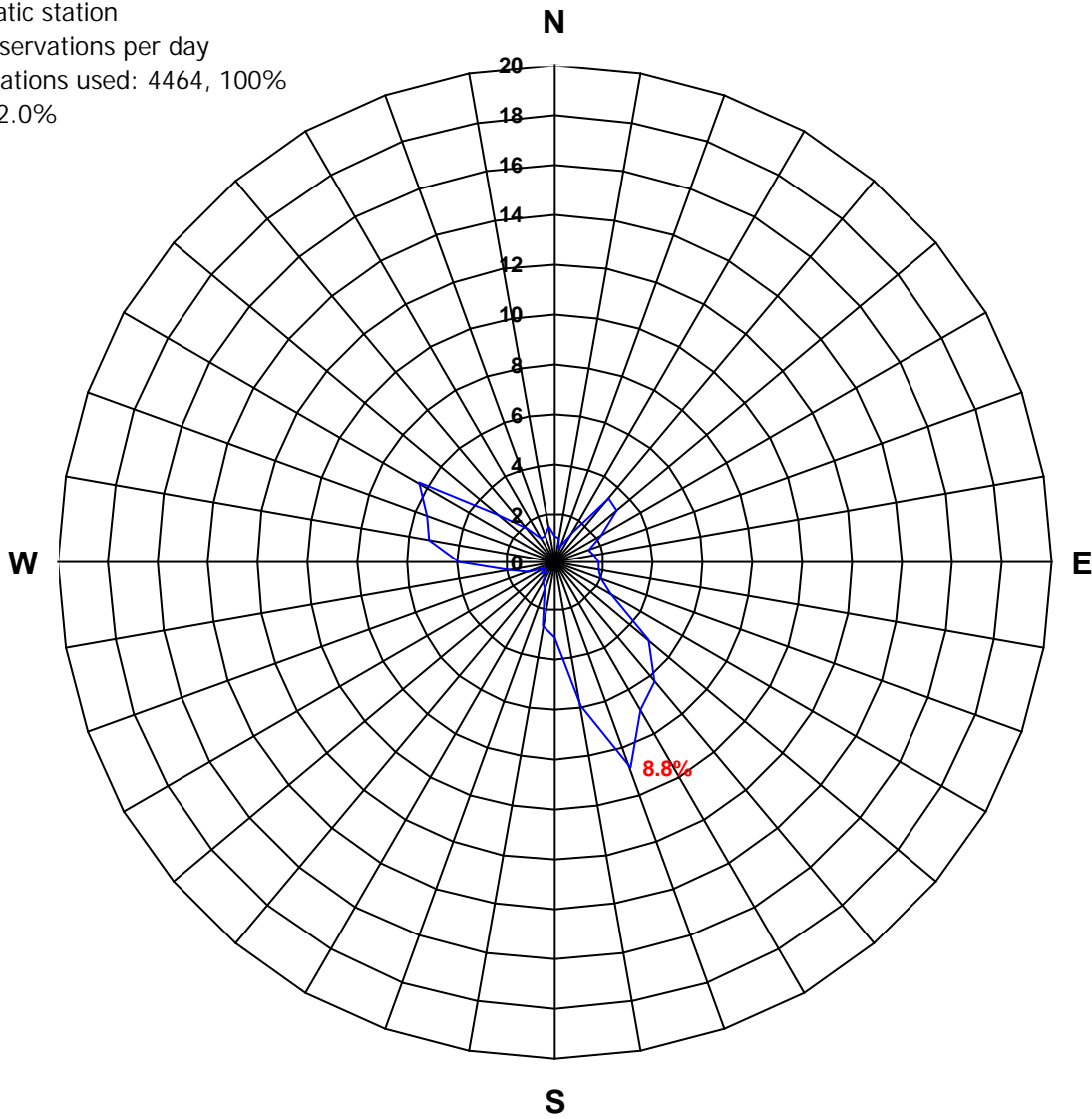


Average Wind Velocity for Wind Directions, m/s

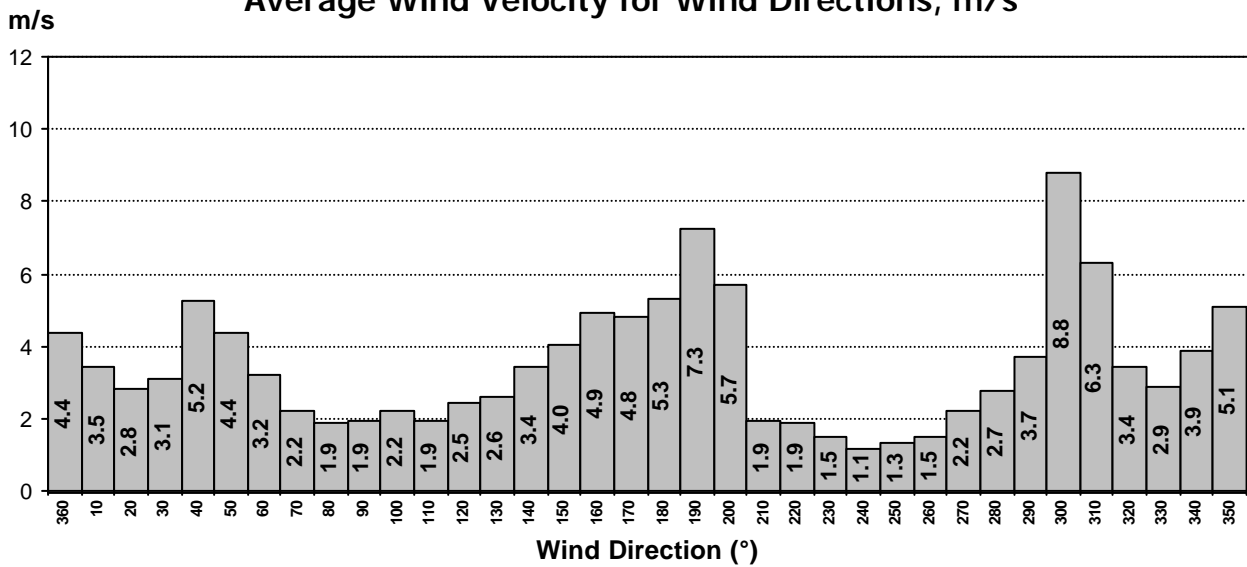


Frequency of Wind Directions, % August 2000

Automatic station
144 observations per day
Observations used: 4464, 100%
Calm: 2.0%

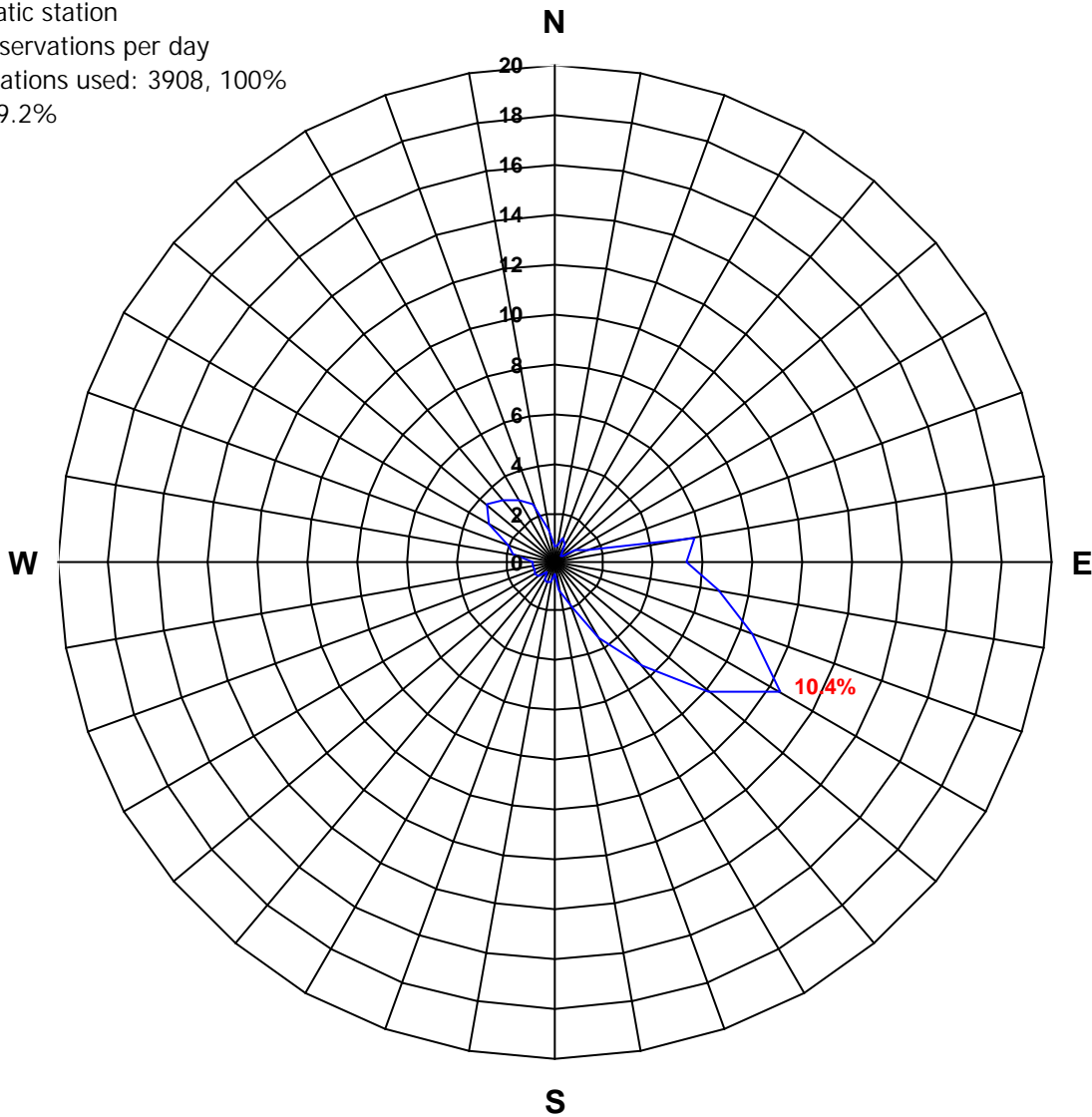


Average Wind Velocity for Wind Directions, m/s

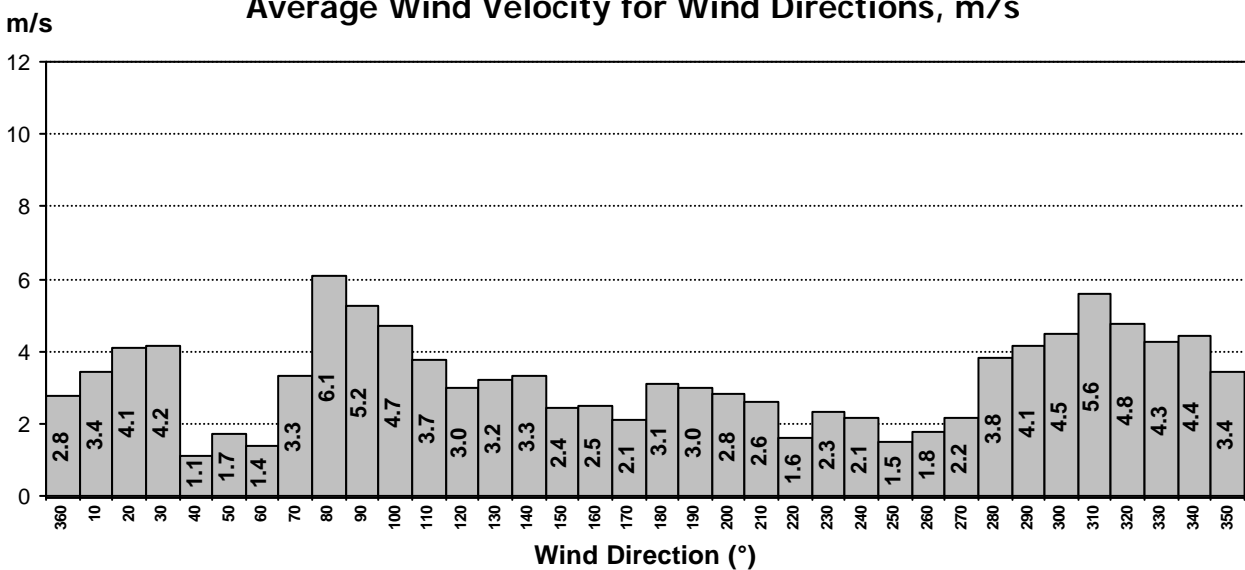


Frequency of Wind Directions, % 3-30 June 2000

Automatic station
144 observations per day
Observations used: 3908, 100%
Calm: 9.2%

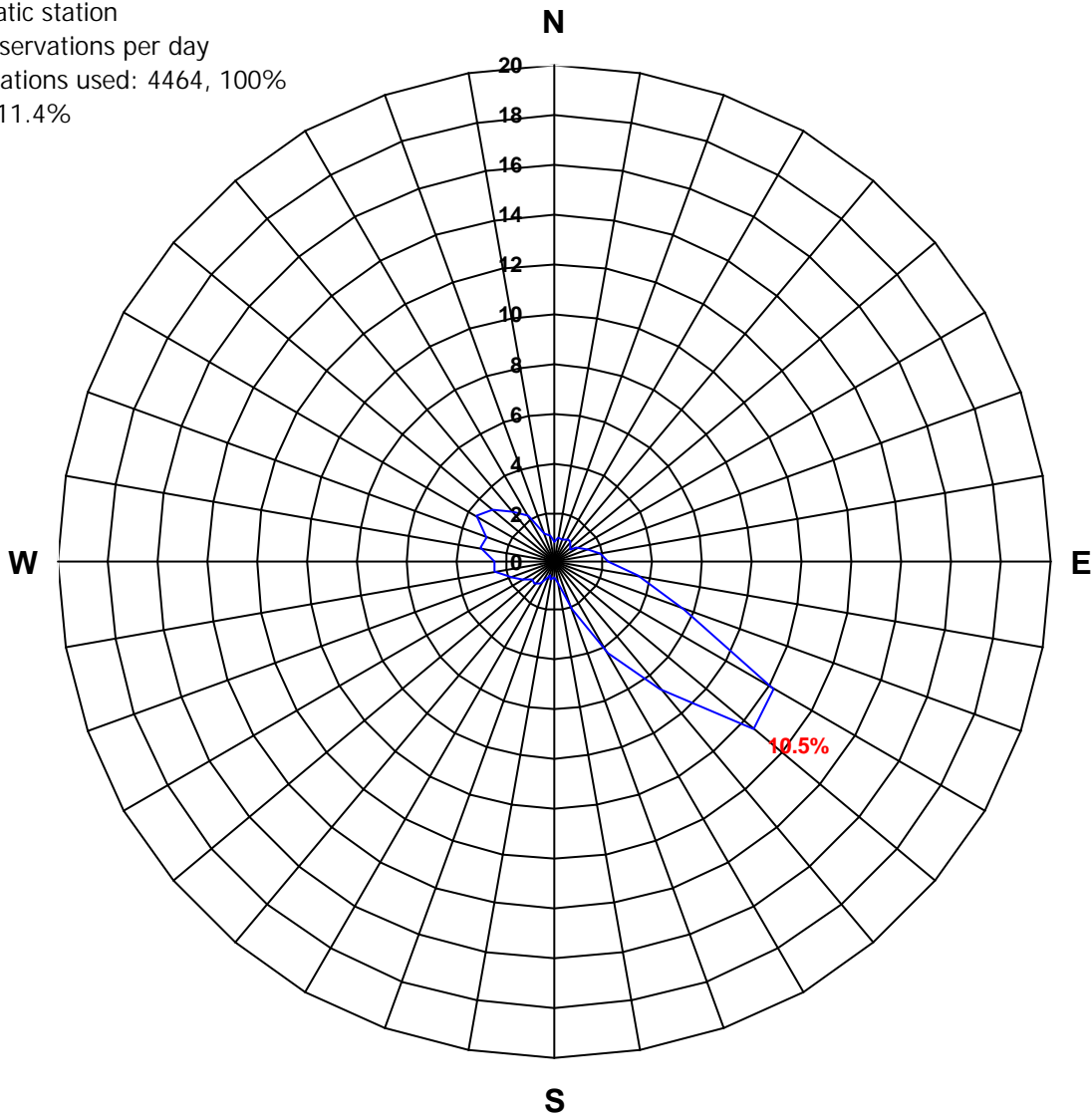


Average Wind Velocity for Wind Directions, m/s

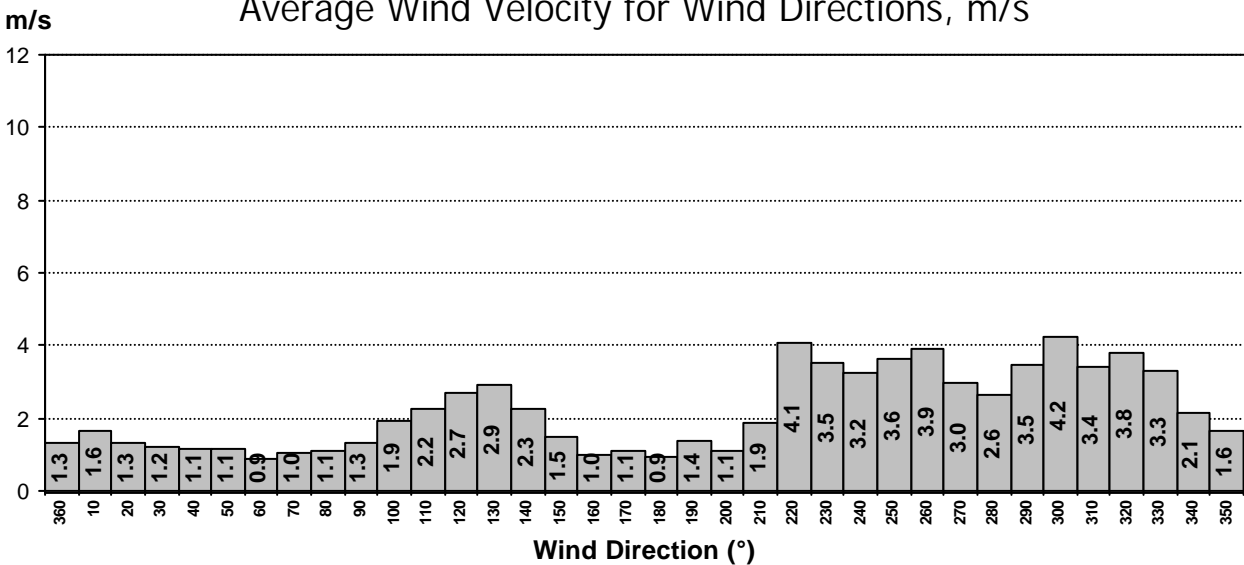


Frequency of Wind Directions, % July 2000

Automatic station
 144 observations per day
 Observations used: 4464, 100%
 Calm: 11.4%

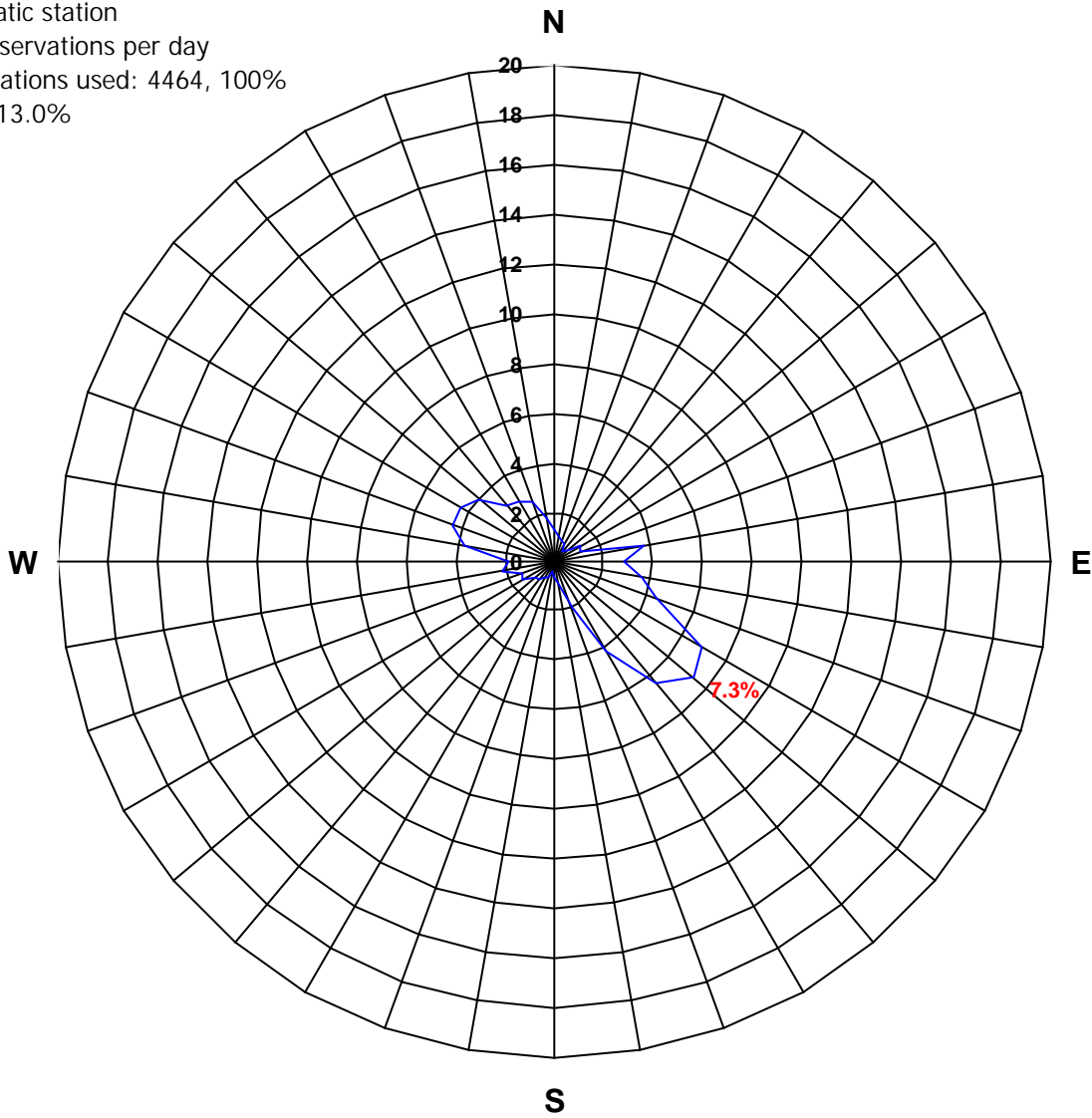


Average Wind Velocity for Wind Directions, m/s

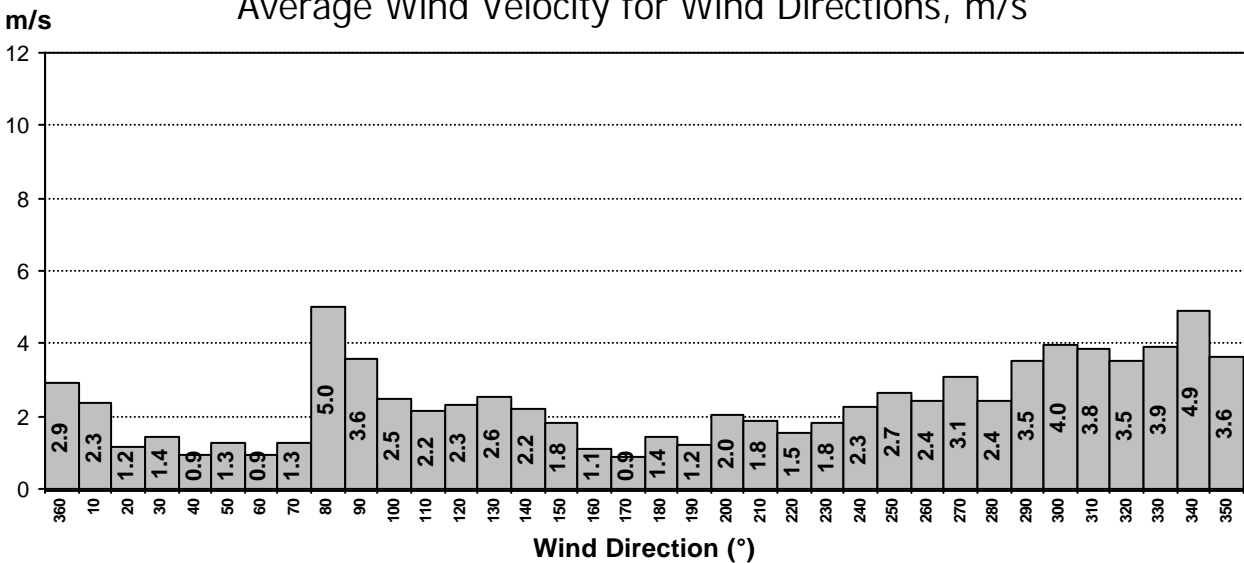


Frequency of Wind Directions, % August 2000

Automatic station
144 observations per day
Observations used: 4464, 100%
Calm: 13.0%

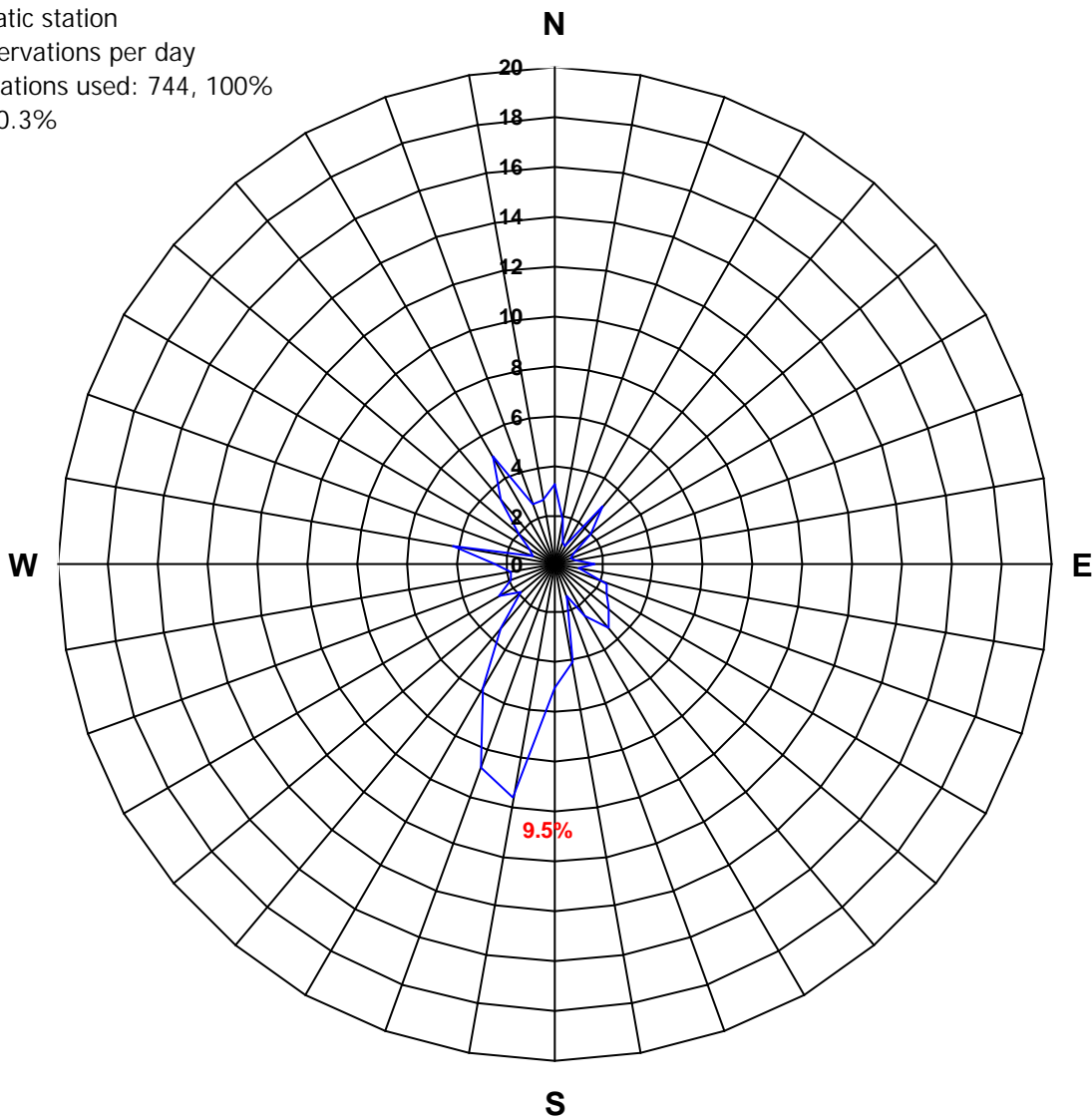


Average Wind Velocity for Wind Directions, m/s

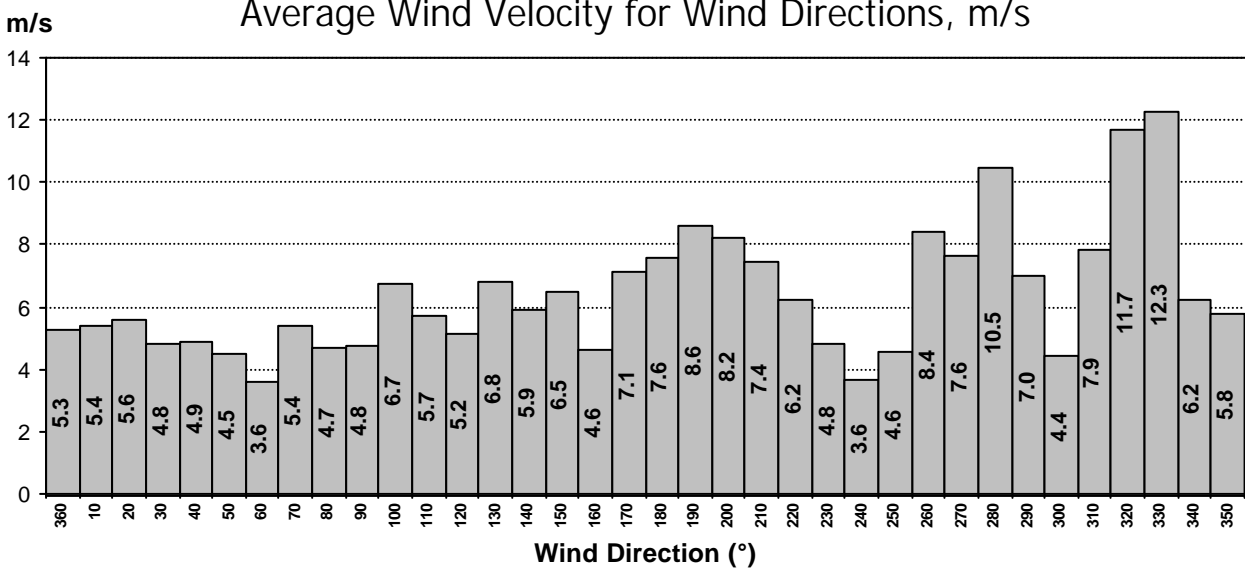


Frequency of Wind Directions, % May 2000

Automatic station
24 observations per day
Observations used: 744, 100%
Calm: 0.3%



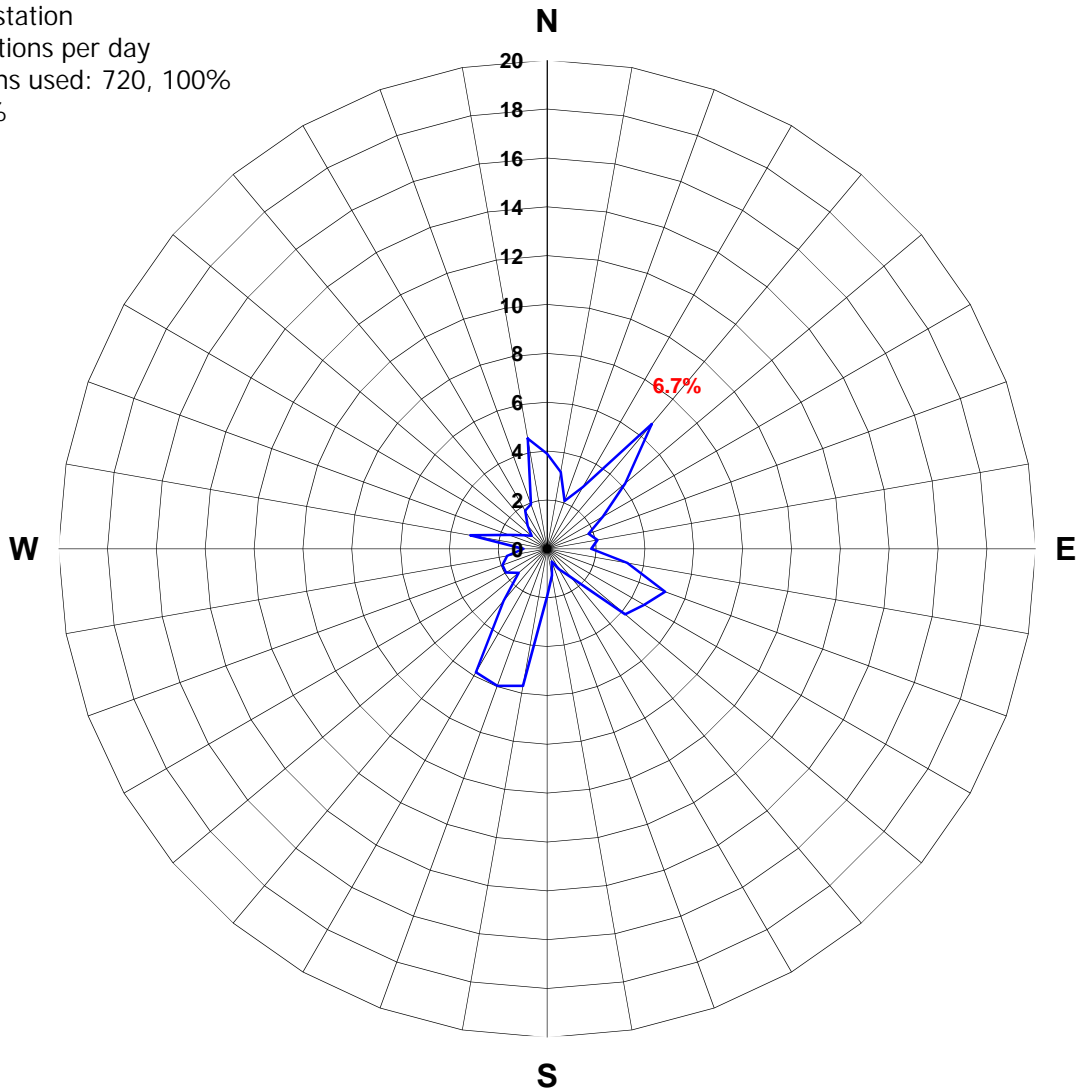
Average Wind Velocity for Wind Directions, m/s



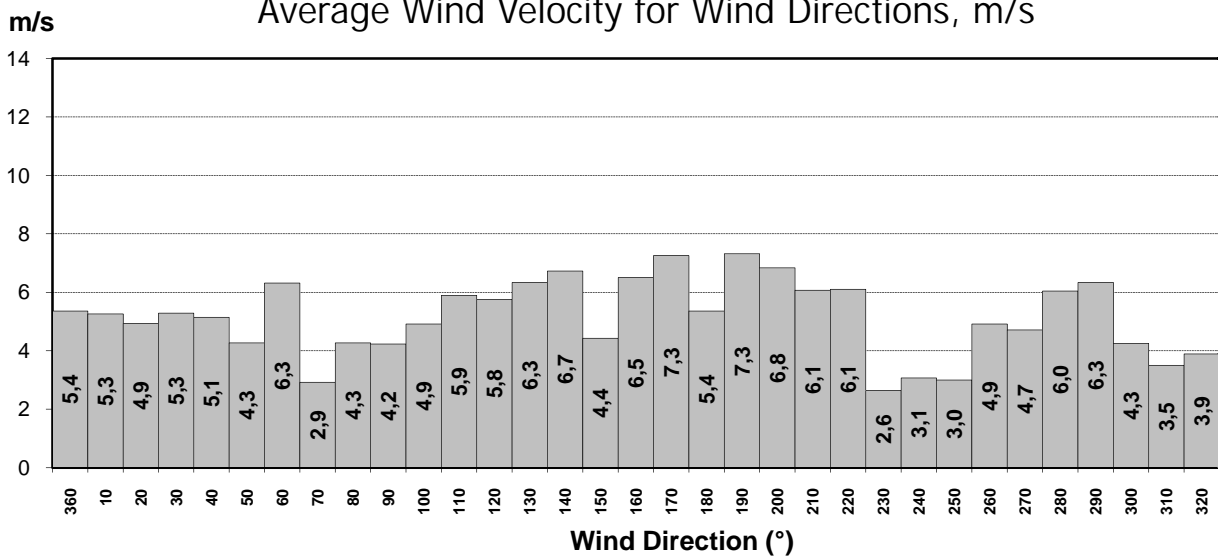
Seley

Frequency of Wind Directions, %

Automatic station
 24 observations per day
 Observations used: 720, 100%
 Calm: 0.7%



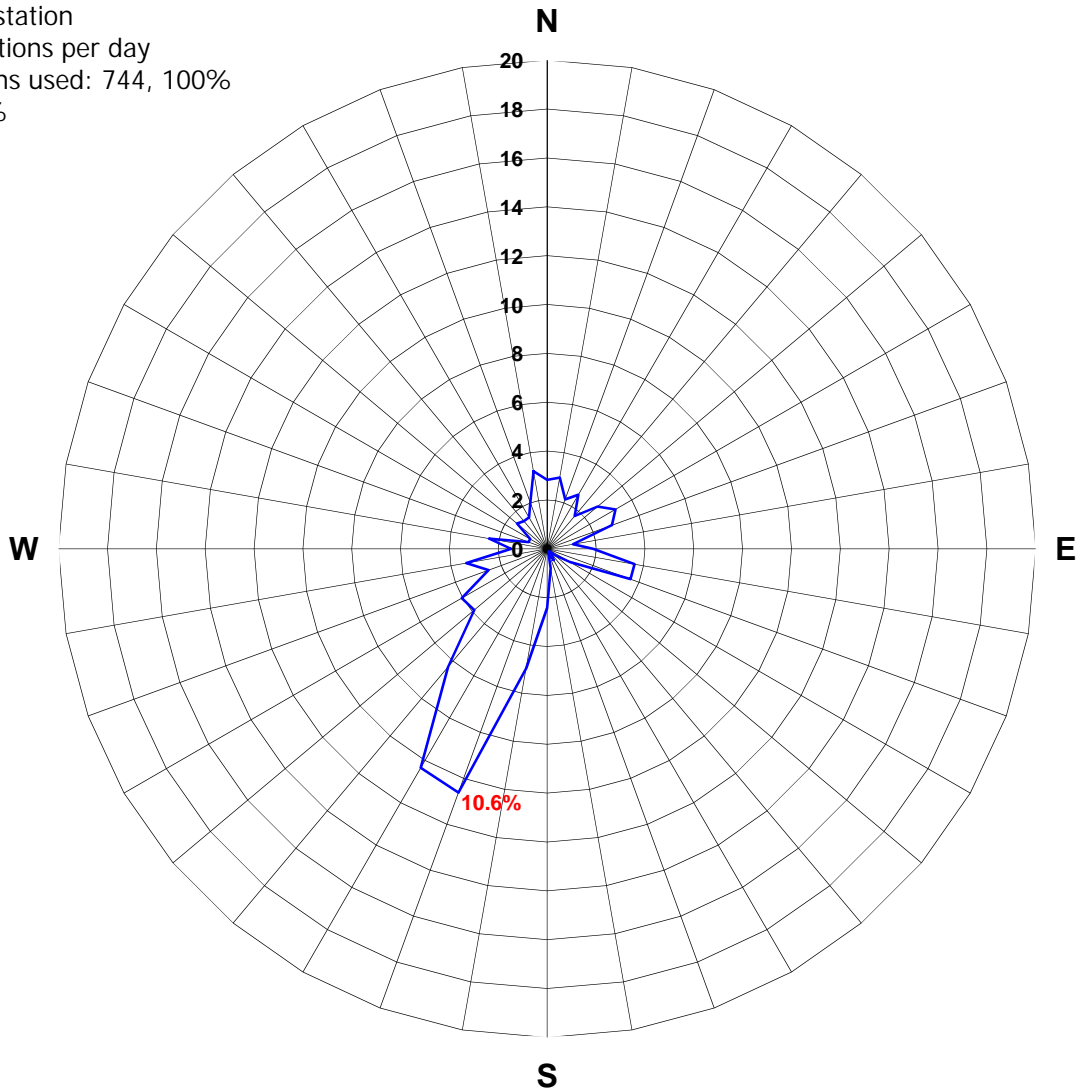
Average Wind Velocity for Wind Directions, m/s



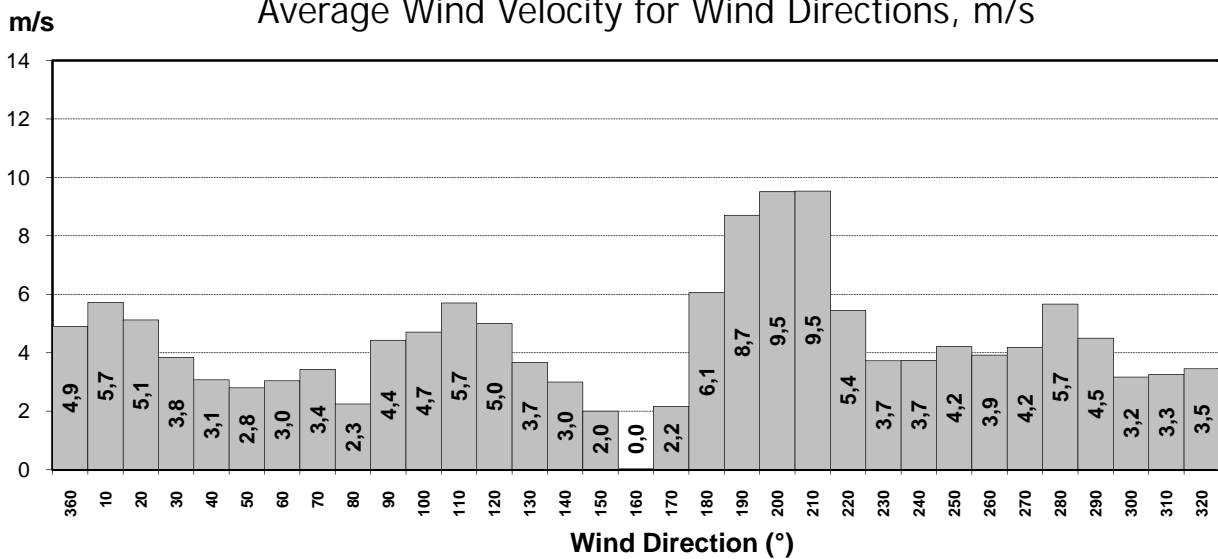
Seley

Frequency of Wind Directions, %

Automatic station
 24 observations per day
 Observations used: 744, 100%
 Calm: 1.9%



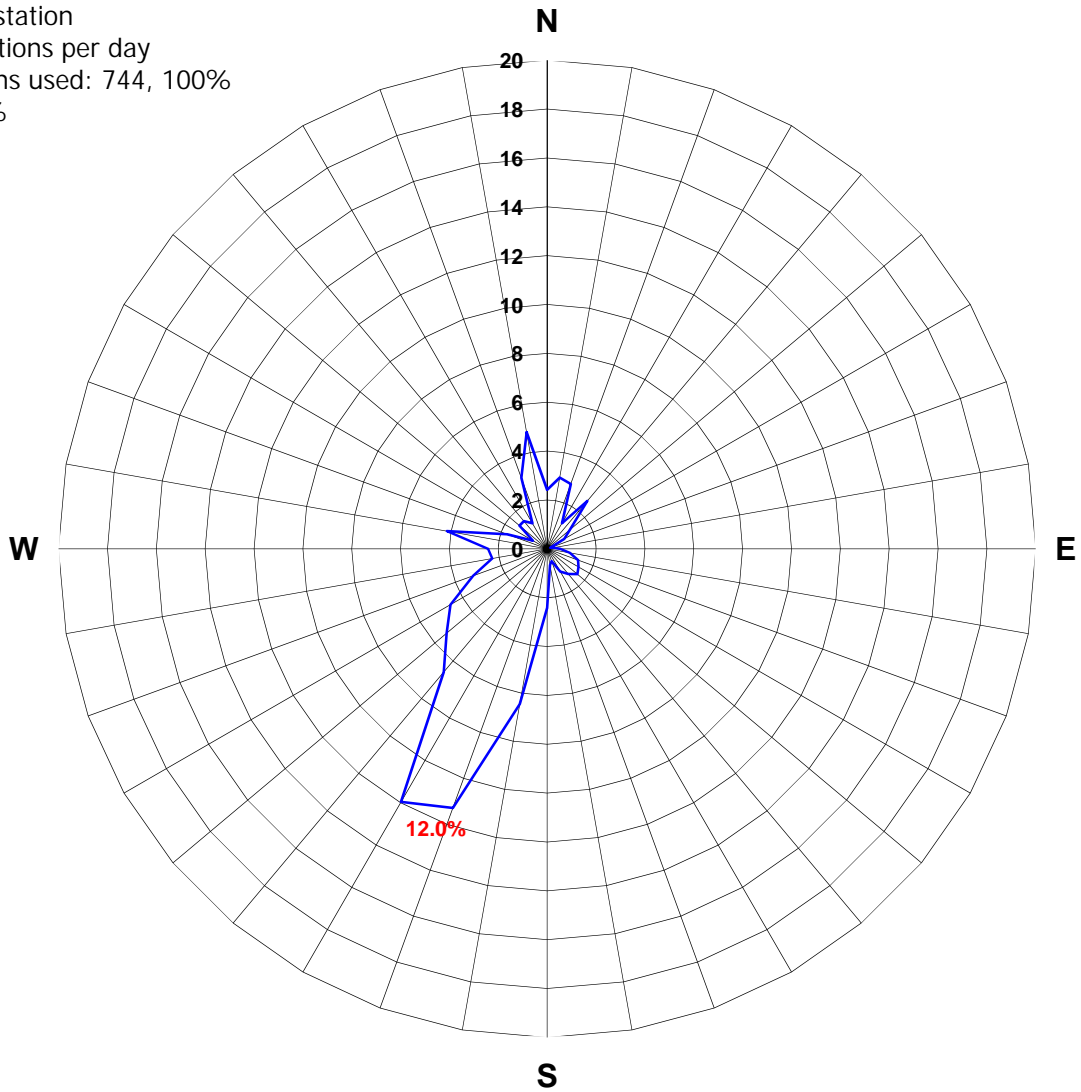
Average Wind Velocity for Wind Directions, m/s



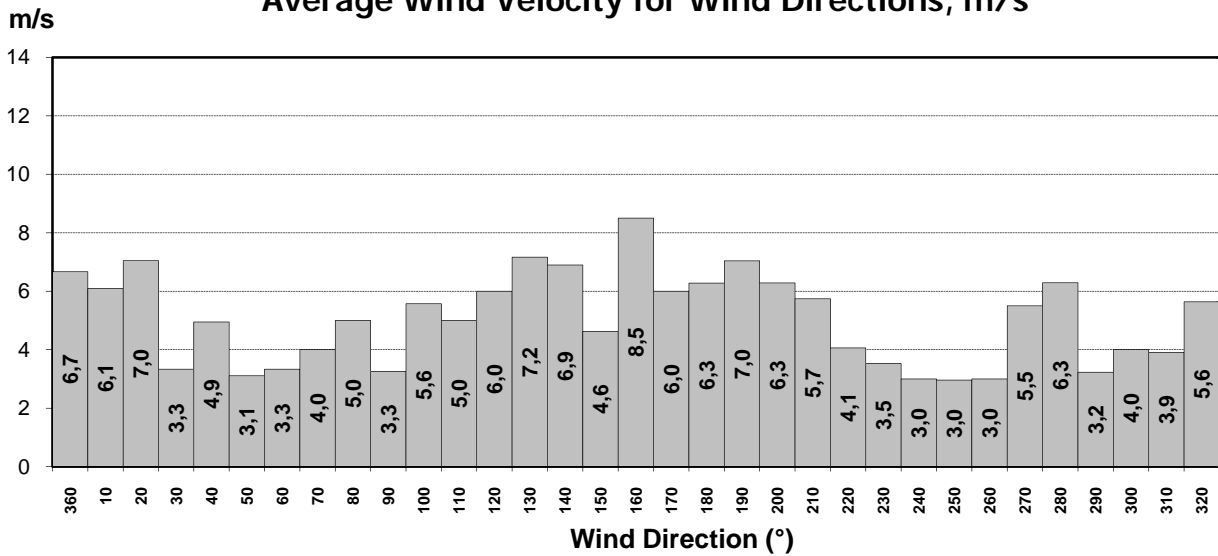
Seley

Frequency of Wind Directions, %

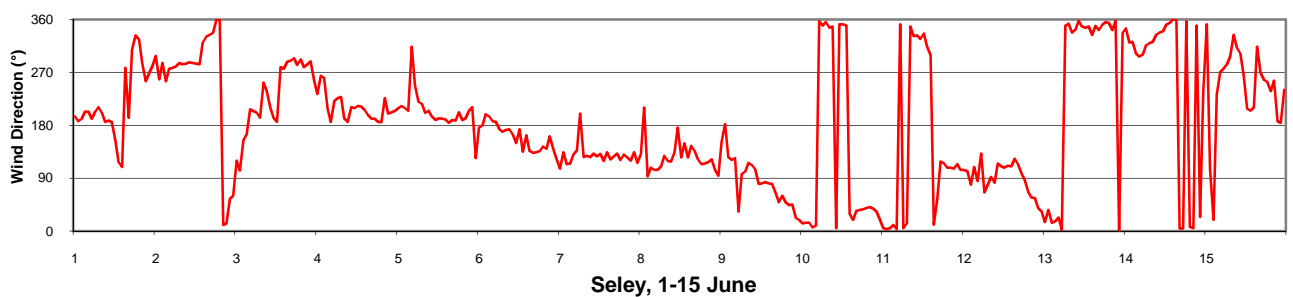
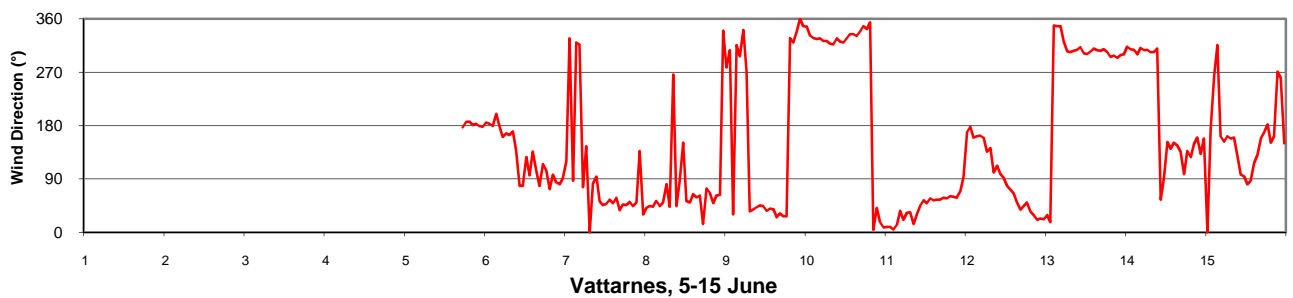
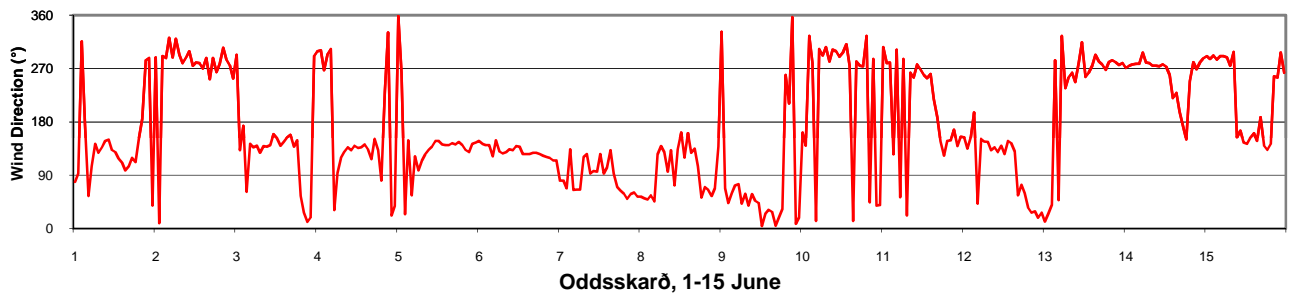
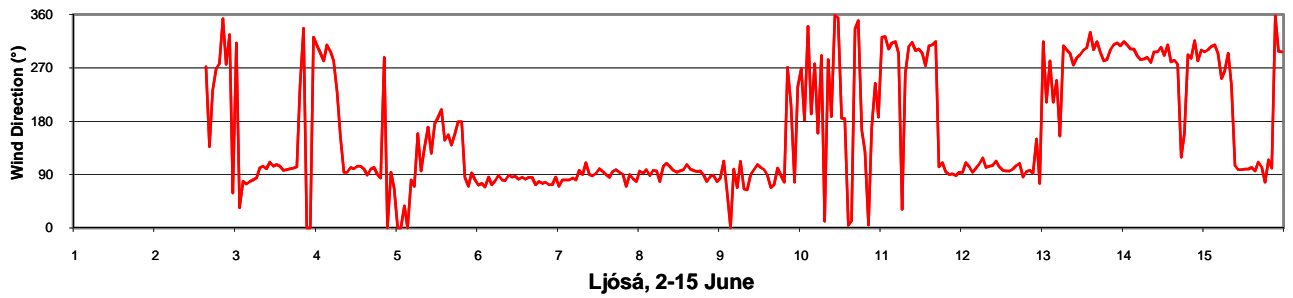
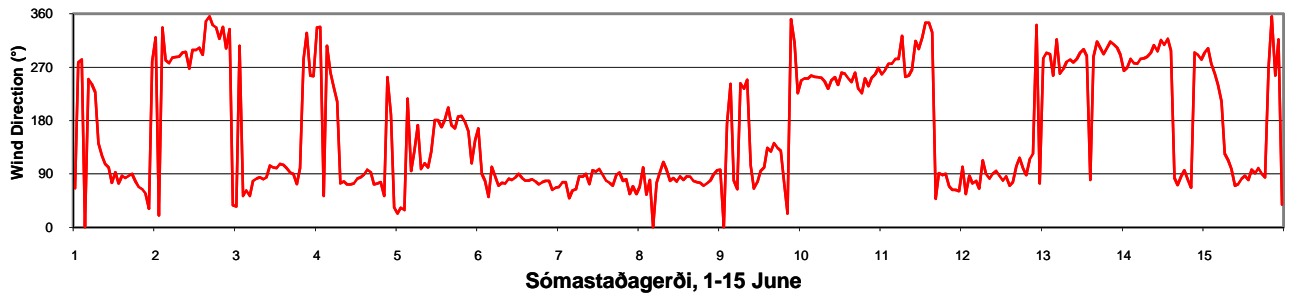
Automatic station
 24 observations per day
 Observations used: 744, 100%
 Calm: 0.8%



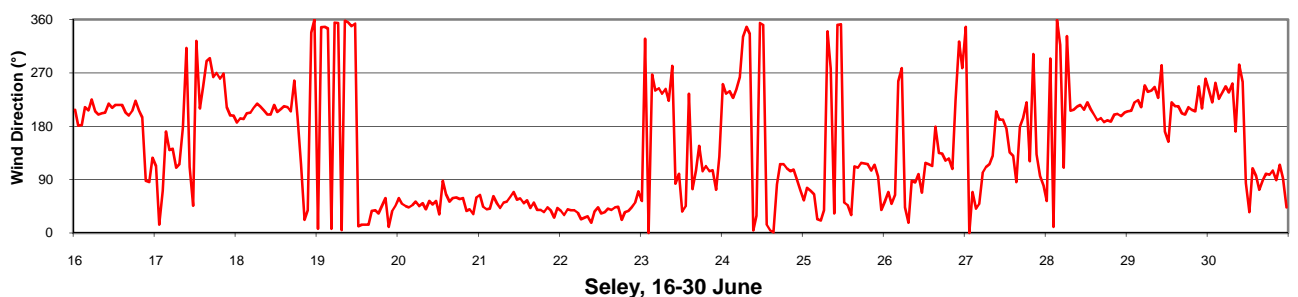
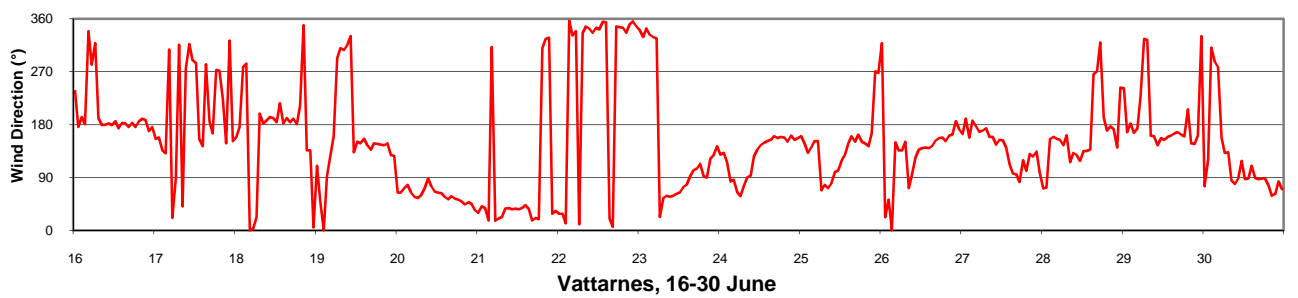
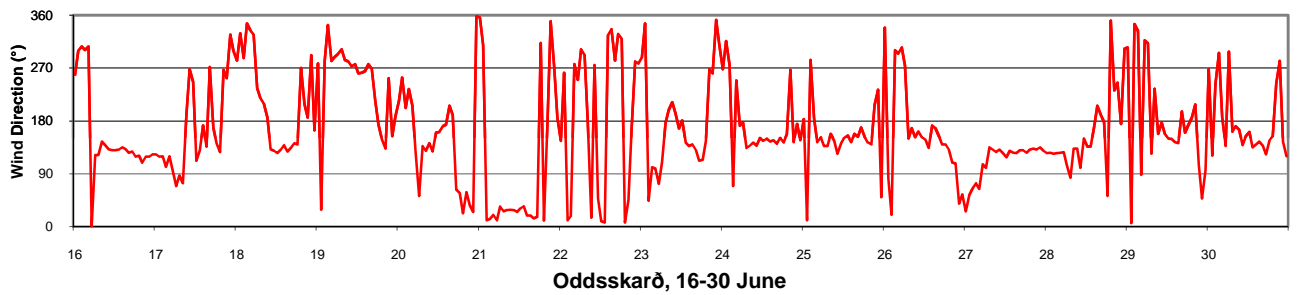
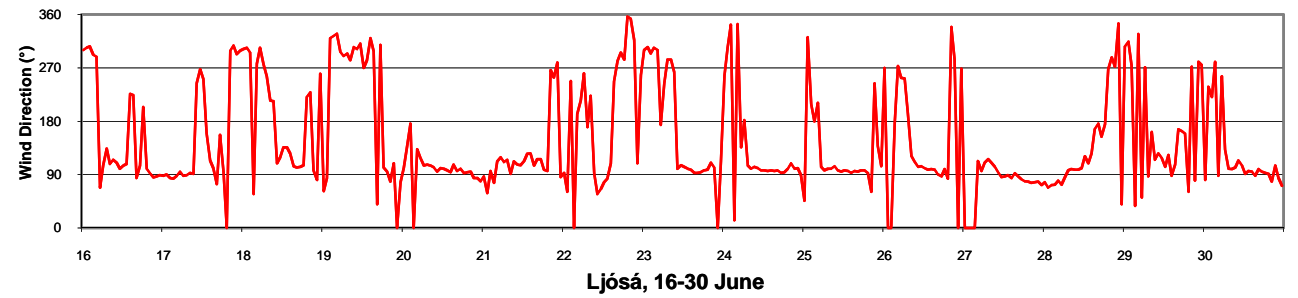
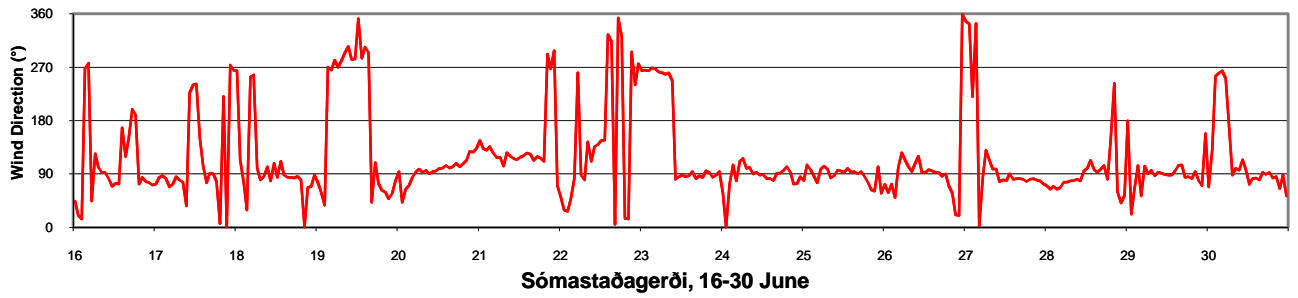
Average Wind Velocity for Wind Directions, m/s



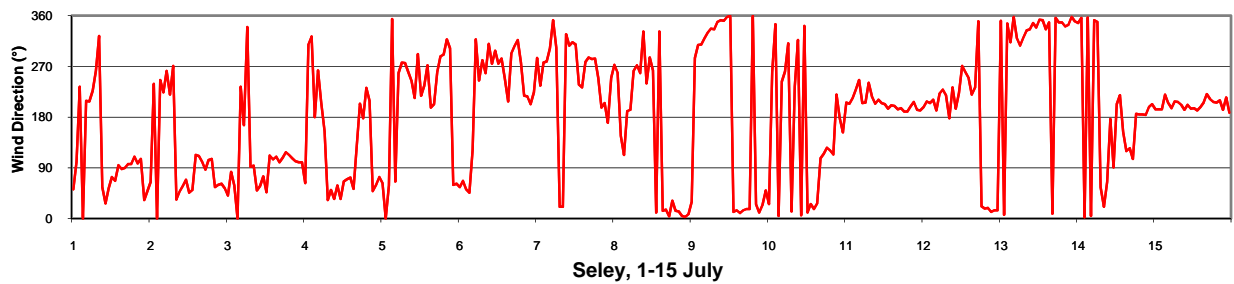
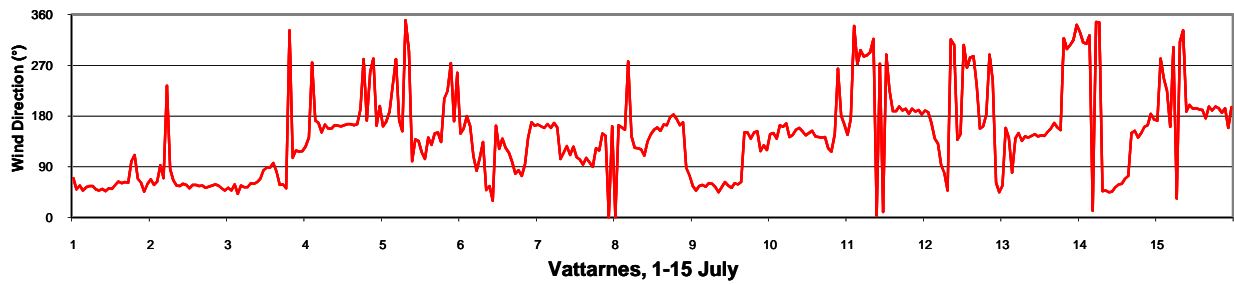
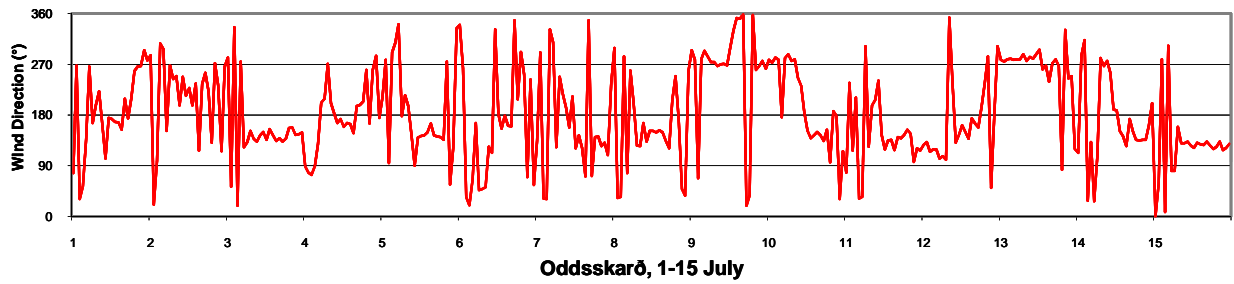
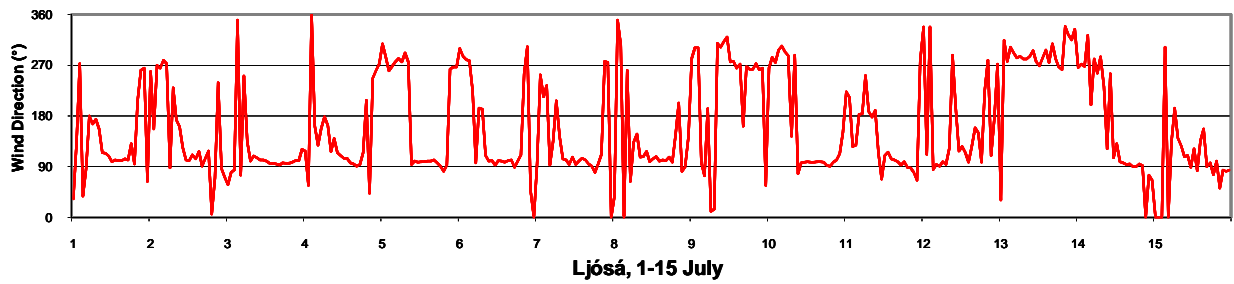
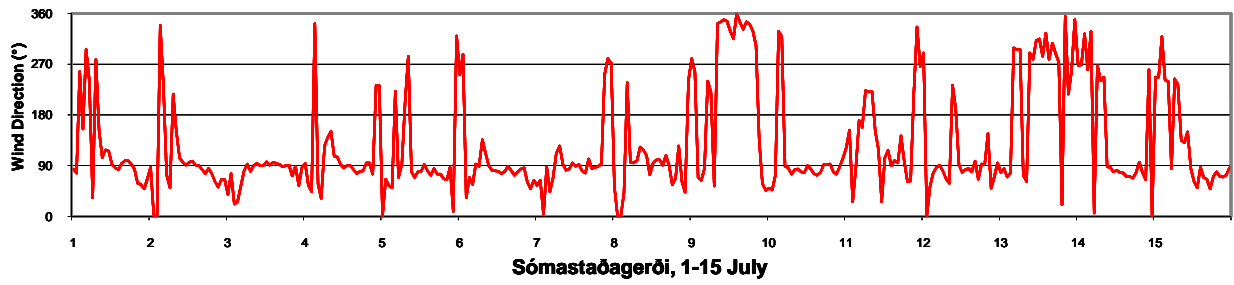
**Simultaneous Observations of Wind Direction at
Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley
1 - 15 June 2000**



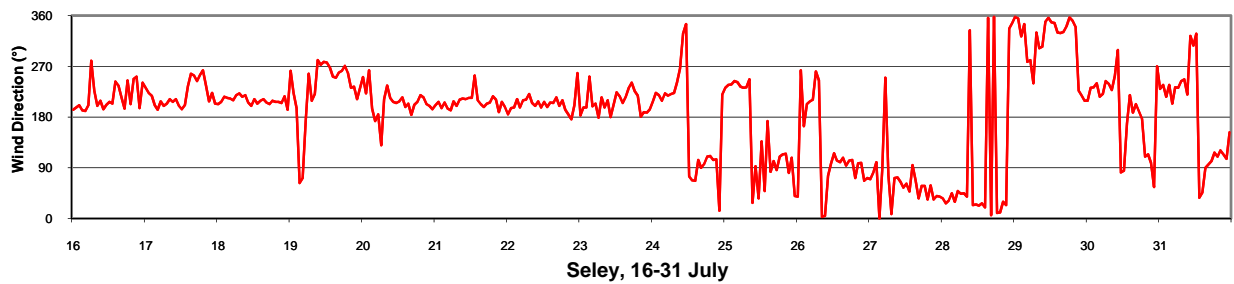
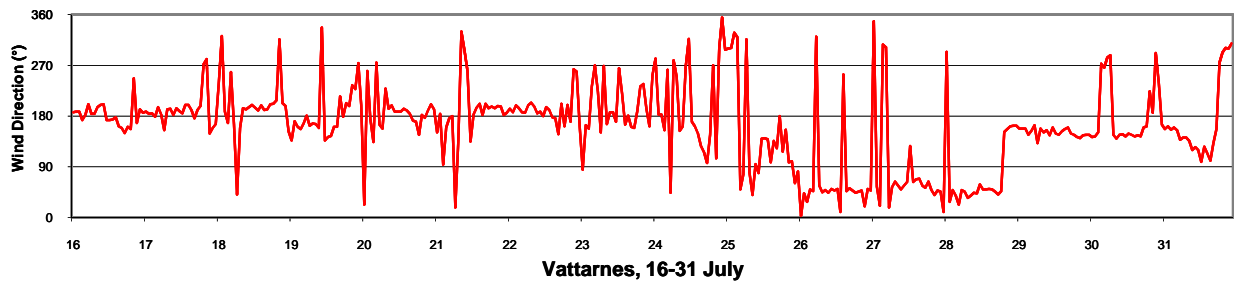
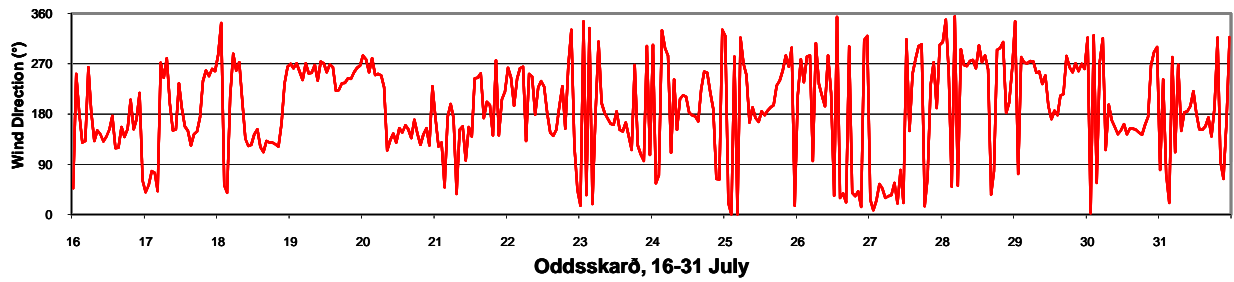
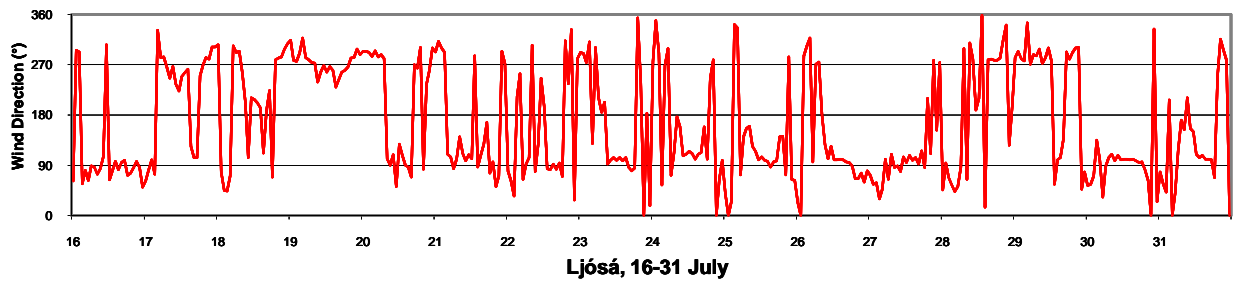
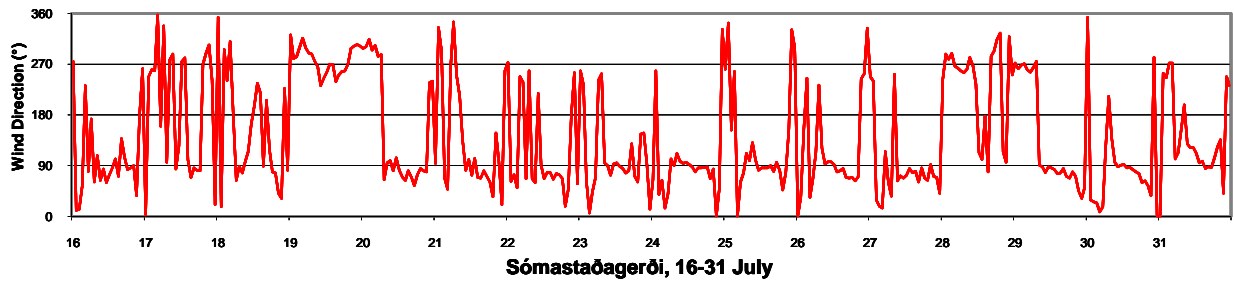
**Simultaneous Observations of Wind Direction at
Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley
16 - 30 June 2000**



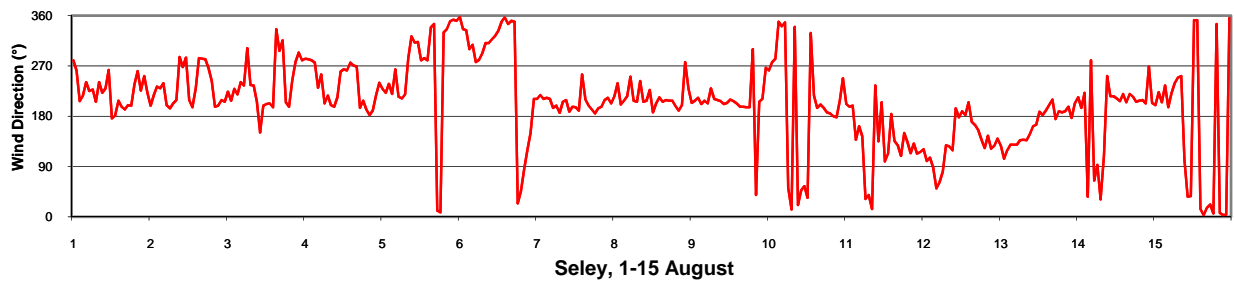
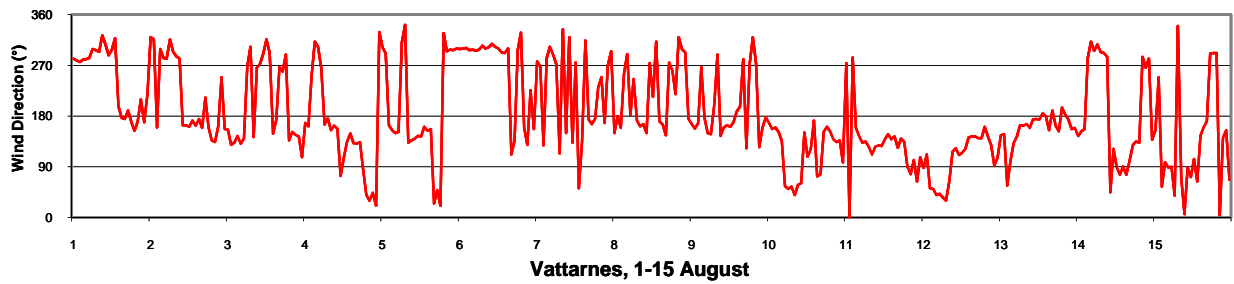
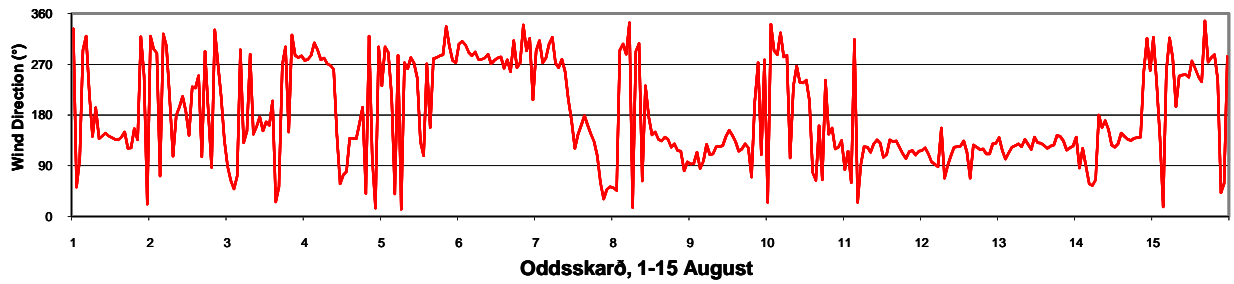
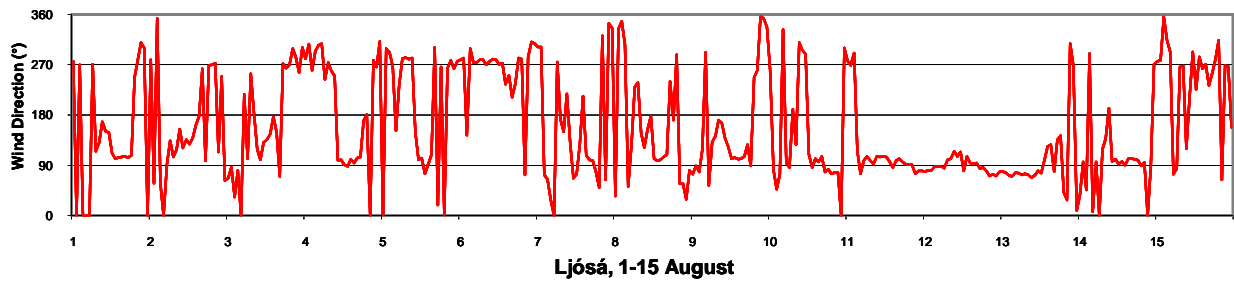
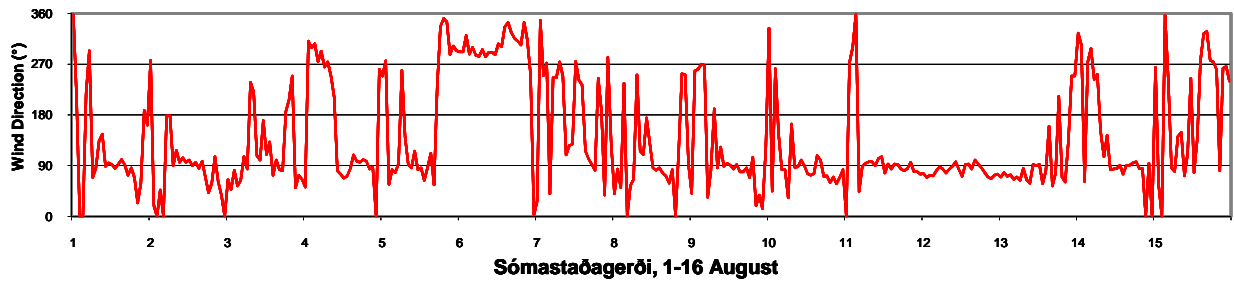
Simultaneous Observations of Wind Direction at
Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley
1 - 15 July 2000



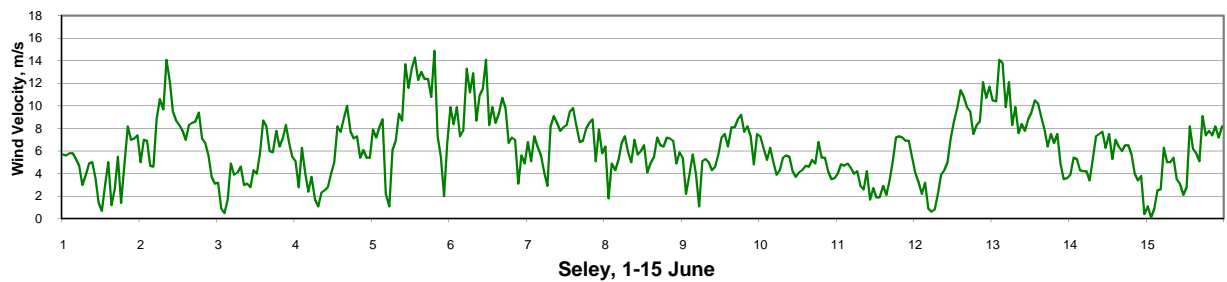
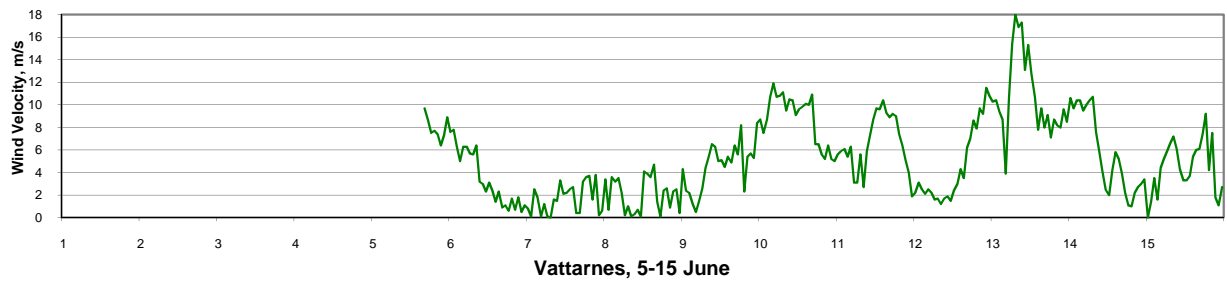
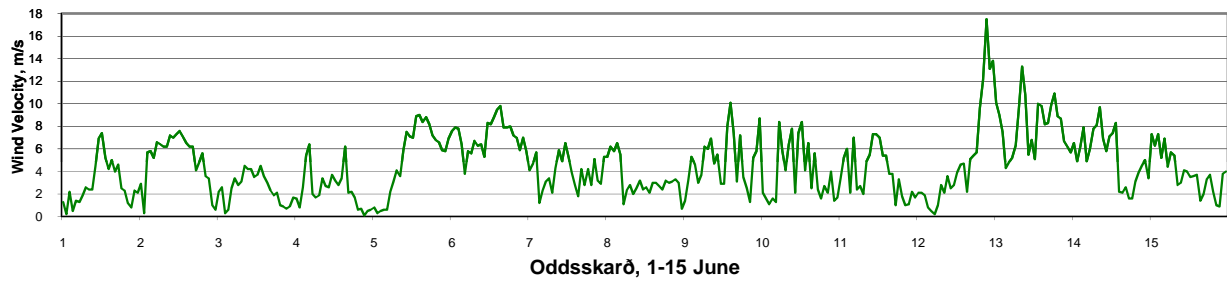
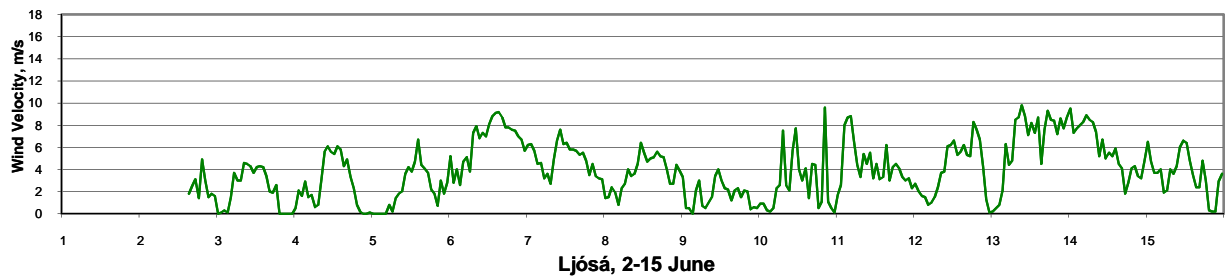
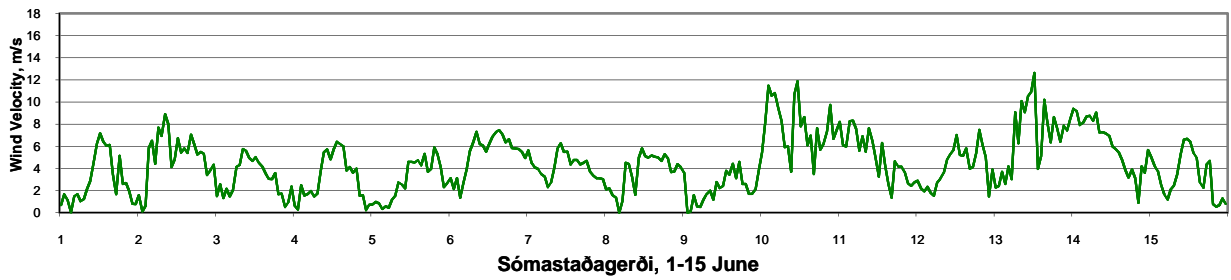
Simultaneous Observations of Wind Direction at
Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley
16 - 31 July 2000



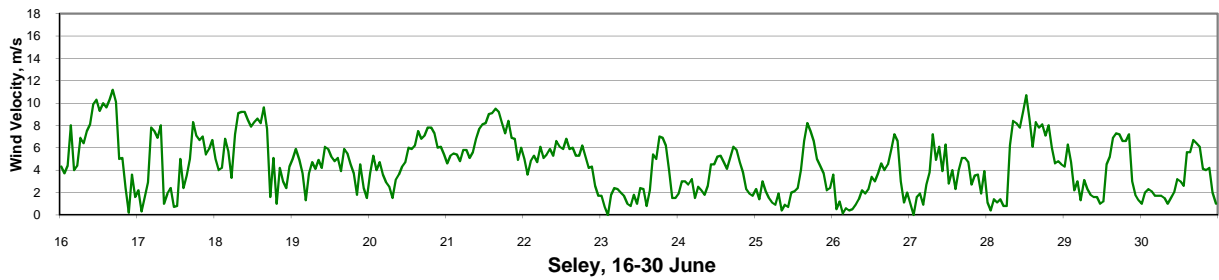
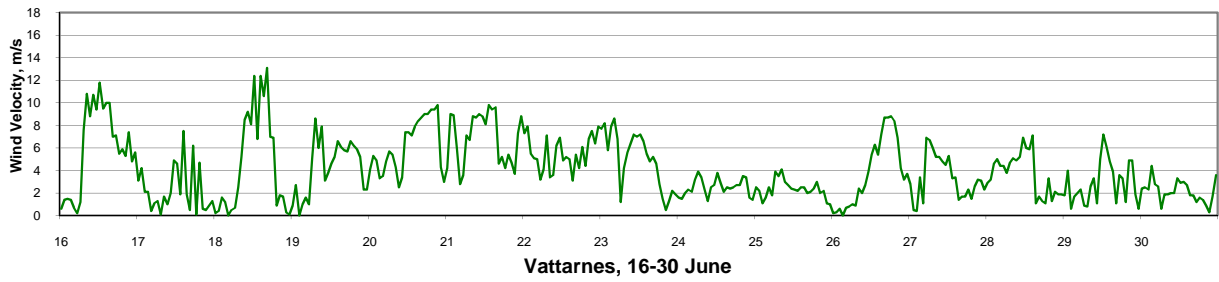
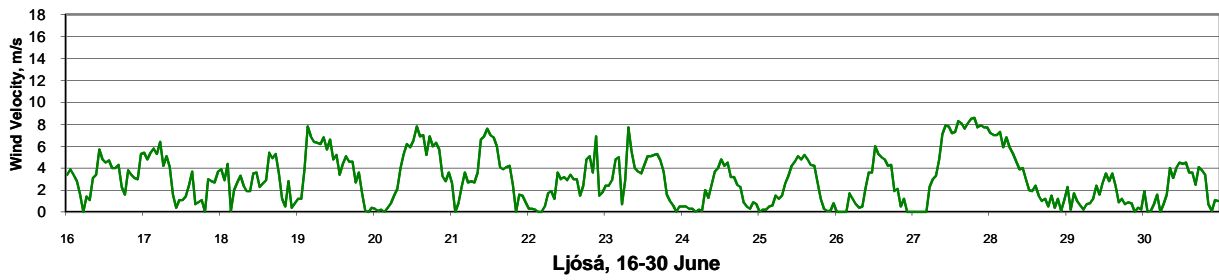
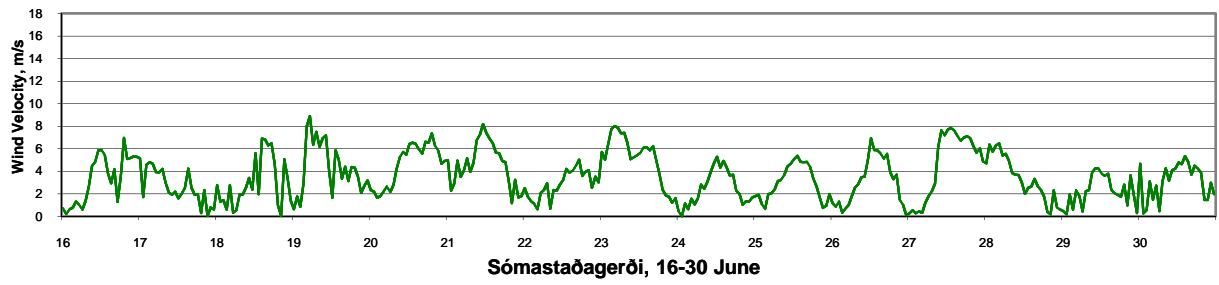
**Simultaneous Observations of Wind Direction at
Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley
1 - 15 August 2000**



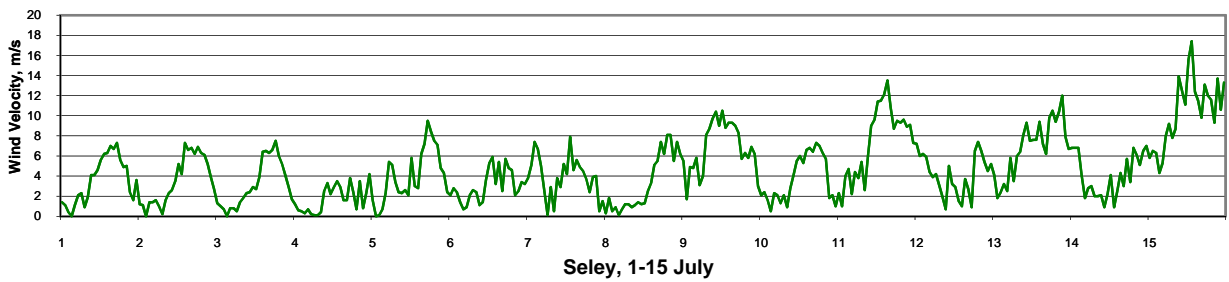
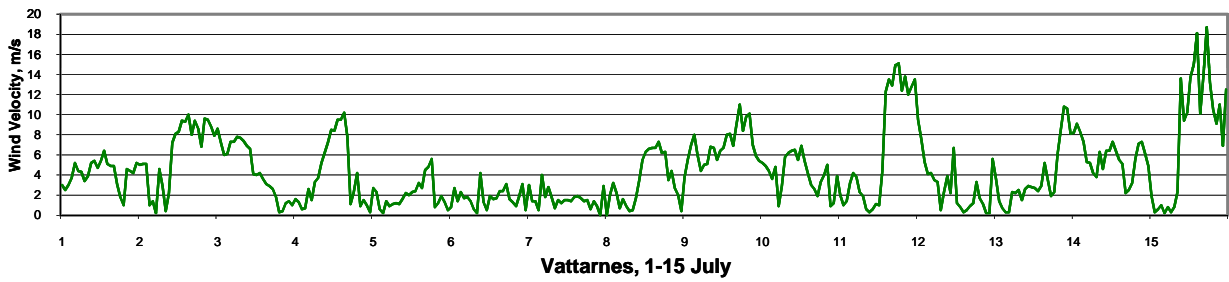
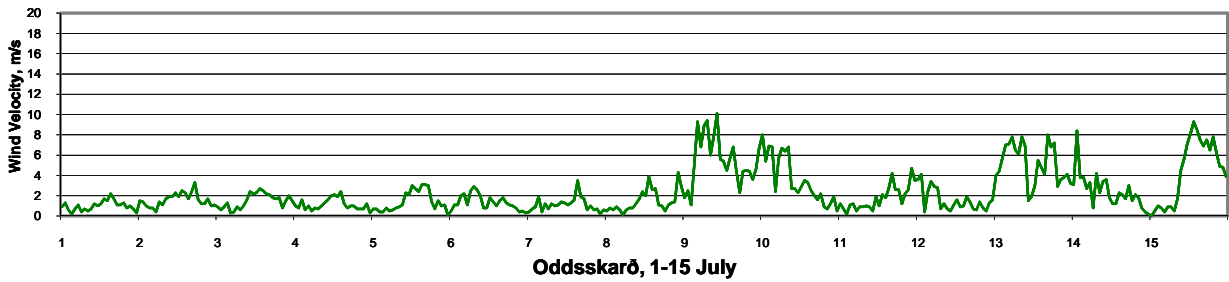
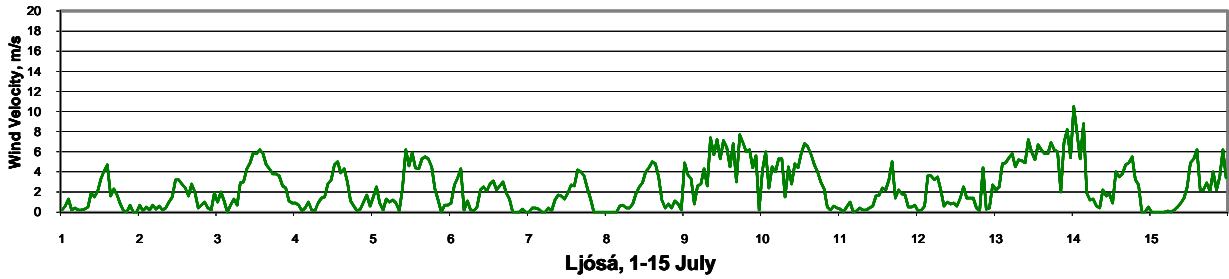
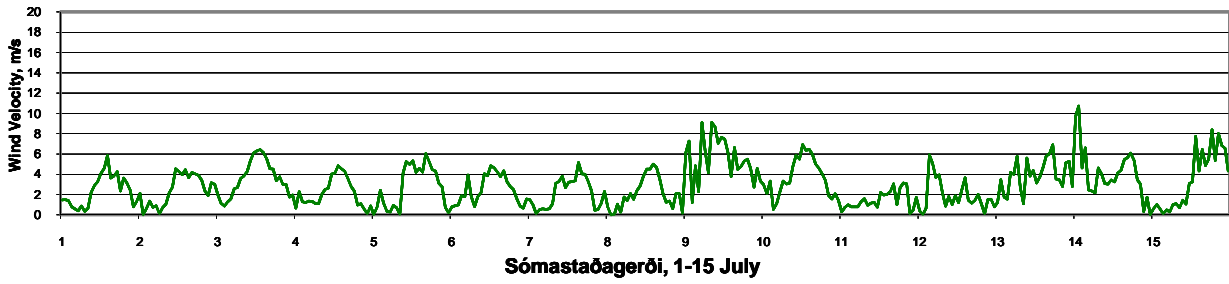
**Simultaneous Observations of Wind Velocity at
Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley
1 - 15 June 2000**



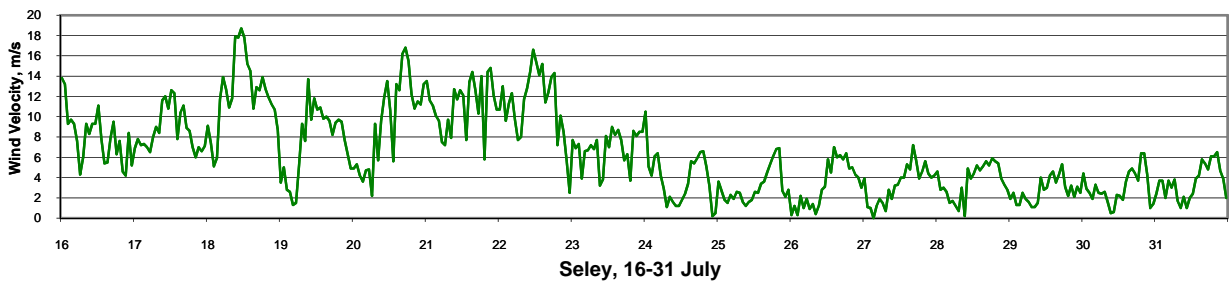
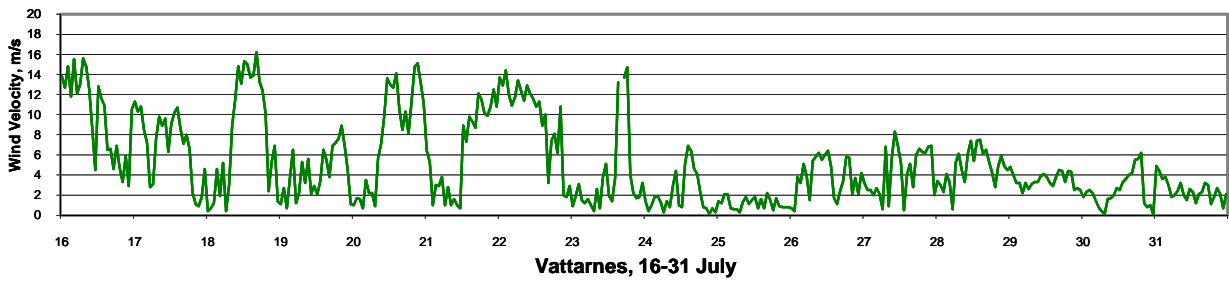
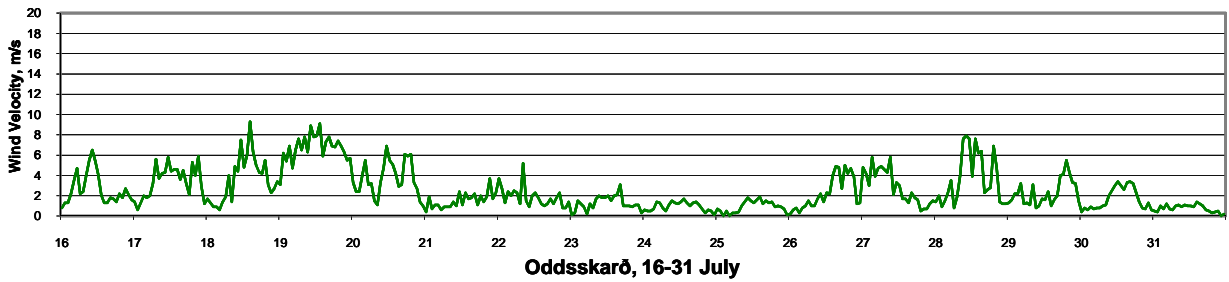
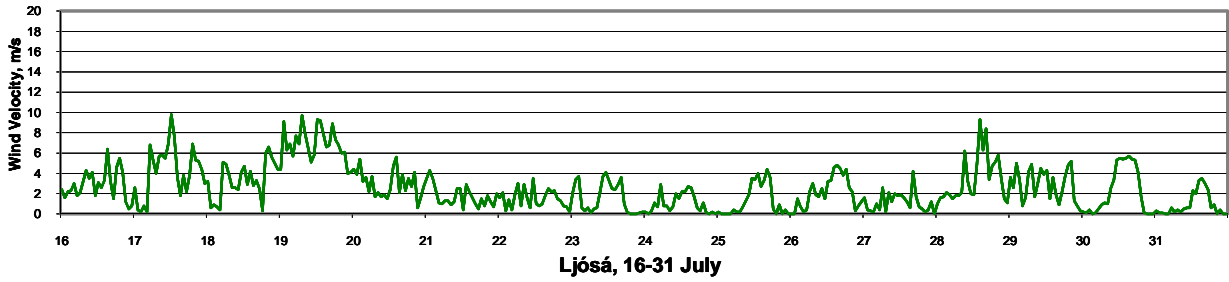
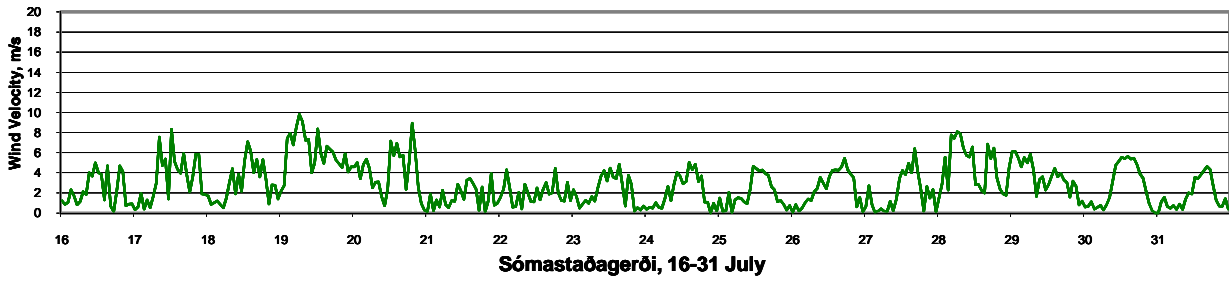
**Simultaneous Observations of Wind Velocity at
Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley
16 - 30 June 2000**



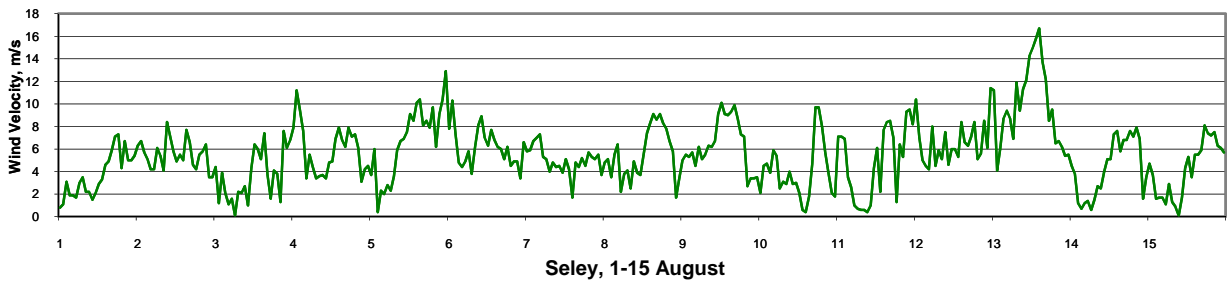
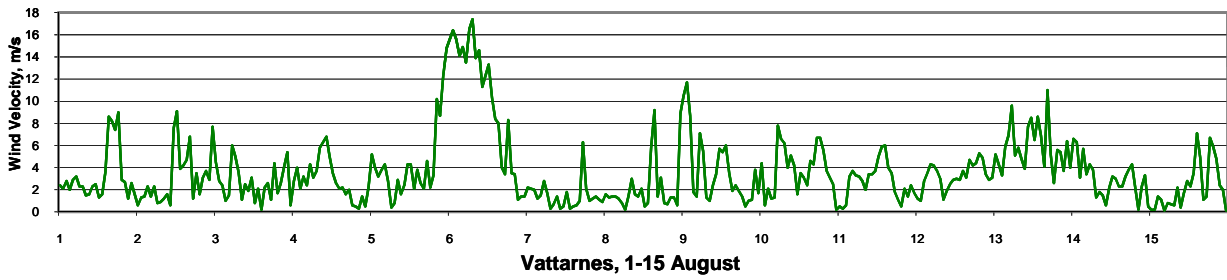
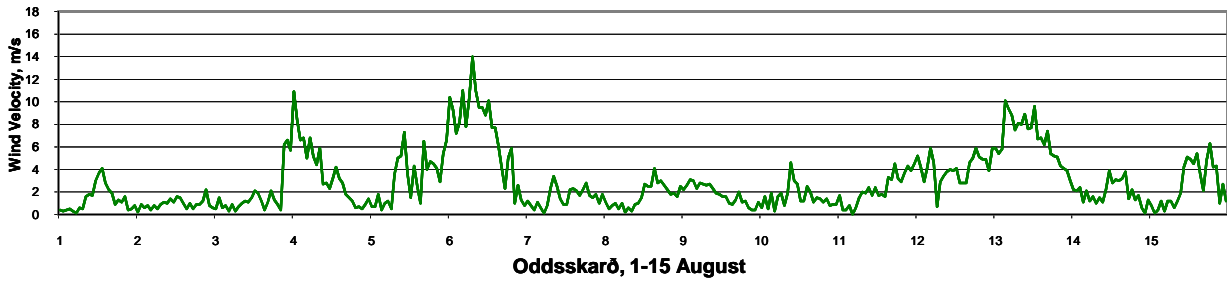
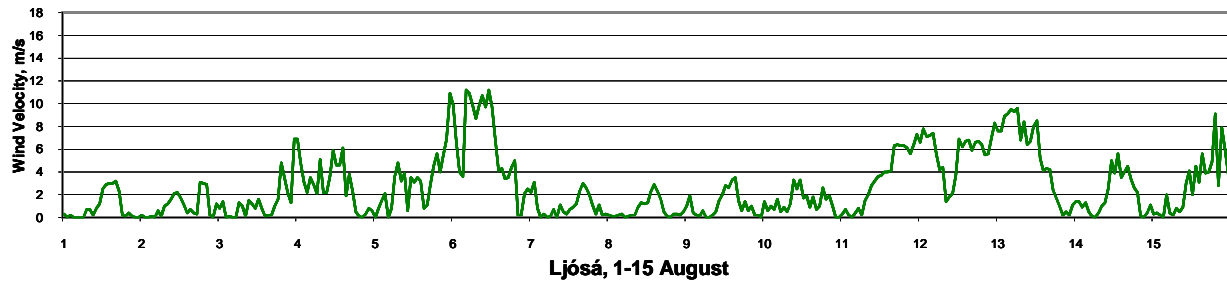
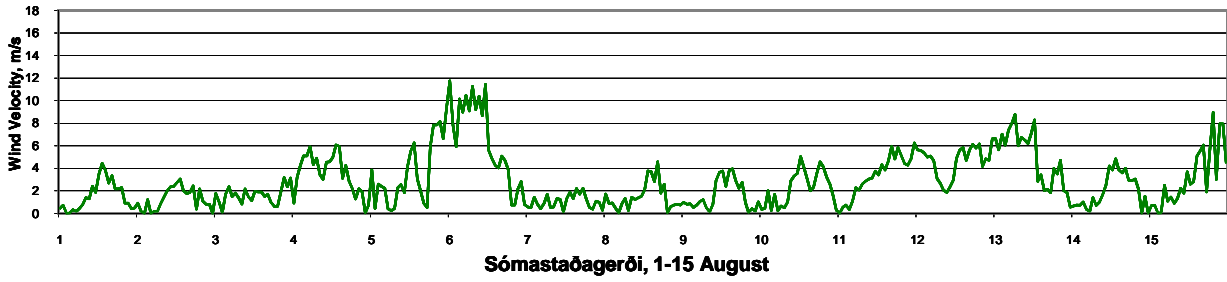
Simultaneous Observations of Wind Velocity at
Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley
1 - 15 July 2000



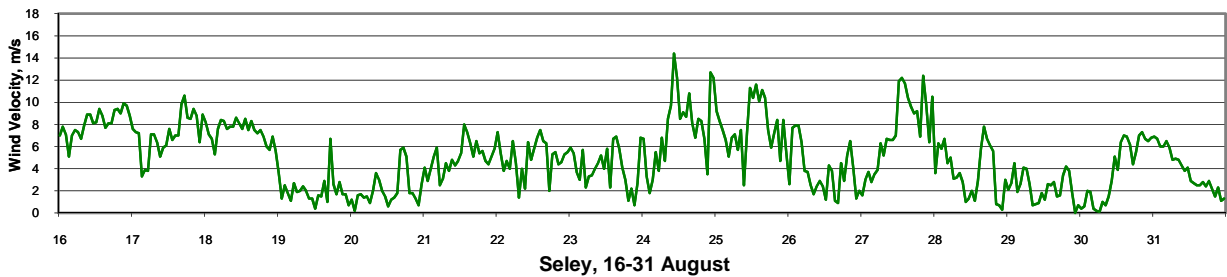
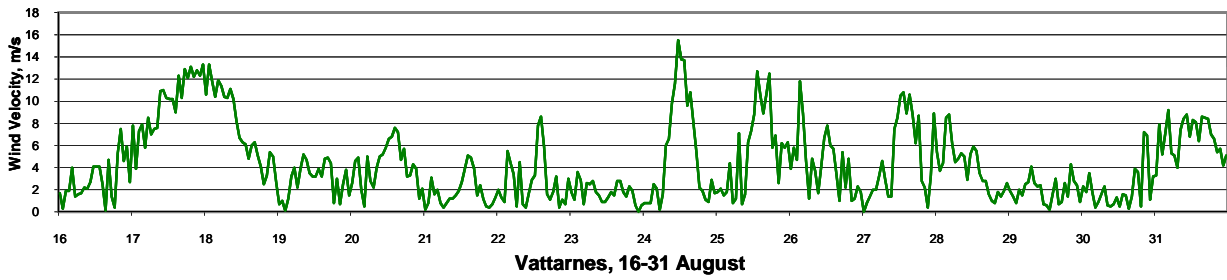
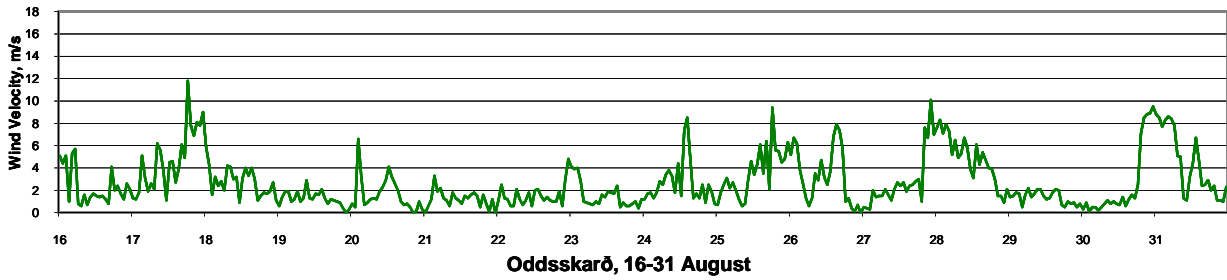
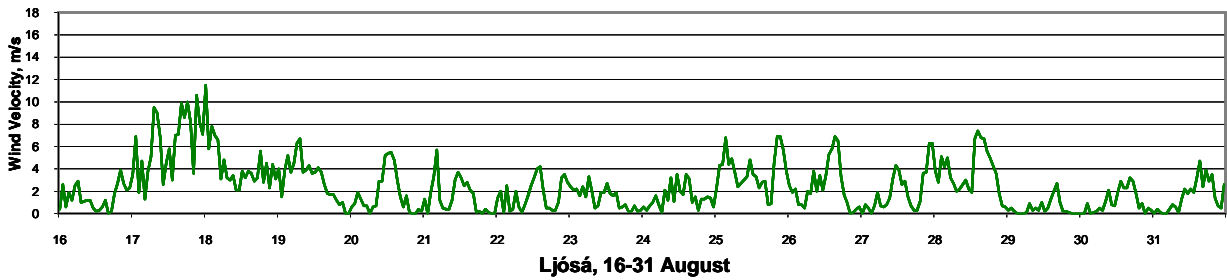
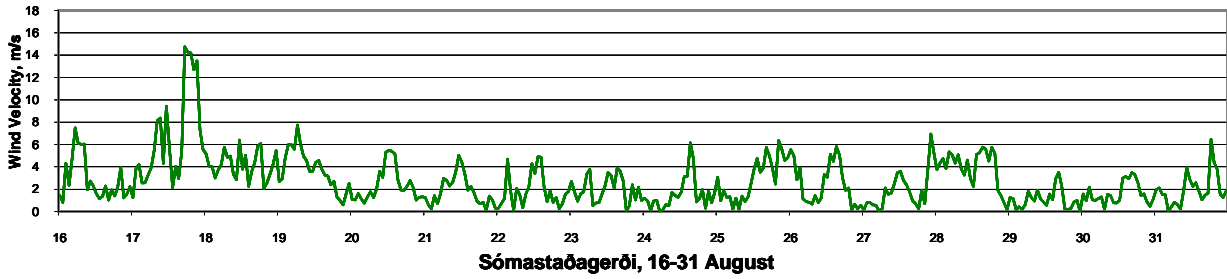
Simultaneous Observations of Wind Velocity at
Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley
16 - 31 July 2000



Simultaneous Observations of Wind Velocity at
Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley
1 - 15 August 2000

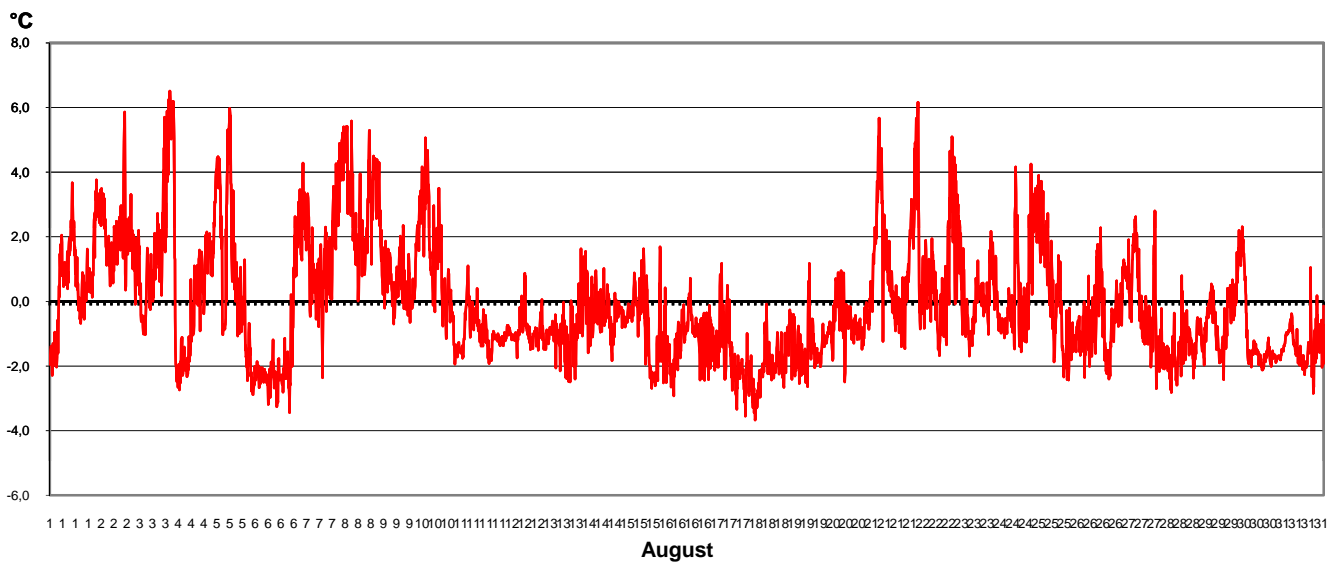
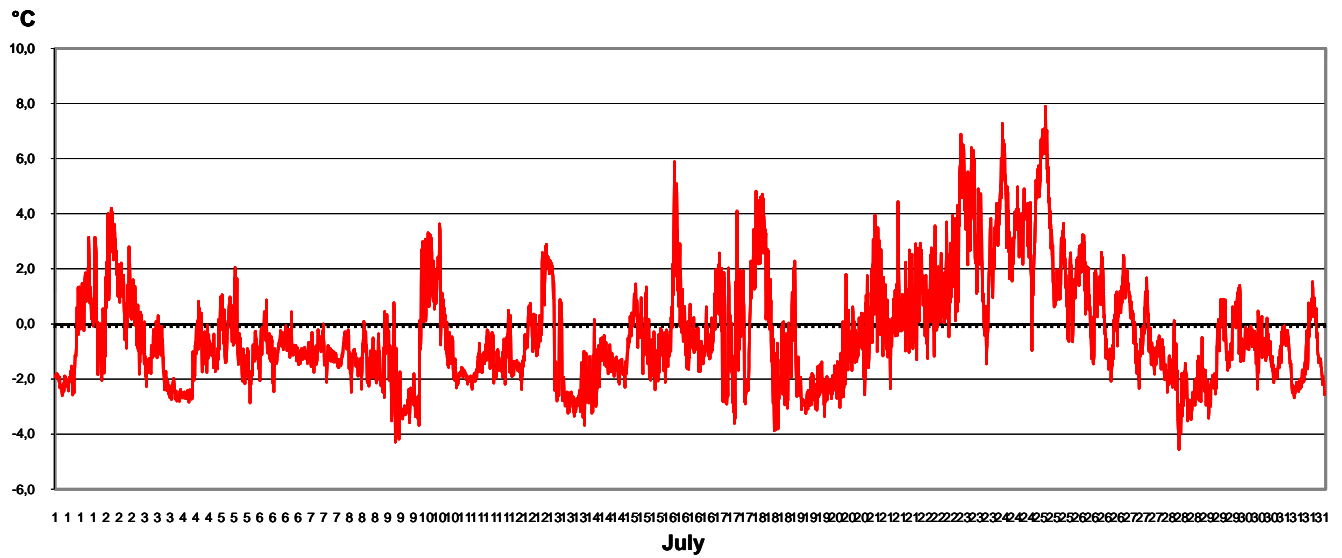
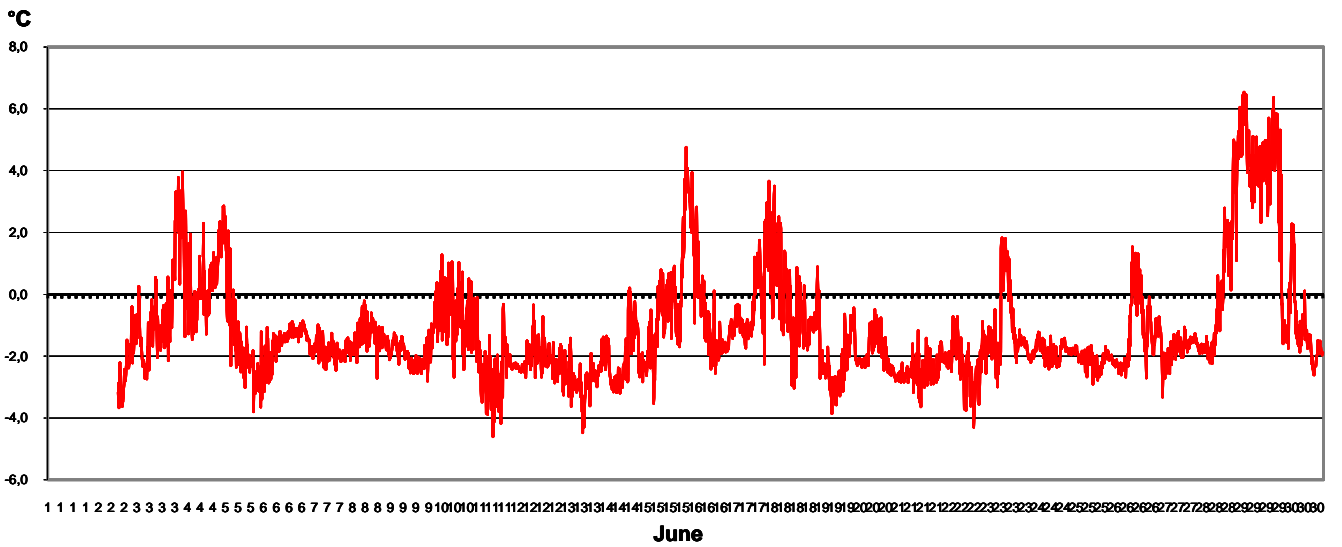


Simultaneous Observations of Wind Velocity at
Sómastaðagerði, Ljósá, Oddsskarð, Vattarnes and Seley
16 - 31 August 2000



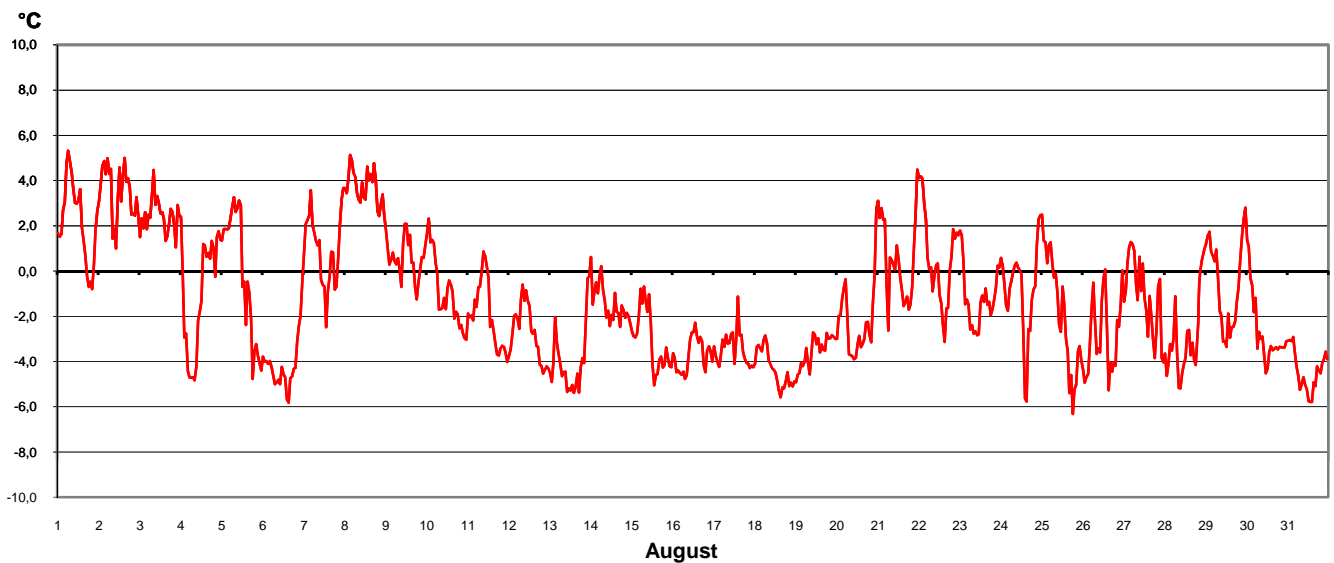
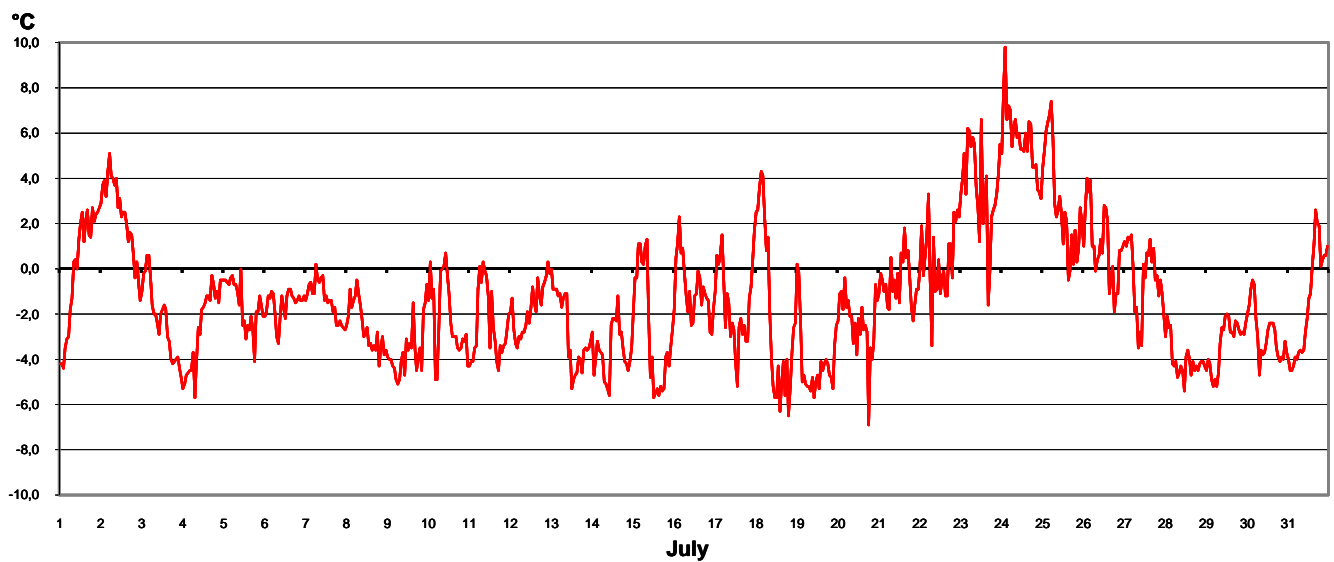
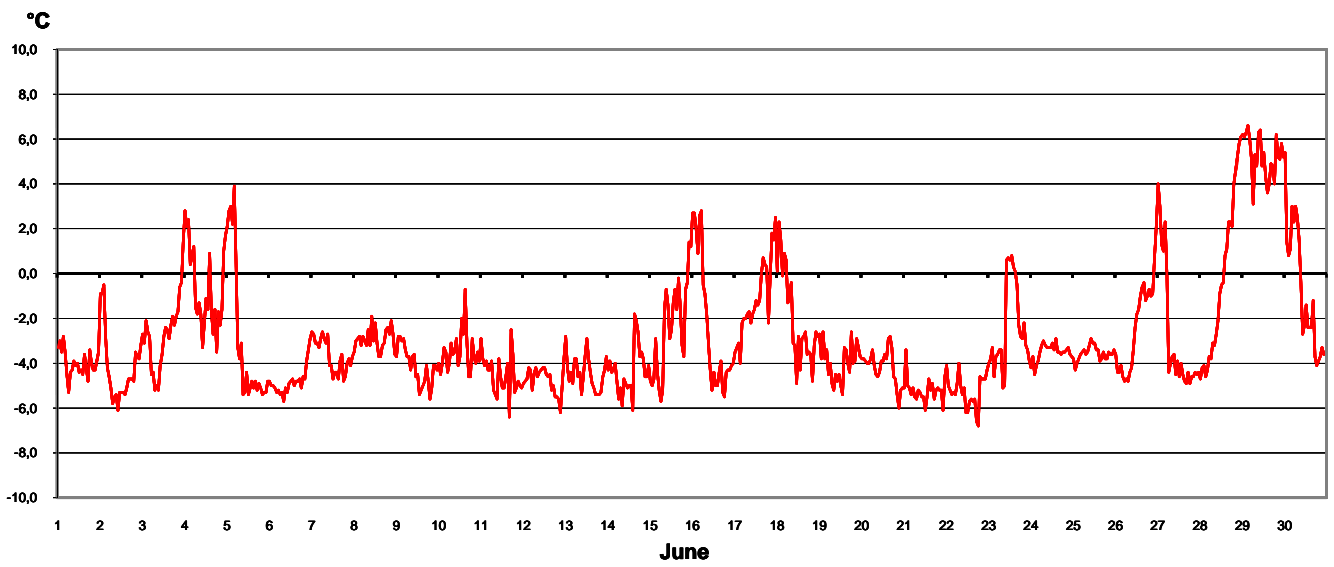
Temperature difference Ljósá - Sómastaðagerði

June - August 2000



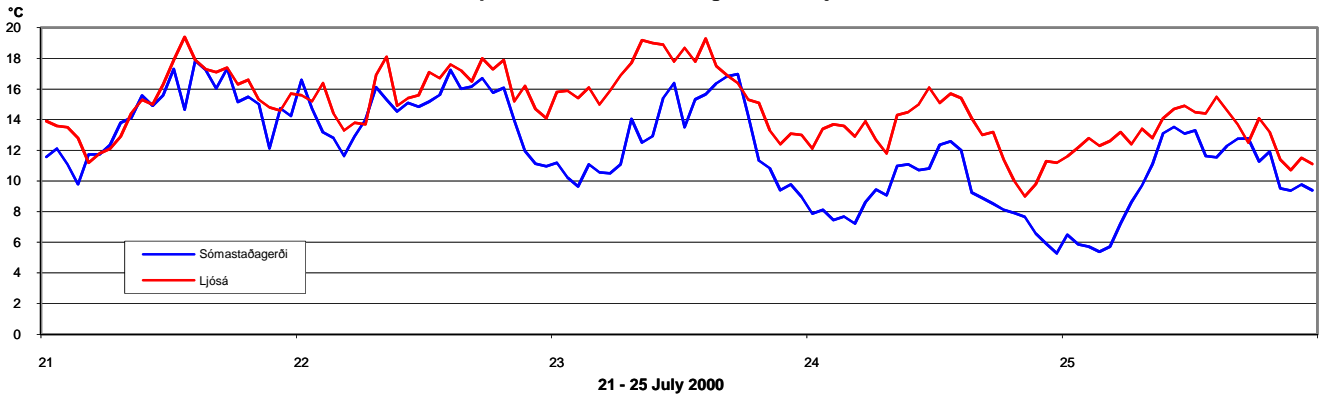
Temperature difference Oddskarð - Eskifjörður

June - August 2000

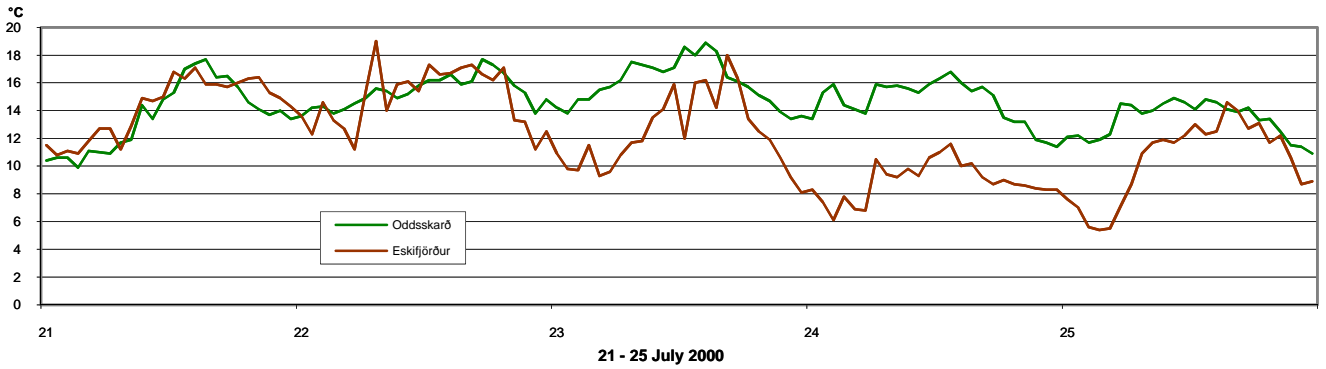


Examples of Difficult Dispersion Conditions in Reyðarfjörður during Summer 2000

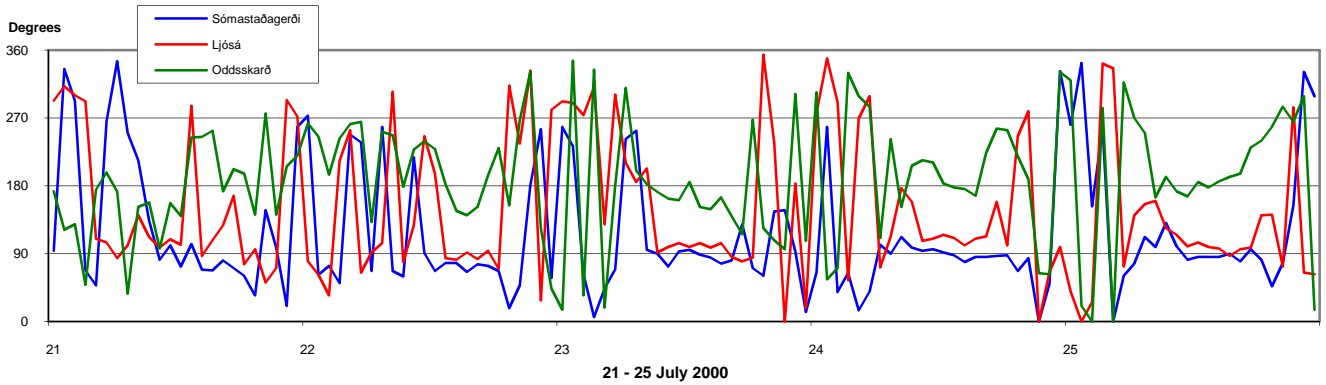
Air Temperature at Sómastaðagerði and Ljósá



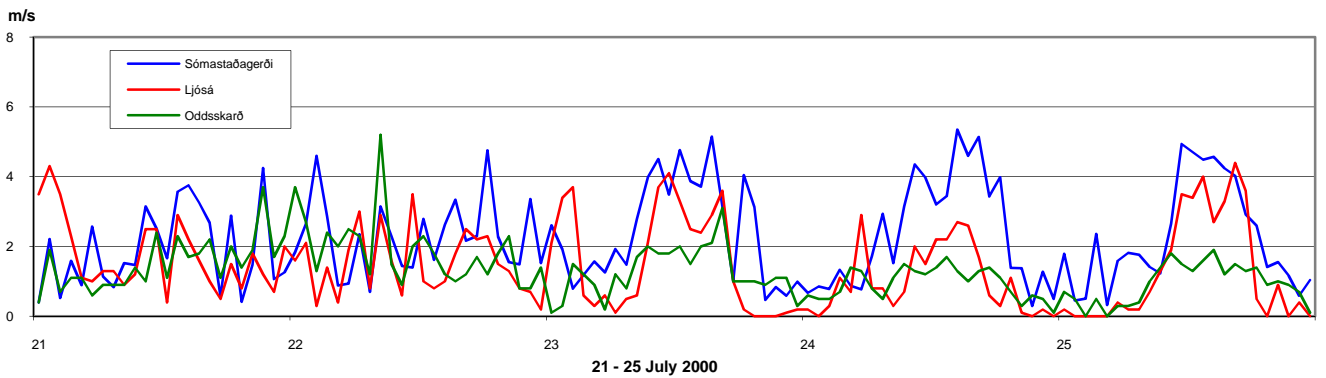
Air Temperature at Oddsskarð and Eskifjörður



Wind Direction at Sómastaðagerði, Ljósá and Oddsskarð



Wind Velocity at Sómastaðagerði, Ljósá and Oddsskarð



Examples of Difficult Dispersion Conditions in Reyðarfjörður during Summer 2000

