Additional Wind and Stability Observations at Sómastaðagerði in Reyðarfjörður IV

September 2000 – May 2001

Contents

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.

Four 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). The fourth Report, Additional Wind and Stability Observations at Sómastaðagerði III, covers the period May-August 2000 (Ref. 4). As the Report was required by Reyðarál already in September 2000, it covered a shorter period of time than the earlier ones. This Report, in addition to data from Sómastaðagerði, included results from three automatic wind and temperature observing stations, Vattarnes, Ljósá and Kollaleira 2, installed in Reyðarfjörður early in June 2000 in accordance with a contract with Reyðarál hf. Further it also included some data for the automatic stations Seley, Eskifjörður and Oddsskarð.

It should be mentioned that three earlier Reports issued by Veðurstofa Íslands also contain meteorological information for the Reyðarfjörður area (Ref. 5-7).

The present Report covers the period September 2000-May 2001 and in some cases the 12-month period June 2000-May 2001. The contracted observation program for Reyðarál hf. terminated at the end of May 2001. A new contract for continuation of the program for at least one additional year is under preparation.

Location of the observation sites and instrumentation has been the same as described in the previous Report (Ref. 4).

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

2. Wind Observations at Sómastaðagerði

The frequency of the wind directions at 10.3 m above the ground at Sómastaðagerði is presented in Table 1 for each of the months June 2000-May 2001 and as wind roses for the months September 2000-May 2001 in Annexes 1-3. The mean frequency of each wind direction for the 12-month period June 2000-May 2001 (year), for the 6-month period October 2000-March 2001 (winter half) and for the 6-month period June-September 2000 and April-May 2001 (summer half of the year) are also presented in Annex 3.

Table 1. Frequency of wind directions at Sómastaðagerði,
June 2000-May 2001, %.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
N	360	3,9	2,5	2,4	1,1	0,9	0,8	1,0	1,9	1,6	1,5	6,1	4,4	2,3
	10	1,7	1,2	1,5	1,3	0,8	0,5	1,0	1,2	0,9	1,3	2,3	1,6	1,3
	20	1,1	0,7	1,1	1,2	0,5	0,8	0,8	1,1	0,6	1,3	1,0	0,9	0,9
	30	1,5	0,9	0,8	1,0	0,8	1,0	1,3	1,1	0,7	1,3	1,3	0,9	1,1
	40	1,3	1,3	1,6	1,3	1,2	1,2	1,8	1,7	1,2	1,1	1,7	1,2	1,4
	50	2,0	2,1	2,9	1,4	1,8	2,1	3,4	2,9	2,1	2,2	1,9	1,7	2,2
	60	3,4	3,3	5,3	4,0	4,4	4,5	5,6	5,0	4,7	5,3	2,1	2,1	4,2
	70	4,4	4,5	4,7	5,1	8,3	8,8	10,1	9,0	10,4	7,6	1,7	3,0	6,5
	80	3,7	5,7	2,6	4,7	**9,9**	**15,9**	13,1	10,5	**11,0**	**7,8**	2,0	5,4	**7,7**
E	90	4,5	4,0	2,2	5,8	9,0	14,8	**14,8**	**10,6**	8,4	7,0	1,7	5,7	7,4
	100	4,6	2,8	1,5	4,2	6,1	7,7	5,8	6,1	6,0	3,9	1,4	2,7	4,4
	110	2,4	1,5	1,5	2,6	4,2	3,4	2,3	2,4	3,1	2,7	1,6	1,7	2,5
	120	1,3	0,5	1,3	3,5	2,2	3,3	2,2	1,9	1,4	2,2	1,6	1,0	1,9
	130	0,9	0,4	0,9	2,2	0,9	2,0	1,2	1,3	0,9	1,0	1,3	0,5	1,1
	140	0,5	0,4	0,7	1,1	0,7	0,9	1,0	1,1	0,4	0,8	0,4	0,3	0,7
	150	0,5	0,4	0,5	0,8	0,4	0,8	0,9	0,7	0,4	0,6	0,3	0,2	0,5
	160	0,7	0,3	0,3	0,4	0,3	0,4	0,5	0,6	0,5	0,3	0,2	0,1	0,4
	170	0,8	0,4	0,4	0,6	0,4	0,6	0,6	0,8	0,6	0,4	0,2	0,1	0,5
S	180	0,8	0,4	0,2	0,4	0,4	0,7	0,4	0,4	0,5	0,6	0,2	0,1	0,4
	190	1,2	0,5	0,4	0,4	0,3	0,5	0,4	0,5	0,4	0,4	0,2	0,2	0,5
	200	1,4	0,3	0,4	0,4	0,7	0,4	0,6	0,6	0,5	0,6	0,3	0,3	0,5
	210	1,6	0,7	0,5	0,6	1,1	0,5	0,7	0,9	0,5	1,0	0,7	0,3	0,8
	220	1,3	0,7	0,7	1,7	1,4	0,6	1,1	1,1	0,9	1,0	0,7	0,6	1,0
	230	1,7	1,1	1,5	4,5	2,2	1,0	1,4	1,9	1,3	1,6	1,6	0,7	1,7
	240	1,8	2,0	3,8	5,2	3,1	1,5	2,1	3,0	2,7	3,2	3,3	2,5	2,9
	250	3,6	3,1	5,5	5,7	5,3	3,1	2,7	3,7	4,0	5,9	6,1	4,3	4,4
	260	6,8	6,0	9,3	8,1	4,8	3,4	3,3	3,9	4,9	6,8	8,1	8,1	6,1
W	270	**7,7**	10,8	**14,4**	**9,1**	4,1	2,9	3,5	4,2	5,3	7,7	**9,5**	**12,0**	7,6
	280	7,6	**13,3**	10,3	6,3	3,4	3,0	2,1	2,9	5,3	6,9	8,2	9,1	6,5
	290	6,2	8,6	6,3	3,9	4,7	3,3	2,1	2,6	5,9	4,7	6,3	6,2	5,0
	300	4,8	5,2	2,8	1,9	3,7	2,1	2,2	2,0	2,2	2,5	4,5	4,6	3,2
	310	3,5	4,2	1,7	1,5	3,7	2,0	1,3	1,4	1,6	1,5	3,8	3,6	2,5
	320	2,5	3,1	1,5	1,6	2,1	1,2	1,0	1,4	2,1	1,4	4,3	3,4	2,1
	330	2,7	2,2	1,9	1,1	1,5	0,8	1,0	1,2	1,8	1,3	3,4	3,5	1,9
	340	1,9	2,0	2,2	0,9	1,3	0,8	1,1	1,6	1,5	1,1	3,1	2,9	1,7
	350	2,8	2,4	2,0	0,7	0,9	0,9	1,1	1,8	1,3	1,3	4,2	2,2	1,8
	Calm	0,6	0,6	2,3	3,8	2,5	1,8	4,5	5,1	2,1	2,3	2,7	1,7	2,5

Calm is in this report defined as a 10-minute wind speed below or equal to 0.2 m/s.
Bold letters in the table indicate the highest frequency values for each month.

As before, winds blowing inwards (E- and ENE-erly) and outwards in the fjord (W-erly) have by far had the highest frequency. During this 12-month period easterly winds have had the highest frequency during May-September, but westerly winds during November-April.

The average10-minute wind velocity at Sómastaðagerði for each of the months June 2000-May 2001 are presented in Table 2. For comparison, corresponding values are also presented for 6 other automatic stations in the Reyðarfjörður area, Ljósá, Kollaleira 2, Eskifjörður, Oddsskarð, Vattarnes and Seley.

Table 2. Average wind velocity at the 10 m height at Sómastaðagerði and at 6 other automatic weather stations in the Reyðarfjörður area, June 2000-May 2001, m/s.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Sómastaðagerði	4,8	6,8	4,5	3,9	3,9	4,0	2,9	2,8	4,2	4,0	4,2	4,8	4,2
Ljósá	4,7	7,2	3,7	3,4	3,5	3,4	2,5	2,5	4,4	4,2	3,5	4,2	3,9
Kollaleira 2	5,3	6,5	3,5	3,2	3,4	3,4	2,2	2,4	4,1	3,6	4,4	4,6	3,9
Eskifjörður	5,4	7,0	4,7	4,5	4,2	4,2	2,9	3,2	4,8	4,2	5,5	5,8	4,7
Oddsskarð	6,2	7,9	4,6	4,2	3,9	3,6	2,4	2,7	4,6	5,0	4,3	5,2	4,5
Vattarnes	6,9	8,8	7,0	5,5	5,5	4,6	4,7	4,0	5,7	6,1	7,7	7,4	6,2
Seley	9,9	9,4	7,0	6,7	6,4	5,6	6,9	5,1	6,6	7,1	8,5	8,6	7,3

The average wind velocity at Sómastaðagerði for the 12-month period June 2000-May 2001 was 4.2 m/s, the lowest monthly mean was 2.8 m/s in August and the highest one 6.8 m/s in February. The average yearly wind velocity was slightly lower at Kollaleira 2 and Ljósá, slightly higher at Eskifjörður and Oddsskarð but considerably higher at Vattarnes at the mouth of the fjord and especially at Seley a short distance outside the fjord.

The frequency of 10-minute wind velocity at Sómastaðagerði in selected velocity intervals is presented in Table 3 for each of the months June 2000-May 2001 as well as for the whole 12-month period.

Table 3. Frequency of 10-minute wind velocity for selected intervals, Sómastaðagerði, June 2000-May 2001, %.

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
Jan	8,2	15,1	12,6	11,0	10,2	57,1	34,3	8,4	0,3		
Feb	4,6	8,9	8,2	6,6	7,8	36,1	39,8	20,6	3,4		
Mar	11,4	15,0	14,4	13,0	11,1	64,9	25,7	8,0	1,4		
Apr	14,7	16,7	14,3	12,4	10,7	68,8	25,9	4,1	1,3		
May	12,7	15,7	16,1	12,7	11,7	68,9	26,6	3,7	0,5	0,4	
Jun	9,4	13,9	14,4	13,6	13,3	64,6	34,0	1,4			
Jul	19,2	20,6	15,9	13,7	13,3	82,6	17,3	0,1			
Aug	23,1	22,3	15,6	13,0	9,8	83,8	14,6	1,6			
Sep	12,3	17,7	11,8	9,7	8,9	60,4	35,6	4,0	0,1		
Oct	12,6	16,9	15,4	14,0	11,8	70,7	22,8	5,6	0,9		
Nov	13,0	15,6	16,6	12,5	10,4	68,0	23,3	7,5	1,2		
Dec	10,6	14,4	11,4	8,3	8,1	52,8	40,1	6,1	1,0		
Year	12,7	16,1	13,9	11,8	10,6	65,1	28,2	5,8	0,8		

As shown in the table above 28.8 % of all wind velocity observations during the year were below 2.0 m/s, 65.1 % below 5.0 m/s and 93.3 % below 10.0 m/s. For August corresponding figures were 45.4 %, 83.8 % and 98.4 %.

The highest 10-minute wind velocity observed at Sómastaðagerði during the 12-month observation period June 2000-May 2001 was 23.6 m/s on 31 May 2001, wind direction 291°. The highest recorded wind gust was 37.0 m/s on the same day. This gives a gust factor of 1.57.

The average wind velocity for each wind direction at Sómastaðagerði is presented in Table 4 as well as in the histograms in Annexes 1-3.

Table 4. Average wind velocity for each wind direction, Sómastaðagerði, June 2000-May 2001, m/s.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
360	6,8	7,5	2,6	2,5	3,3	2,3	1,1	4,5	3,9	4,0	**8,1**	**8,9**	**6,0**
10	3,5	5,5	2,4	3,1	1,0	1,8	1,1	1,6	1,8	2,7	3,9	4,9	3,1
20	1,7	1,6	2,3	2,0	1,2	1,3	1,0	1,0	1,5	1,2	1,6	1,8	1,5
30	1,7	1,6	1,9	1,7	1,5	1,5	1,0	1,0	1,3	1,3	1,5	1,2	1,1
40	2,3	2,1	1,9	1,6	1,9	1,6	1,2	1,1	1,7	1,9	2,2	1,6	2,0
50	3,0	3,2	3,0	2,6	2,0	1,9	1,7	2,0	2,3	2,5	1,8	2,2	2,4
60	4,6	4,9	4,8	4,3	3,4	2,6	2,2	2,7	3,8	3,5	2,6	3,4	3,6
70	5,1	6,3	5,8	4,0	4,0	4,0	3,3	3,7	5,2	4,2	3,9	5,5	4,4
80	6,4	8,4	5,6	4,7	4,0	4,4	3,9	3,1	5,3	5,7	5,6	7,6	5,0
90	8,5	**9,5**	**6,5**	4,9	3,9	3,9	3,6	3,0	5,1	**6,9**	5,4	7,9	5,0
100	8,7	8,4	5,9	4,0	3,6	3,8	2,8	2,8	5,0	5,4	5,1	6,2	4,8
110	**9,5**	6,5	4,7	4,1	3,0	3,5	1,8	1,9	5,2	4,5	4,2	4,8	4,4
120	7,7	4,2	3,9	5,4	2,4	3,8	1,7	1,6	3,5	4,1	5,2	6,0	3,8
130	7,1	3,1	3,7	3,9	1,7	3,8	1,4	1,2	2,8	3,1	4,9	4,0	3,5
140	5,0	2,9	3,9	2,5	1,7	3,1	1,0	1,1	2,3	2,9	3,5	1,7	2,5
150	3,9	4,3	2,6	2,3	2,2	2,6	1,4	1,0	1,8	3,2	2,0	1,9	2,4
160	4,7	5,3	1,9	2,1	1,7	2,1	1,1	1,0	2,5	3,4	2,1	2,0	2,7
170	4,8	4,9	1,4	2,8	1,9	3,5	1,3	1,1	3,1	3,1	2,0	1,0	2,9
180	5,0	5,0	1,1	1,7	2,1	4,0	1,4	1,3	2,5	3,6	1,6	1,7	3,2
190	5,4	5,7	1,6	2,1	2,8	3,9	1,6	1,7	2,4	2,9	1,0	1,6	3,1
200	6,4	4,9	1,7	1,7	3,8	3,1	1,9	2,0	2,2	3,8	1,4	1,2	3,3
210	5,9	4,9	1,6	1,9	3,9	2,9	2,1	2,4	1,5	4,4	1,8	1,9	3,6
220	5,4	4,2	1,9	2,2	2,7	1,9	2,3	1,9	1,9	2,7	2,9	2,7	2,8
230	3,6	3,5	2,3	2,3	2,6	2,8	1,5	1,8	1,9	2,8	2,4	2,5	2,3
240	2,8	4,2	2,5	2,8	2,7	3,5	2,4	2,3	2,1	2,2	2,3	3,4	2,9
250	3,5	5,5	3,3	3,8	3,0	5,6	3,0	2,2	3,1	2,5	3,2	3,7	3,6
260	4,3	6,9	5,2	4,3	3,9	5,0	3,7	2,6	3,4	3,4	4,0	4,5	4,4
270	4,7	8,4	5,8	5,3	3,7	5,6	4,2	3,4	4,3	4,4	4,5	5,5	5,2
280	4,4	8,6	6,0	5,4	5,1	5,9	**4,8**	3,6	5,2	4,9	4,4	4,7	5,5
290	4,0	7,5	6,3	**6,3**	**8,0**	**6,1**	4,7	**5,3**	**7,1**	5,7	4,2	4,4	5,8
300	3,6	6,3	4,3	4,4	7,3	5,6	4,5	4,2	4,5	3,3	4,2	4,0	4,8
310	3,4	5,6	3,9	5,6	7,4	5,3	4,1	3,0	3,5	2,6	3,7	3,7	4,4
320	2,7	5,3	2,6	4,7	7,0	3,5	3,4	3,5	4,0	1,9	5,0	3,5	4,0
330	2,7	4,9	3,8	2,7	6,6	3,3	2,6	4,1	3,9	1,6	5,1	4,5	4,0
340	2,5	5,7	3,5	1,7	3,9	3,0	3,0	4,1	3,4	1,7	5,3	4,6	3,8
350	4,5	5,7	3,8	2,5	2,9	3,5	4,0	4,6	3,6	1,9	7,5	4,1	4,6

For each month the highest averages in the table are indicated with bold letters.

The distribution of 10-minute wind velocity at Sómastaðagerði during the 12-month period June 2000-May 2001 is shown in Fig. 2.

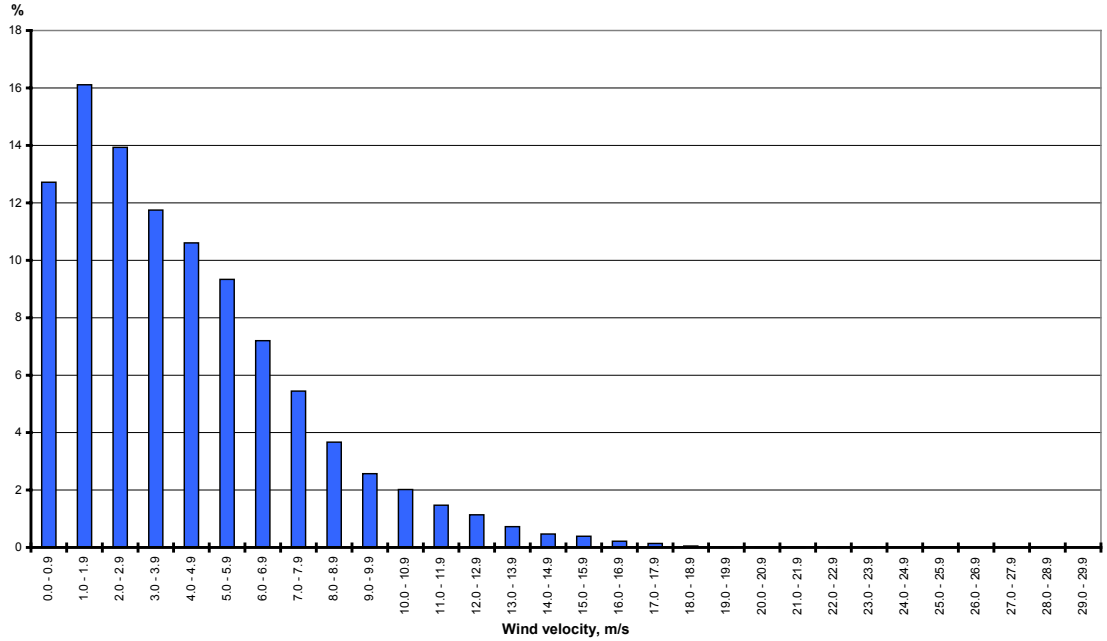

Fig. 2. Wind velocity distribution at Sómastaðagerði, 10-minute means, June 2000-May 2001, %.

For comparison the corresponding wind velocity distribution for Seley is shown in Fig. 3.

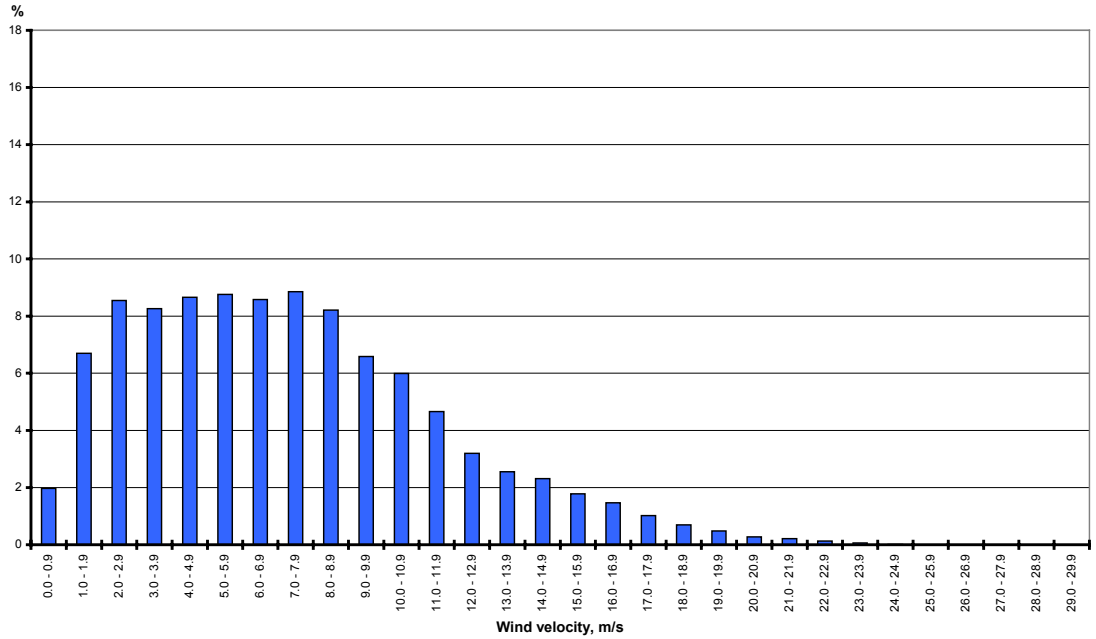

Fig. 3. Wind velocity distribution at Seley, 10-minute means, June 2000-May 2001, %.

3. Air Temperature and Stability Observations at Sómastaðagerði

The monthly average temperature at 3.0 m, 10.5 m and 36.5 m above the ground at Sómastaðagerði is presented in Table 5 for the months June 2000-May 2001 as well as for the whole year June 2000-May 2001. As no new thermometer calibrations have been made the same thermometer corrections have been used as reported in the previous Report (Ref. 4), i.e. +0.3° C at 3.0 m height and +0.1° C at the 10.5 and 36.5 m levels.

Table 5. Monthly average temperature at the 3.0 m, 10.5 m and 36.5 m levels at Sómastaðagerði and average temperature difference between the 36.5 m level and the 3.0 m and 10.5 m levels, June 2000-May 2001, °C.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Sómastaðagerði$_{3.0}$	2,79	0,52	-1,47	1,64	5,76	6,24	10,02	9,96	8,26	5,25	2,22	0,81	4,14
Sómastaðagerði$_{10.5}$	3,06	0,64	-1,45	1,60	5,62	6,28	10,03	10,09	8,25	5,33	2,41	0,95	4,35
Sómastaðagerði$_{36.5}$	3,17	0,64	-1,48	1,56	5,52	6,07	9,99	10,09	8,24	5,33	2,47	0,99	4,34
$T_{36.5} - T_{3.0}$	0,38	0,12	-0,01	-0,08	-0,24	-0,17	-0,03	0,13	-0,02	0,08	0,25	0,18	0,20
$T_{36.5} - T_{10.5}$	0,11	0,00	-0,03	-0,04	-0,10	-0,21	-0,04	0,00	-0,01	0,00	0,06	0,04	-0,01

Due to the small difference in height between the thermometer levels the averages in the table are given with two decimals. However, it should be pointed out that the second decimal is uncertain due to uncertain thermometer corrections.

The temperature difference between the 36.5 m and 3.0 m levels and the 36.5 and 10.5 m levels in the mast at Sómastaðagerði are also presented for each day of the months September 2000-May 2001 in Annexes 4-8. 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. There are 144 observations per day. We note how frequently the lowest air layer at Sómastaðagerði is stable during the winter months as well as during the night at other times of the year.

For the month of May 2001 the diurnal variation of the mean temperature difference between the observation levels in the mast is shown in the lower part of Annex 8. As noted before, the lowest air layer is on average stable during the night and late evening.

4. Monthly Mean Temperature at Sómastaðagerði, Ljósá, Kollaleira, Kollaleira 2, Vattarnes, Eskifjörður and Oddsskarð

The monthly mean temperature at 3.0 m above the ground at Sómastaðagerði and at 2.0 m above the ground at six other weather stations in the Reyðarfjörður area are presented for the period June 2000-May 2001 in Table 6.

Table 6. Monthly mean temperature at weather stations in the Reyðarfjörður area, °C June 2000-May 2001.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Sómastaðagerði$_{3.0}$	2,8	0,5	-1,5	1,6	5,8	6,2	10,0	10,0	8,3	5,2	2,2	0,8	4,1
Kollaleira	2,3	-0,2	-2,0	1,2	6,1	7,3	11,0	10,5	8,2	5,0	1,8	0,2	4,3
Kollaleira 2	2,1	-0,1	-2,1	1,2	5,8	7,1	10,6	10,3	8,1	4,8	1,5	0,1	4,1
Ljósá	1,4	-1,4	-3,2	0,2	4,4	5,5	10,0	9,9	7,1	3,7	0,6	-0,9	3,1
Vattarnes	3,1	1,2	-0,7	1,6	4,8	5,5	8,6	9,4	8,1	5,8	3,2	1,7	4,4
Eskifjörður	2,5	0,4	-1,5	1,7	5,4	6,4	10,0	10,0	8,2	5,3	2,0	0,8	4,3
Oddsskarð	-0,7	-3,4	-5,1	-1,6	2,4	3,4	8,7	8,7	5,5	1,9	-1,2	-2,8	1,4

Attention is drawn to the different height of the ground level at the stations. The approximate elevations are: Oddsskarð 520 m above mean sea level, Ljósá 280 m, Kollaleira 41 m, Kollaleira 2 43 m, Sómastaðagerði 32 m, Vattarnes 6 m and Eskifjörður 2 m.

During the winter months, October-March, Vattarnes has had the highest mean temperatures, but during the summer months May-August the means at Vattarnes are lower than at the other lowland stations in Reyðarfjörður.

5. Wind Observations at Ljósá, Kollaleira 2, Vattarnes and Seley

For the months September 2000-May 2001 the frequency of the wind directions and the average wind speed in each direction is presented for Ljósá in Annexes 9-11, for Kollaleira 2 in Annexes 12-14, for Vattarnes in Annexes 15-17 and for Seley in Annexes 18-20. For each station information is also provided for the 12-month period June 2000-May 2001 and the two six-month periods October 2000-March 2001 (winter) and June-September 2000 and April-May 2001 (summer).

Attention is drawn to the great difference between the wind roses for Sómastaðagerði and Ljósá on the one hand and for Vattarnes and Seley on the other hand. The high frequency of easterly winds at Sómastaðagerði and Ljósá during the summer half of the year is in contrast to the low frequency at Seley and Vattarnes at the mouth of the fjord. To uphold the frequent easterly winds in the inner part of Reyðarfjörður air must be descending over the outer part of the fjord. Accordingly the sea and land breeze circulation largely appears to be an infjord phenomenon in Reyðarfjörður.

Attention is also drawn to the greater frequency of easterly winds and the lower frequency of westerly winds at Ljósá than at Sómastaðagerði, especially during the winter, indicating that the cold westerly outflow is often not very thick in Reyðarfjörður. At Ljósá easterly winds are most common, at Vattarnes west-northwesterly winds and at Seley north-northeasterly winds are most frequent, especially during the winter.

Finally we draw attention to the frequency of calm, here defined as a 10-minute wind speed below or equal to 0.2 m/s (in accordance with speed values expressed in tables for the Beaufort Scale of Wind). The reported 12-month frequency is high at Ljósá and Kollaleira 2, respectively 11.8 and 8.9 %. At Eskifjörður the value is 2.9 % and

at Sómasstaðagerði 2.5 %. At the mouth of Reyðarfjörður, at Vattarnes and Seley, the frequency of calm is still lover, respectively 0.9 and 0.2 % for the period June 2000-May 2001.

6. Air Temperature Difference Kollaleira 2-Vattarnes

As seen in table 6 the monthly mean air temperature is higher at Vattarnes than at the lowland stations inside Reyðarfjörður during the winter months October-March, but lower during the summer months May-August.

The air temperature difference Kollaleira 2-Vattarnes is also presented from day to day in graphical form in Annexes 21-24. During the summer the diurnal temperature variation is much greater at infjord stations as Kollaleira than at stations as Vattarnes located on a small peninsula extending into the ocean. The influence of this on the air temperature difference between Kollaleira 2 and Vattarnes is clearly seen by the large and semiregular diurnal variations shown in Annex 21 for the months June-August 2000. This quite considerable temperature difference, ranging on some days in June and July from approx. +8 to –2 °C, is the driving force for the sea and land breeze circulation in Reyðarfjörður during the summer.

7. Simultaneous Observations of Wind Direction and Wind Velocity at Sómastaðagerði and Ljósá, and of the Temperature Difference Ljósá-Sómastaðagerði and Oddsskarð-Eskifjörður, June 2000-May 2001

For each month of the 12-month period June 2000-May 2001 simultaneous observations of wind direction and wind velocity at Sómastaðagerði and Ljósá and of the air temperature difference Ljósá-Sómastaðagerði and Oddsskarð-Eskifjörður are presented in graphical form in Annexes 25-36. The purpose of these Annexes is to present an overview of the meteorological factors that mainly would influence dispersion of pollutants from an aluminium smelter at Sómastaðagerði. Three diagrams are presented in each of these Annexes. The first one shows simultaneous wind directions at Sómastaðagerði and Ljósá, the second corresponding values of wind velocity at these stations, and the third one corresponding values of the temperature difference between Ljósá and Sómastaðagerði on the one hand and Oddsskarð and Eskifjörður on the other.

The most unfavorable dispersion conditions in Reyðarfjörður occur probably in very light and variable winds, conditions mainly occurring at night during the summer half of the year, when the air frequently is stable. Due to the variable wind directions the same air may pass several times over the smelter and Búðareyri during one night. Some examples of three days periods with light and variable winds are presented in Annexes 37 and 38.

During sea breeze the wind direction is usually the same at Sómastaðagerði and Ljósá, indicating that the easterly winds reach higher than the station Ljósá. The westerly winds needed for closing the sea and land breeze circulation seem usually to be higher than approx. 500 m a.s.l. (The approx. elevation of Oddsskarð).

On the other hand several periods show westerly winds at Sómastaðagerði with easterly winds blowing at Ljósá, 250 m higher up. Such episodes occurred for instance in October 2000. Examples of these and other types of infjord circulation are presented in Annex 39.

At Sómastaðagerði westerly winds are very common in winter and during the night in summer. These winds will be favorable for blowing polluted air from the planned aluminium smelter out to sea. However, during the early morning in summer the wind usually turns from westerly to easterly and a limited amount of polluted air can then pass again over the smelter, receiving an additional amount of pollutants. During the early morning in summer the lowest air layer usually also turns from stable to unstable condition and fumigation can then occur. For a short spell of time polluted air is then brought down to the ground by vertical mixing.

As seen in Annexes 25-36 positive temperature difference Ljósá-Sómastaðagerði usually coincides in time with positive temperature difference Oddsskarð-Eskifjörður. The graphs indicate that ground based temperature inversions are frequent in Reyðarfjörður and the inversion layers often reach from the sea level to a level higher than Ljósá or Oddsskarð. For the months July-September 2000 the vertical temperature difference per 100 m height difference is shown for the two station pairs in Annex 40.

8. Remarks

From 1 May 1998 the Icelandic Meteorological Office has made wind, temperature and stability observations at Sómastaðagerði in Reyðarfjörður to provide meteorological data as 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 were added for further clarification of the meteorological conditions in the fjord (See Fig. 1). The present report together with the previous report (Ref.4) contains data for all these stations. Observations from other automatic stations in the Reyðarfjörður area have also been used. Important knowledge has been obtained on the general wind and temperature climate of Reyðarfjörður and on the possible circulation of air inside the fjord. .

Dispersion calculations have been carried out by the Norwegian Institute for Air Research (NILU), Kjeller, Norway (Ref. 8).

All observation data from the present observation network in Reyðarfjörður are stored in the computerized data base of the Icelandic Meteorological Office and can be obtained and used for further calculations as needed.

9. Stutt yfirlit á íslensku (Short Summary in Icelandic)

Vegna ráðagerða um álver í Reyðarfirði hefur Veðurstofa Íslands frá 1. maí 1998 annast mælingar á vindátt, vindhraða, lofthita og stöðugleika lofts í 38 m háu mastri að Sómastaðagerði í Reyðarfirði. Í byrjun júní 2000 voru til viðbótar settar upp sjálfvirkar veðurstöðvar sem mæla vindátt, vindhraða og lofthita, að Kollaleiru við

botn fjarðarins (Kollaleira 2), Vattarnesi við mynni hans og að Ljósá í 280 m hæð yfir sjó á hjalla í fjallshlíðinni ofan við Sómastaðagerði.

Greinargerð þessi nær sumpart til 12 mánaða tímabilsins júní 2000-maí 2001, en sumpart til 9 mánaðanna september 2000-maí 2001. Niðurstöður eldri mælinga í Sómastaðagerði og á öðrum stöðum á Reyðarfjarðarsvæðinu er að finna í fyrri skýrslum Veðurstofunnar (Ref. 1-7).

Fyrsti kafli greinargerðarinnar er inngangur. Fjallað er um vindmælingar í Sómastaðagerði í 2. kafla hennar og vindrósir eru birtar í fylgisskjölum 1-3. Gerð er grein fyrir mælingum á stöðugleika lofts í Sómastaðagerði í 3. kafla og fylgiskjölum 4-8. Í kafla 4 eru birt meðaltöl fyrir lofthita mánaðanna á 7 veðurstöðvum á Reyðarfjarðarsvæðinu. Í kafla 5 og fylgiskjölum 9-20 er svo gerð grein fyrir vindmælingum á sjálfvirku veðurstöðvunum Ljósá, Kollaleiru 2, Vattarnesi og Seley. Í 6. kafla og fylgiskjölum 21-24 er fjallað um mismun á lofthita á Kollaleiru og Vattarnesi, en segja má að hann sé drifkraftur haf- og landgolu í Reyðarfirði. Í kafla 7 og fylgiskjölum 25-40 er gerð grein fyrir samtíma mælingum á vindátt og vindhraða á veðurstöðvunum Sómastaðagerði og Ljósá og ennfremur fyrir hitamismun, annars vegar milli stöðvanna Ljósár og Sómastaðagerðis, hins vegar milli Oddsskarðs og Eskifjarðar. Loks er í kafla 8 greint frá því að tilgangur hinna umfangsmiklu veðurathugana sem gerðar hafa verið í Reyðarfirði sé einkum að skapa grundvöll til að reikna dreifingarspár fyrir loftmengun frá ráðgerðu álveri. Slíkir útreikningar hafa verið gerðir af norskri stofnun með mikla reynslu á þessu sviði, Norsk institutt for luftforskning, NILU (Ref. 8). Jafnframt hafa safnast mikilsverðar almennar upplýsinga um veðurfar í Reyðarfirði.

10. 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.

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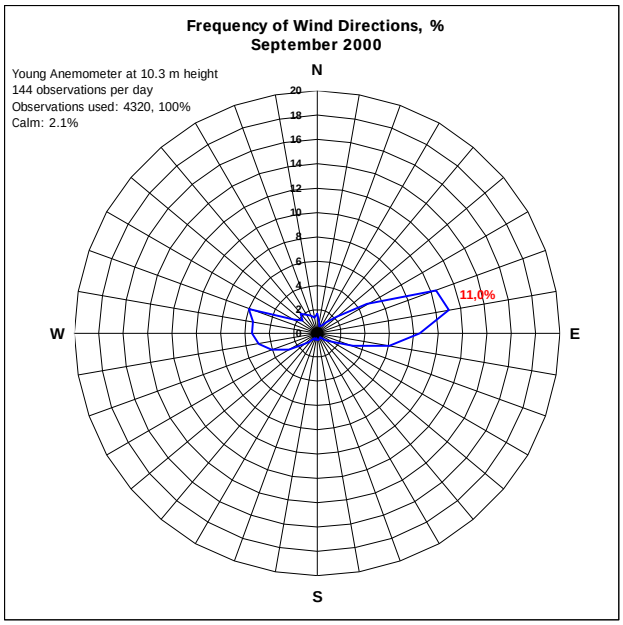
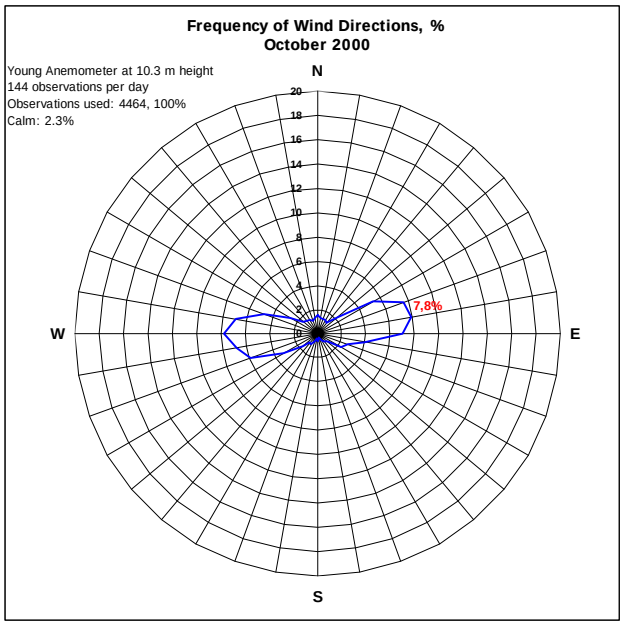
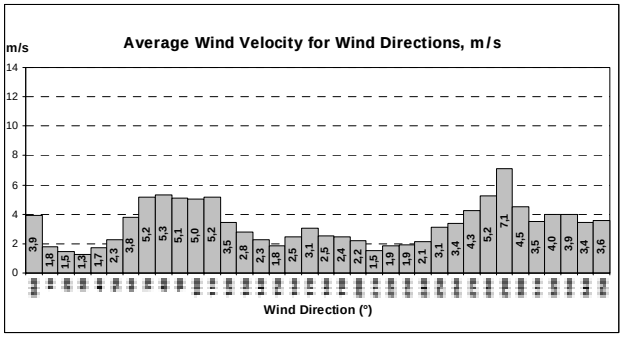
8. Cristina Guerreiro, Herdis Laupsa and Svein Knudsen: Impact Assessment for emissions from a planned aluminium smelter in Reyðarfjörður, Iceland. NILU: OR 25/2001. Ref. O-100084. Kjeller, Norway, May 2001, 132 p.


Frequency of Wind Directions, %
September 2000
Young Anemometer at 10.3 m height
144 observations per day
Observations used: 4320, 100%
Calm: 2.1%
N
W
E
S
11,0%


Frequency of Wind Directions, %
October 2000
Young Anemometer at 10.3 m height
144 observations per day
Observations used: 4464, 100%
Calm: 2.3%
N
W
E
S
7,8%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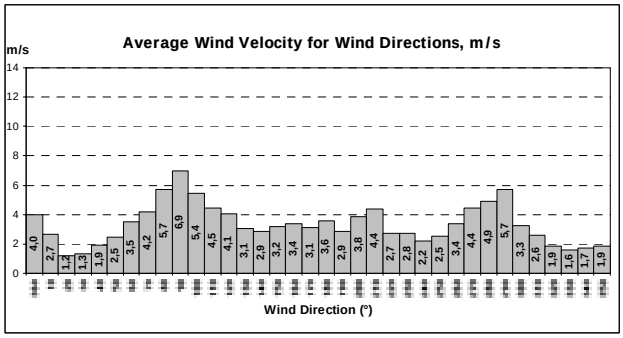
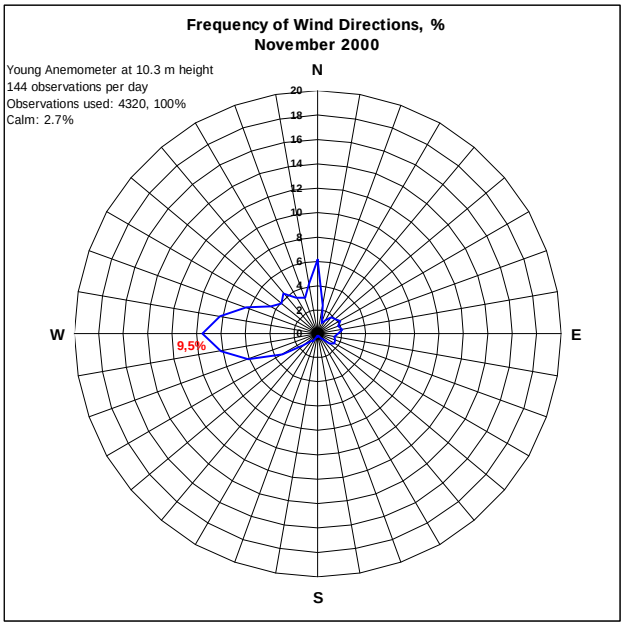
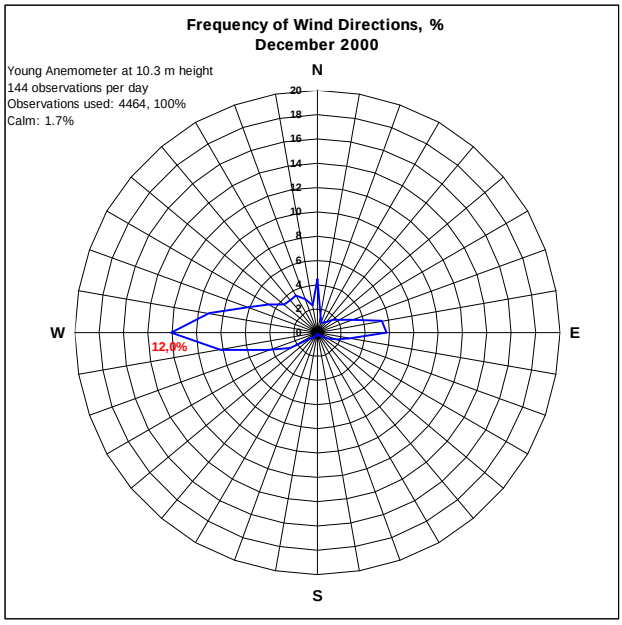
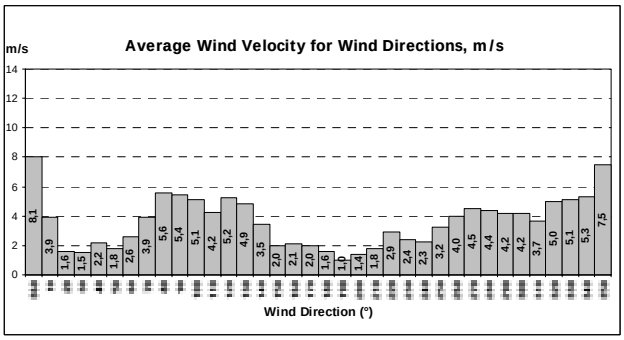
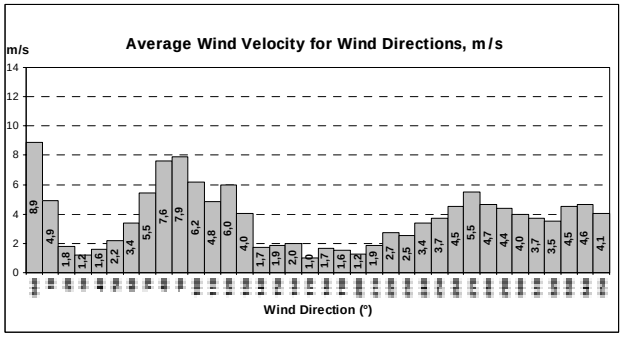
m/s
Wind Direction (°)


Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)


Frequency of Wind Directions, %
November 2000
Young Anemometer at 10.3 m height
144 observations per day
Observations used: 4320, 100%
Calm: 2.7%
N
W
E
S
9,5%


Frequency of Wind Directions, %
December 2000
Young Anemometer at 10.3 m height
144 observations per day
Observations used: 4464, 100%
Calm: 1.7%
N
W
E
S
12,0%


Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)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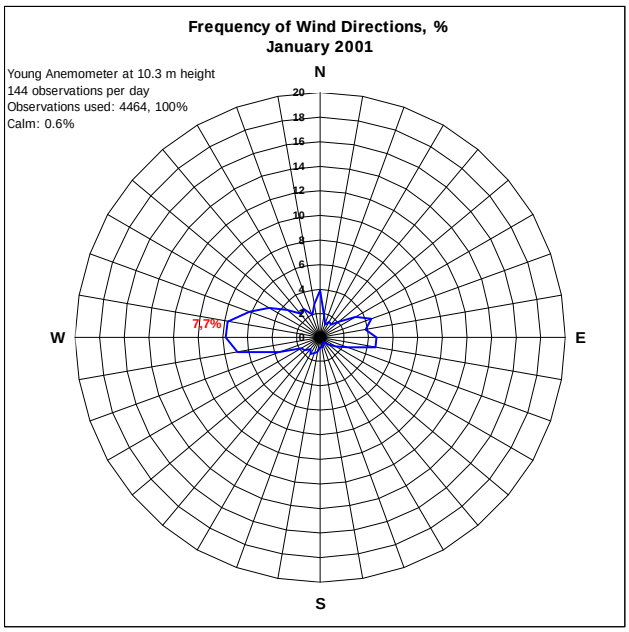
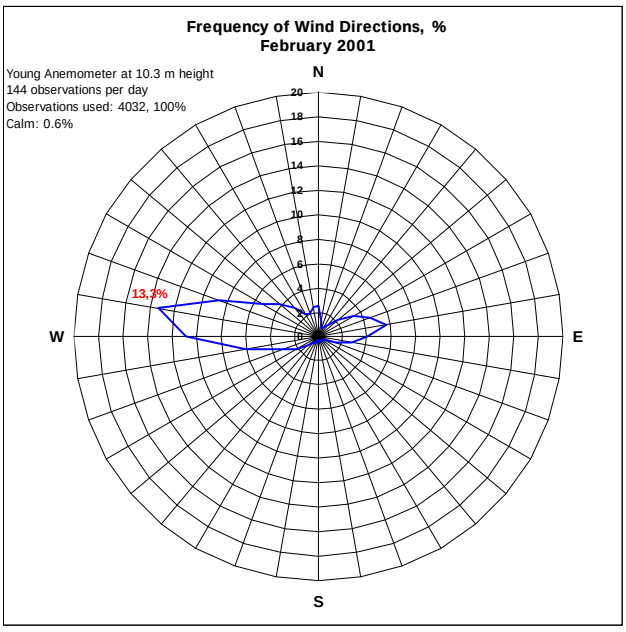
m/s
Wind Direction (°)


Frequency of Wind Directions, %
January 2001
Young Anemometer at 10.3 m height
144 observations per day
Observations used: 4464, 100%
Calm: 0.6%
N
W
E
S
7,7%


Frequency of Wind Directions, %
February 2001
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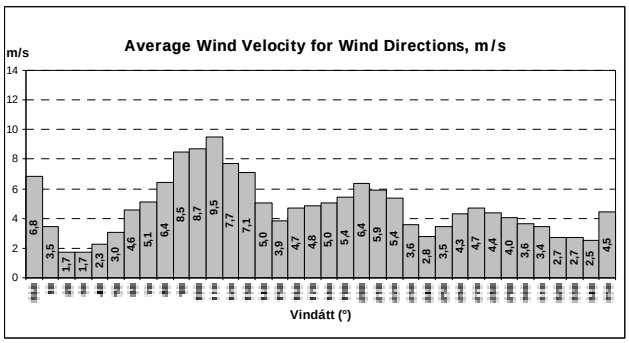
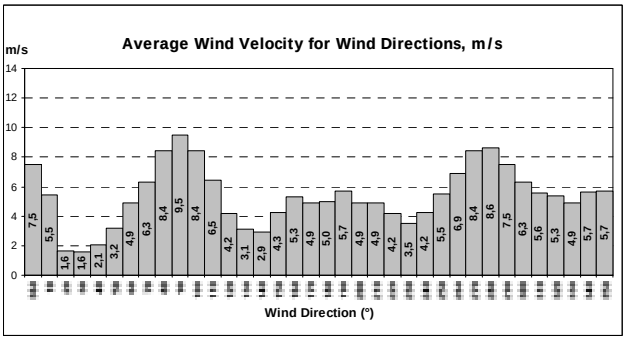
Observations used: 4032, 100%
Calm: 0.6%
N
W
E
S
13,3%


Average Wind Velocity for Wind Directions, m/s
m/s
Vindátt (°)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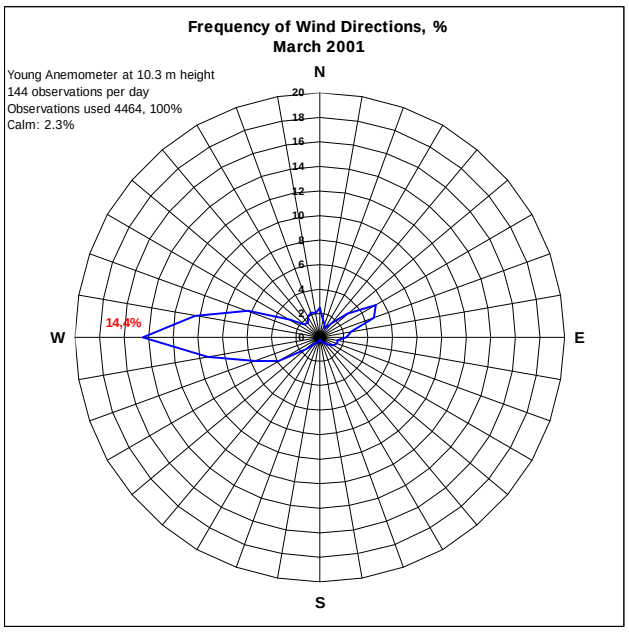
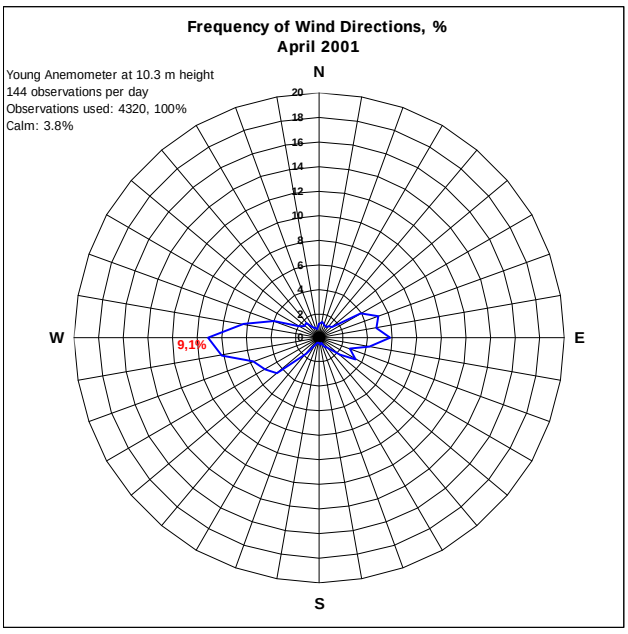
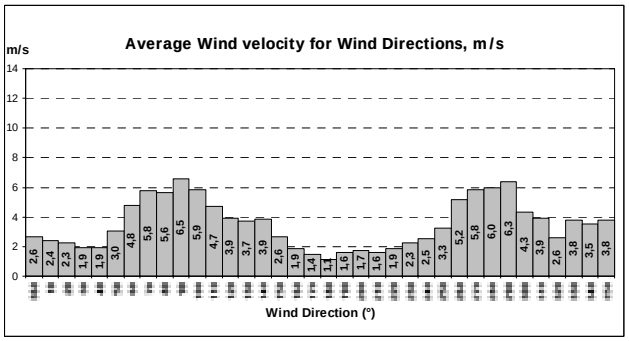
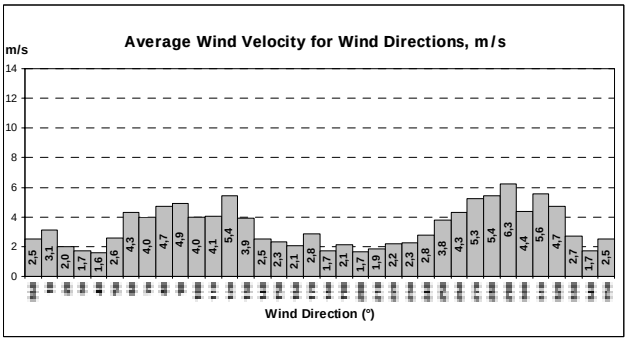
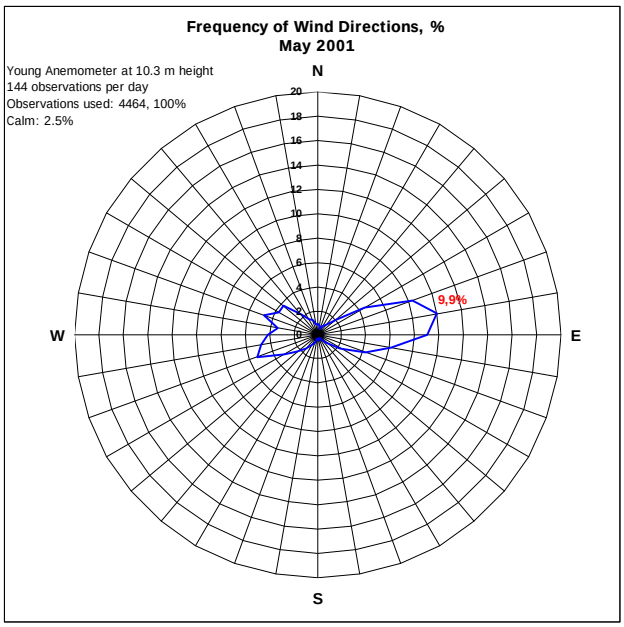
m/s
Wind Direction (°)

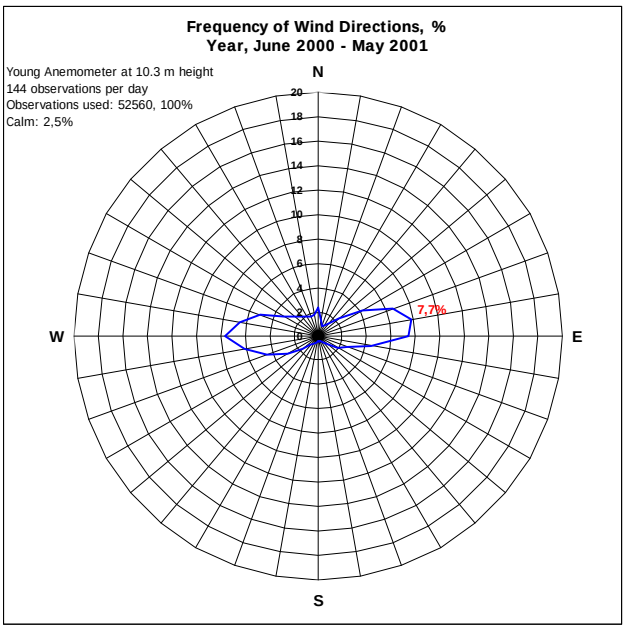

Frequency of Wind Directions, %
March 2001
Young Anemometer at 10.3 m height
144 observations per day
Observations used 4464, 100%
Calm: 2.3%
N
W
E
S
14,4%

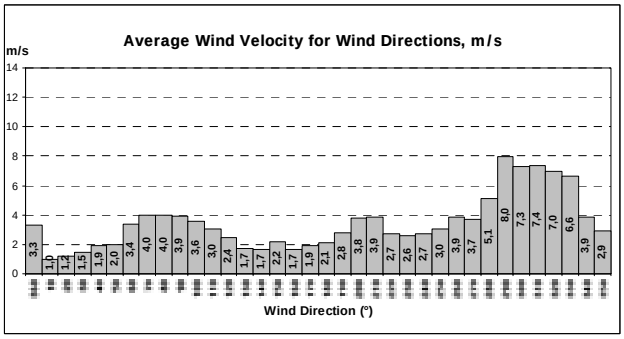

Frequency of Wind Directions, %
April 2001
Young Anemometer at 10.3 m height
144 observations per day
Observations used: 4320, 100%
Calm: 3.8%
N
W
E
S
9,1%

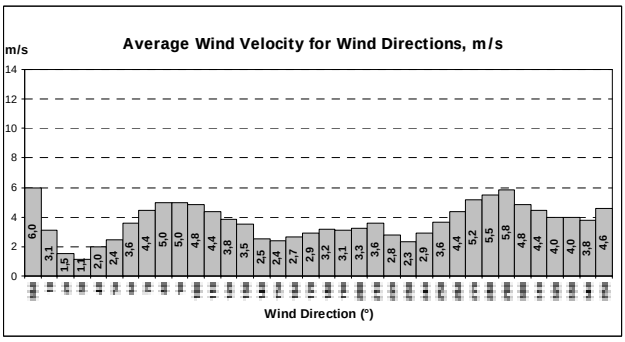

Average Wind velocity for Wind Directions, m/s
m/s
Wind Direction (°)

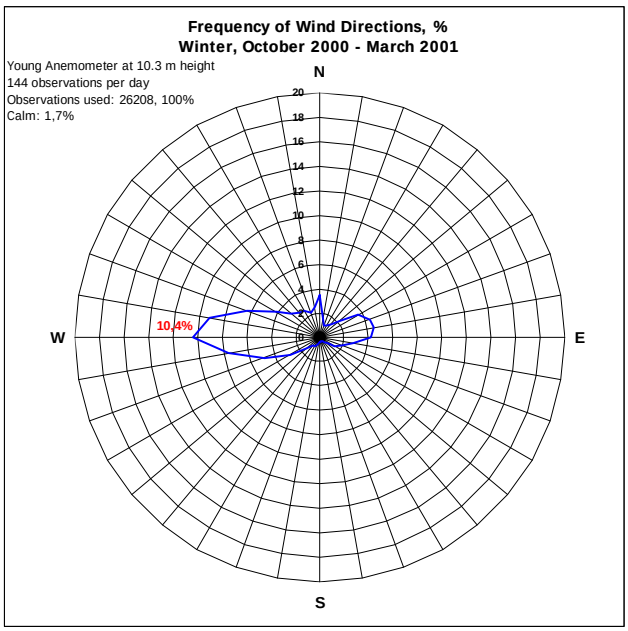

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

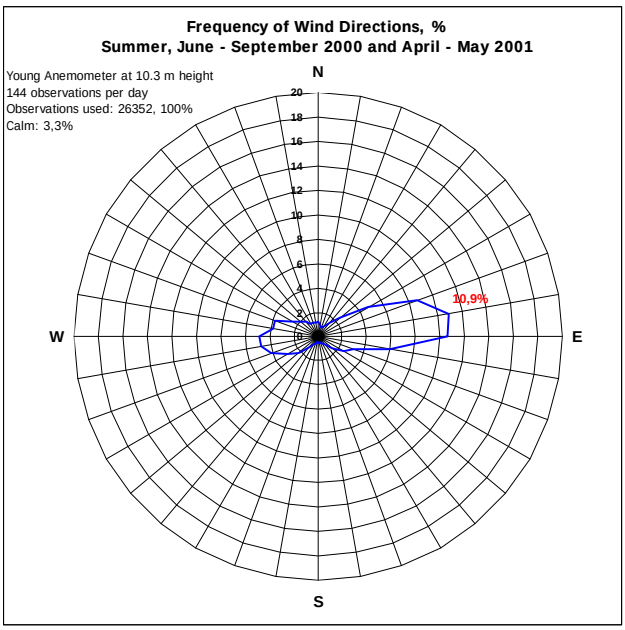

Frequency of Wind Directions, %
May 2001
Young Anemometer at 10.3 m height
144 observations per day
Observations used: 4464, 100%
Calm: 2.5%
N
W
E
S
9,9%

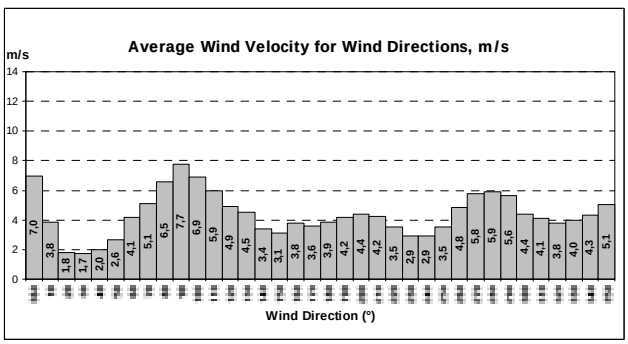

Frequency of Wind Directions, %
Year, June 2000 - May 2001
Young Anemometer at 10.3 m height
144 observations per day
Observations used: 52560, 100%
Calm: 2,5%
N
W
E
S
7,7%

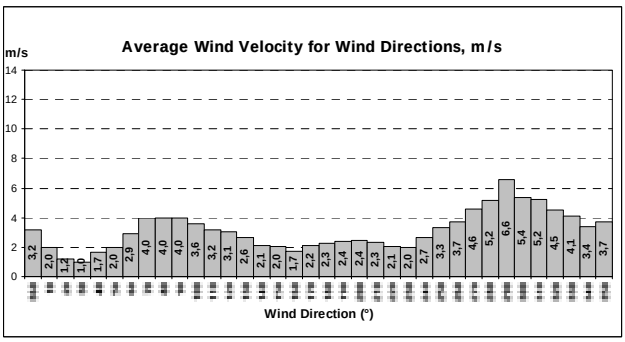

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)


Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

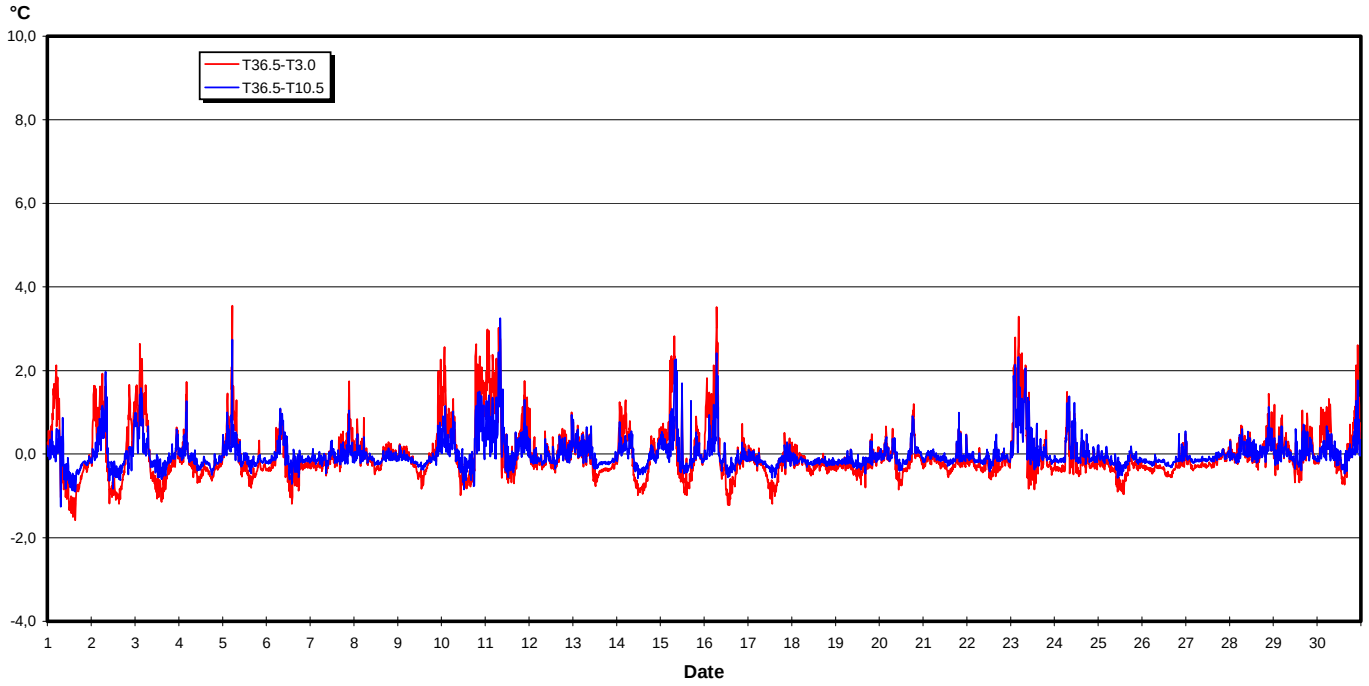

Frequency of Wind Directions, %
Winter, October 2000 - March 2001
Young Anemometer at 10.3 m height
144 observations per day
Observations used: 26208, 100%
Calm: 1,7%
N
W
E
S
10,4%


Frequency of Wind Directions, %
Summer, June - September 2000 and April - May 2001
Young Anemometer at 10.3 m height
144 observations per day
Observations used: 26352, 100%
Calm: 3,3%
N
W
E
S
10,9%

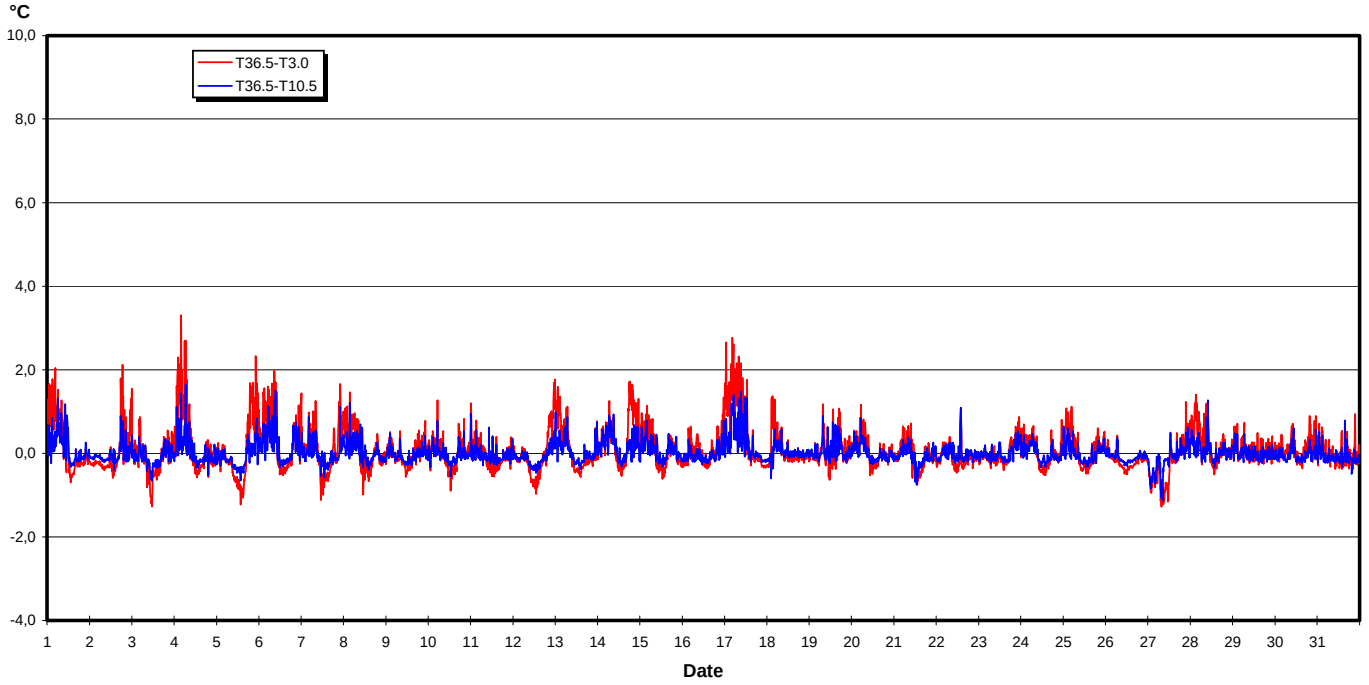

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)


Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

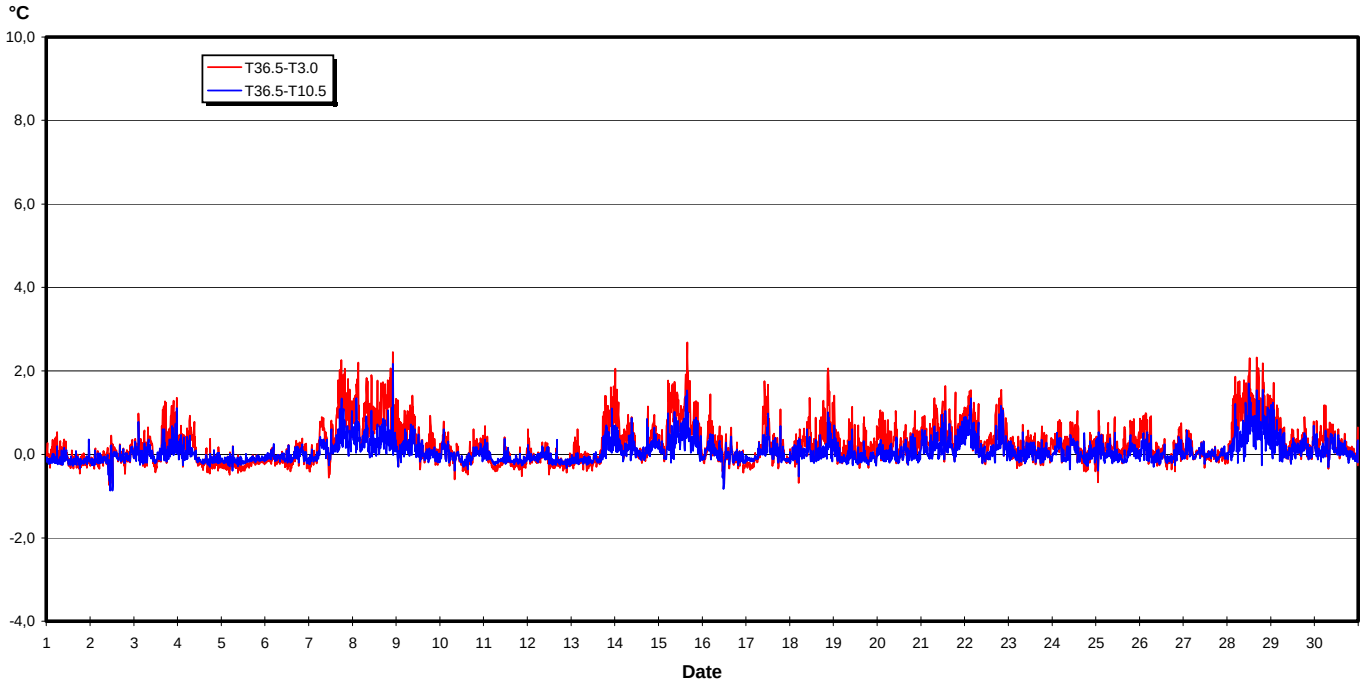
Sómastaðageröi
Vertical Temperature Gradient, °C
September 2000



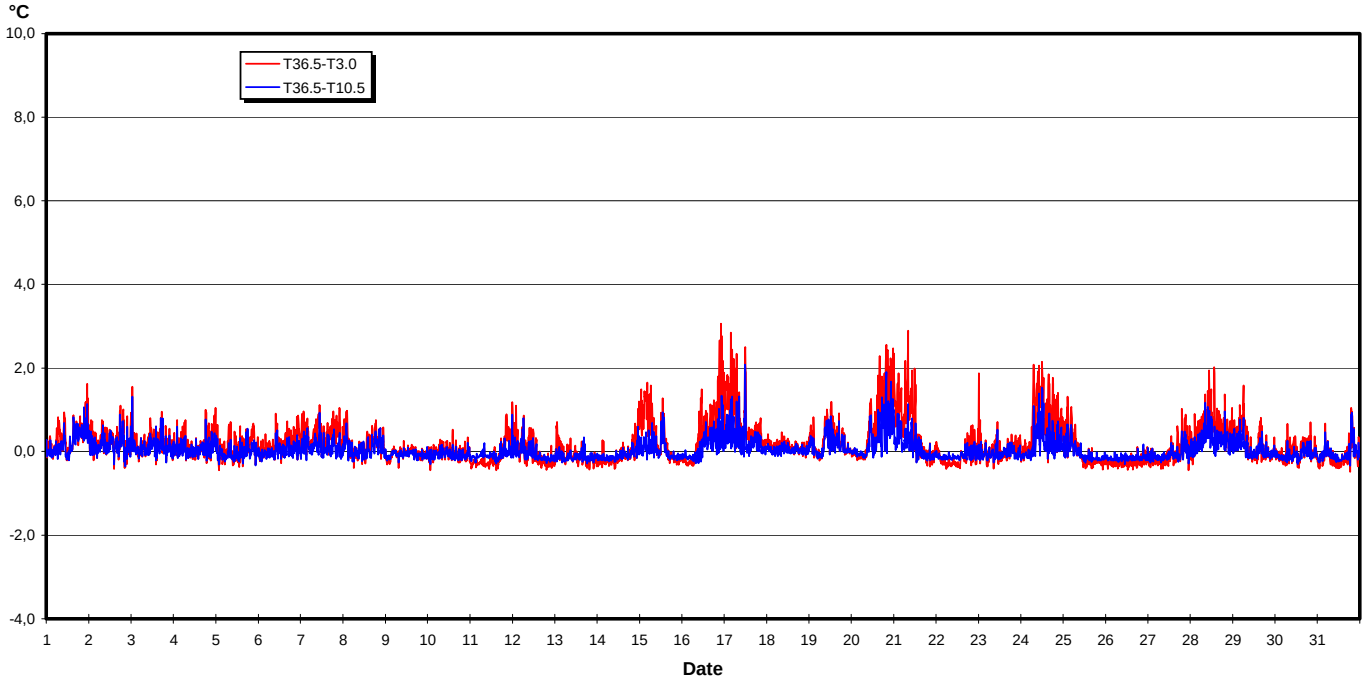
Sómastaðageröi
Vertical Temperature Gradient, °C
October 2000



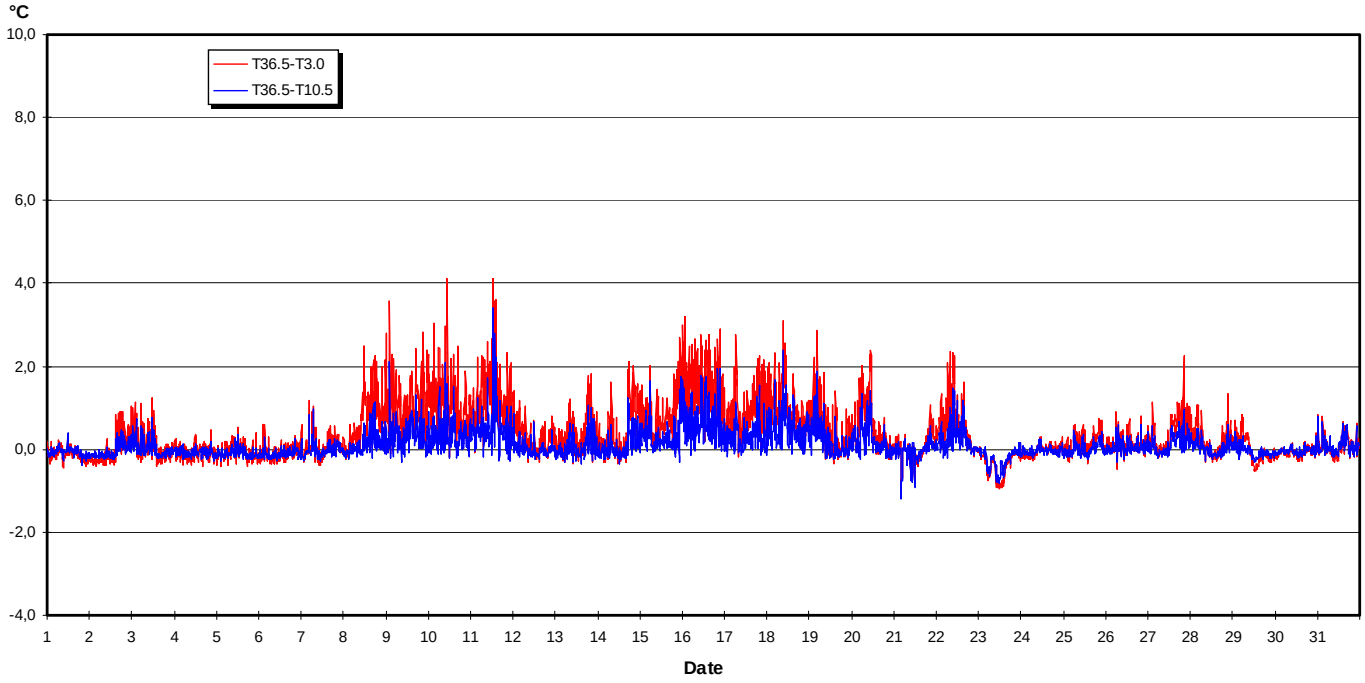
Sómastaðageröi
Vertical Temperature Gradient, °C
November 2000



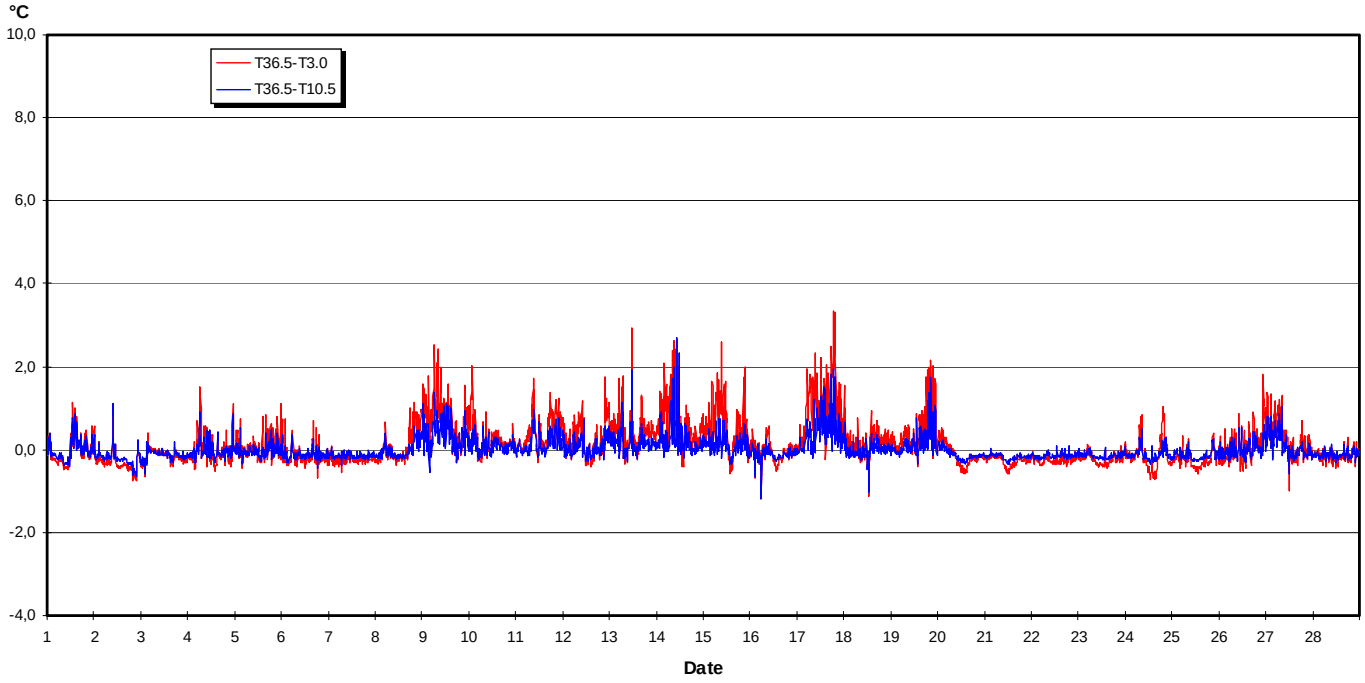
Sómastaðageröi
Vertical Temperature Gradient, °C
December 2000



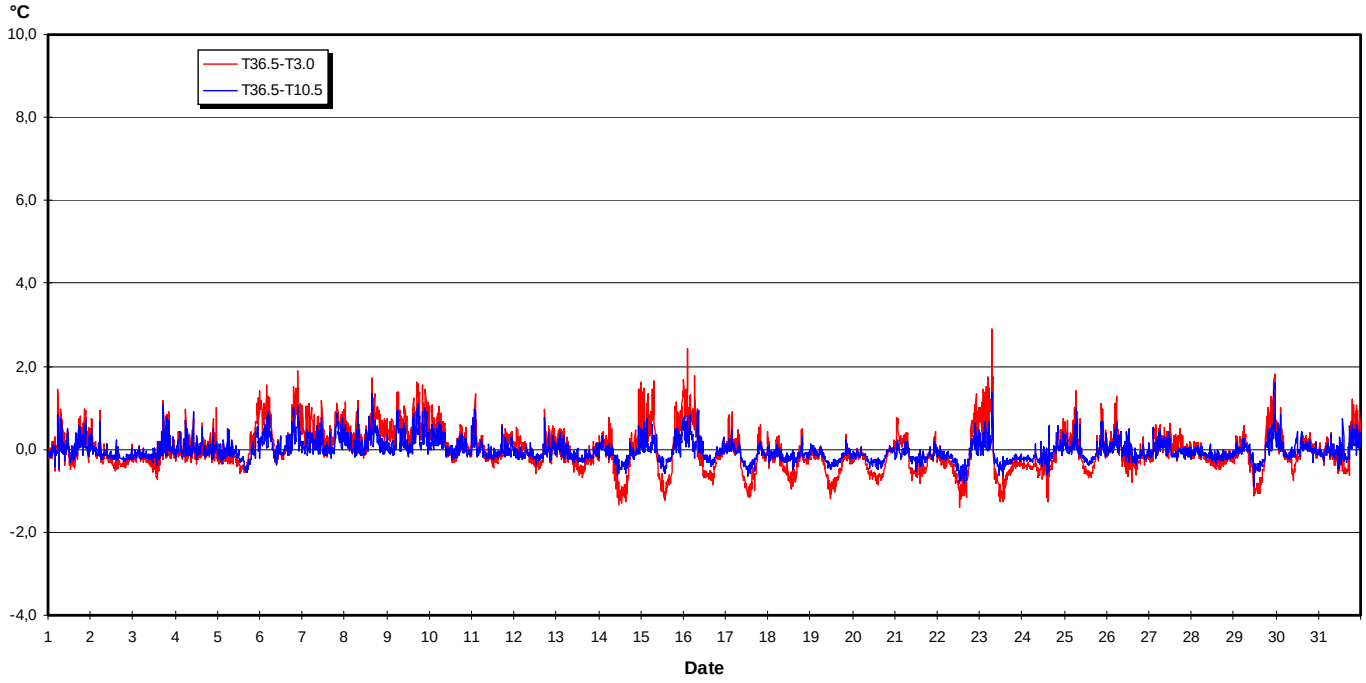
Sómastaðagerði
Vertical Temperature Gradient,°C
January 2001



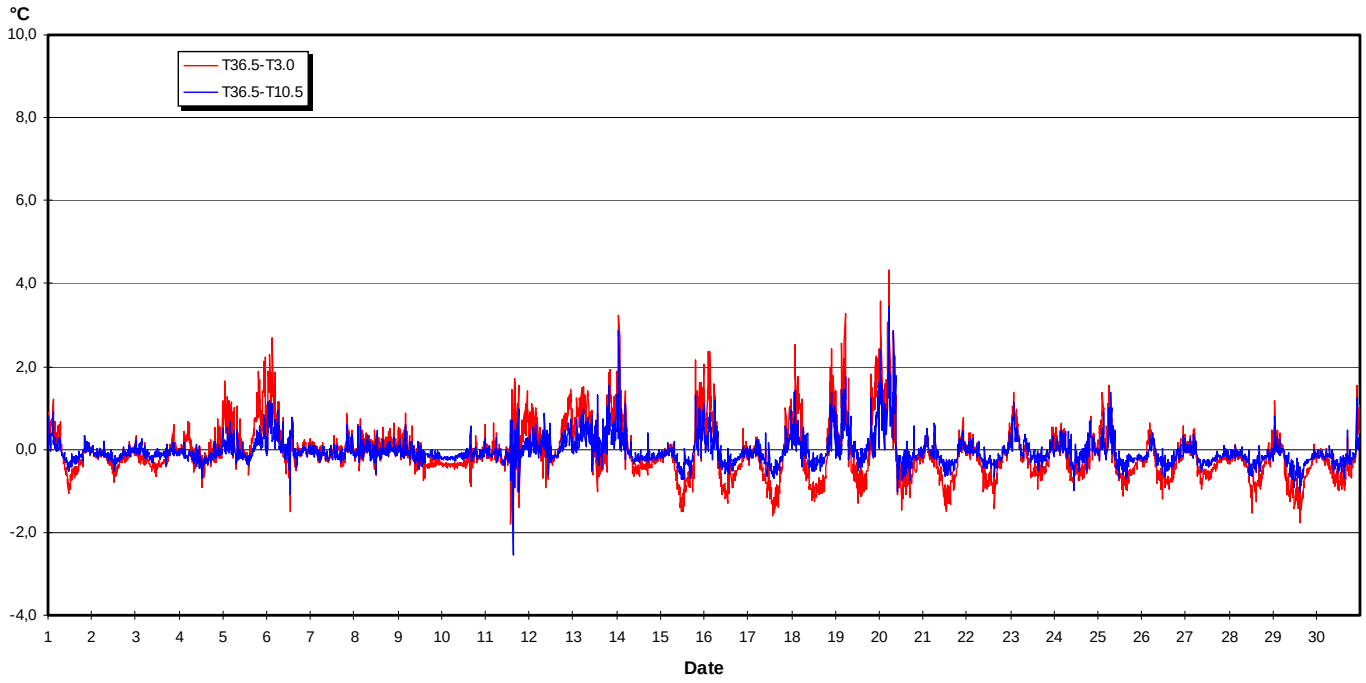
Sómastaðagerði
Vertical Temperature Gradient, °C
February 2001



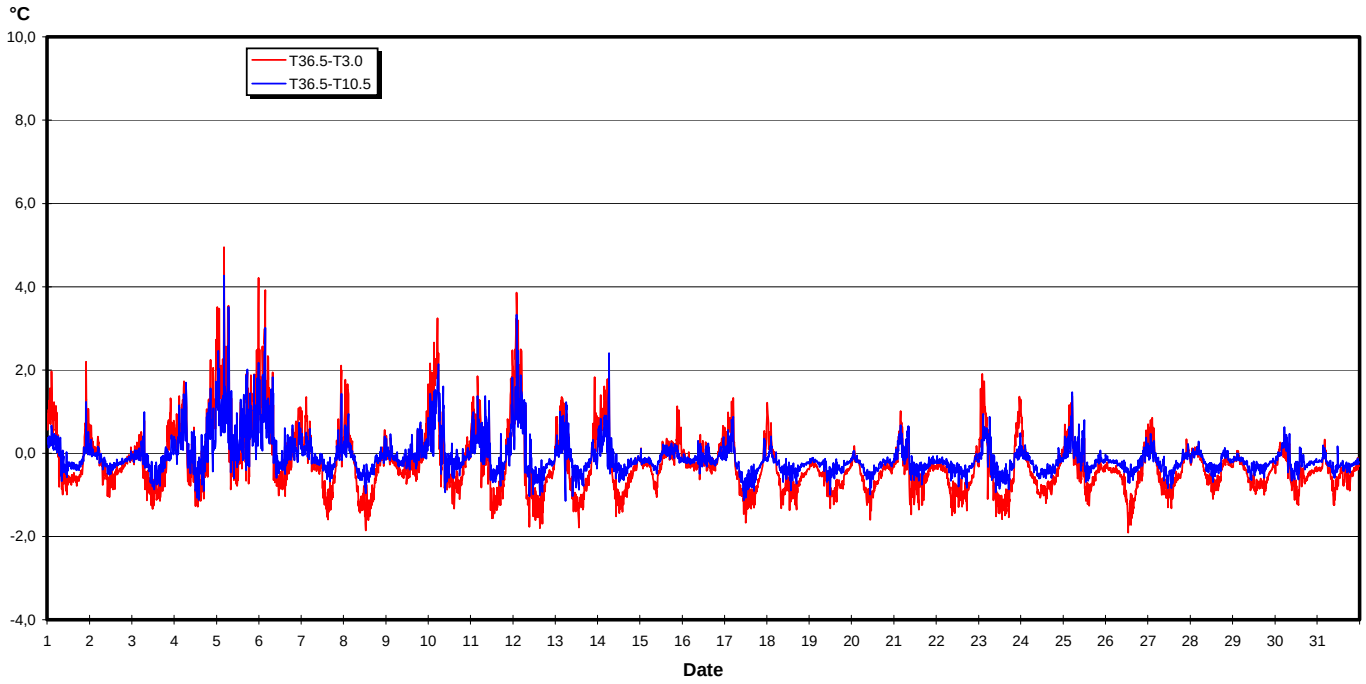
Sómastaðageröi
Vertical Temperature Gradient, °C
March 2001



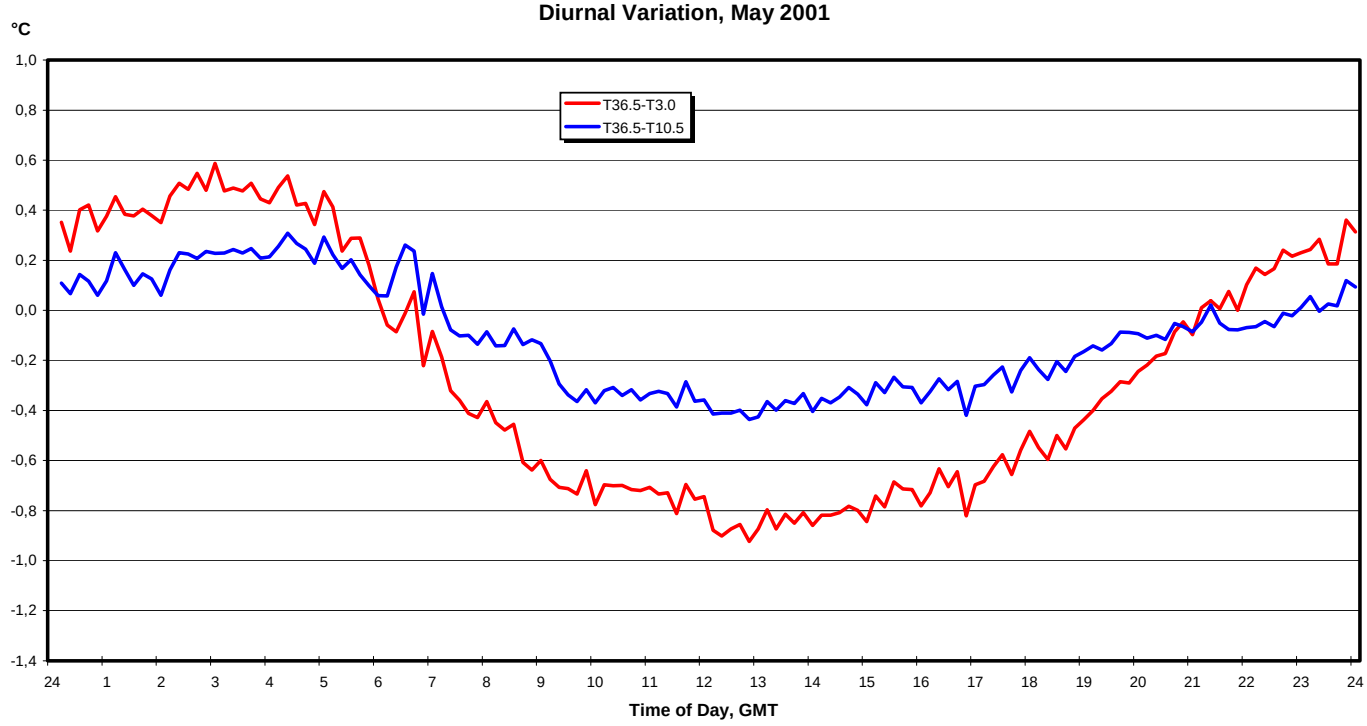
Sómastaðageröi
Vertical Temperature Gradient, °C
April 2001



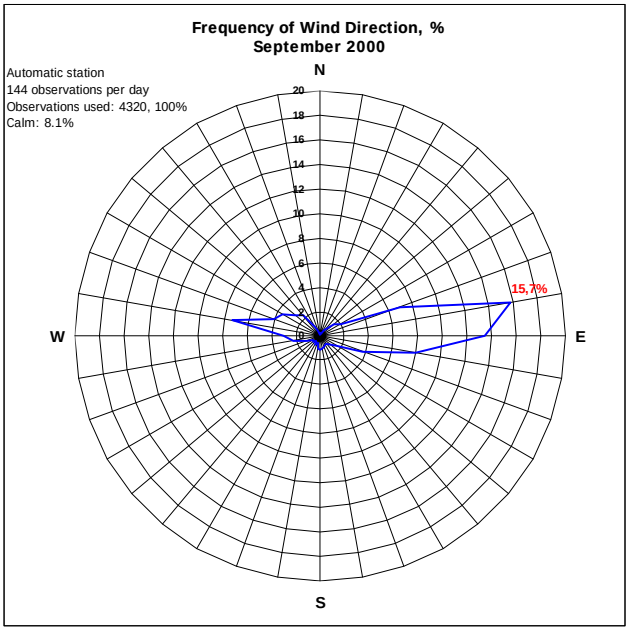
Sómastaðagerði
Vertical Temperature Gradient, °C
May 2001

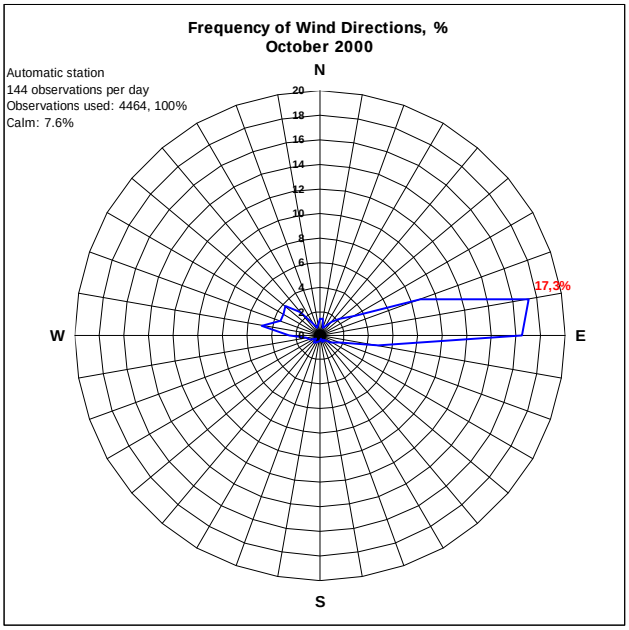


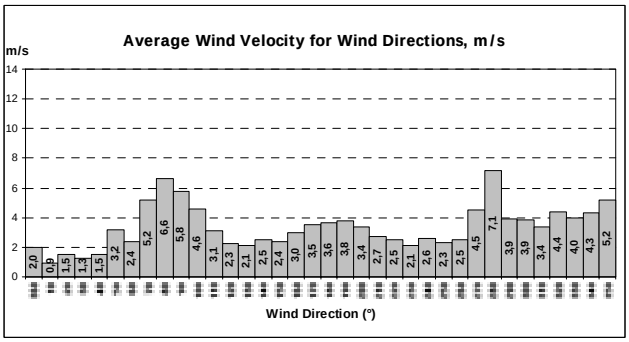
Sómastaðagerði
Average Vertical Temperature Gradient, °C
Diurnal Variation, May 2001

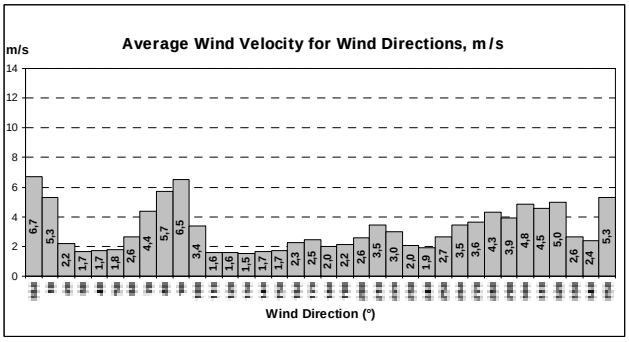


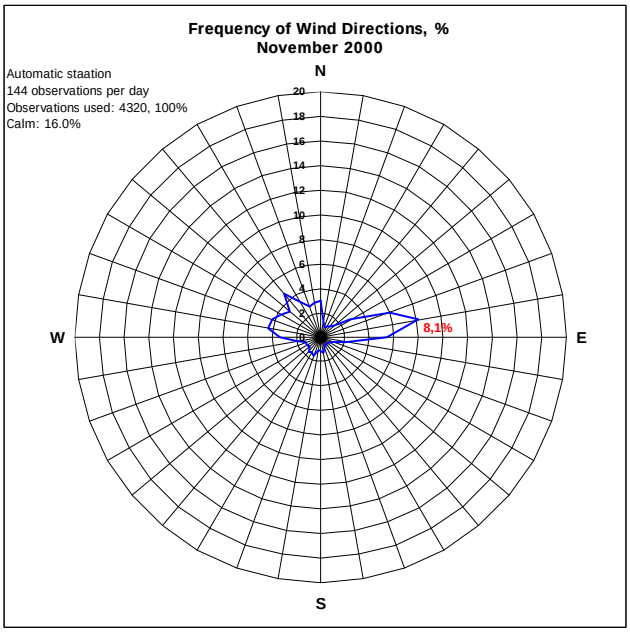
Ljósá

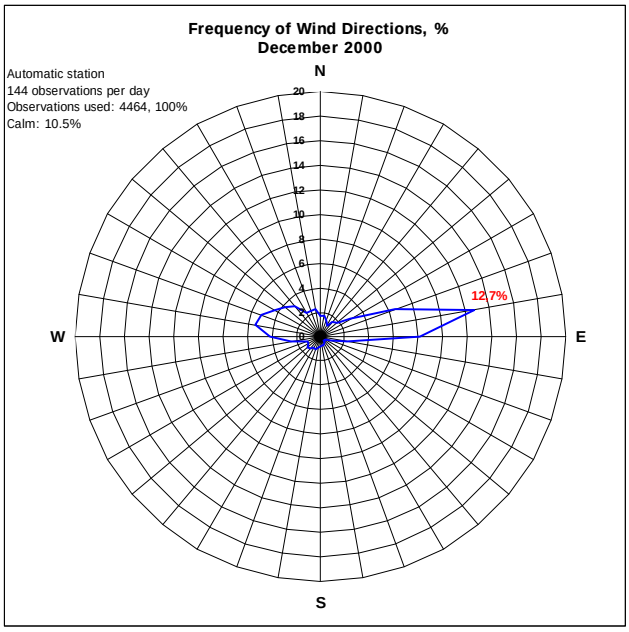

Frequency of Wind Direction, %
September 2000
Automatic station
144 observations per day
Observations used: 4320, 100%
Calm: 8.1%
N
W
E
S
15,7%

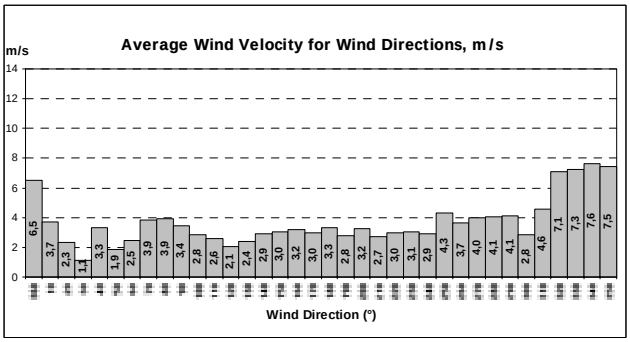

Frequency of Wind Directions, %
October 2000
Automatic station
144 observations per day
Observations used: 4464, 100%
Calm: 7.6%
N
W
E
S
17,3%

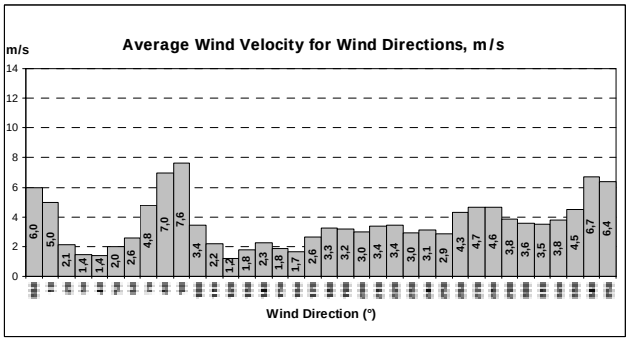

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)


Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

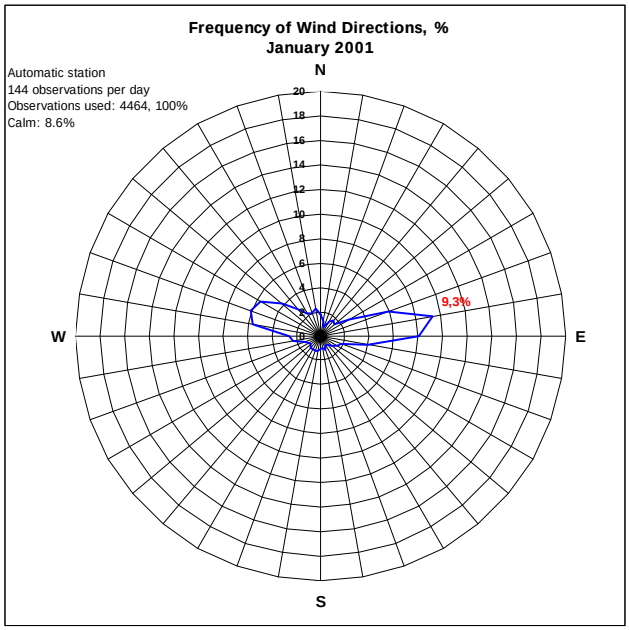

Frequency of Wind Directions, %
November 2000
Automatic staation
144 observations per day
Observations used: 4320, 100%
Calm: 16.0%
N
W
E
S
8,1%

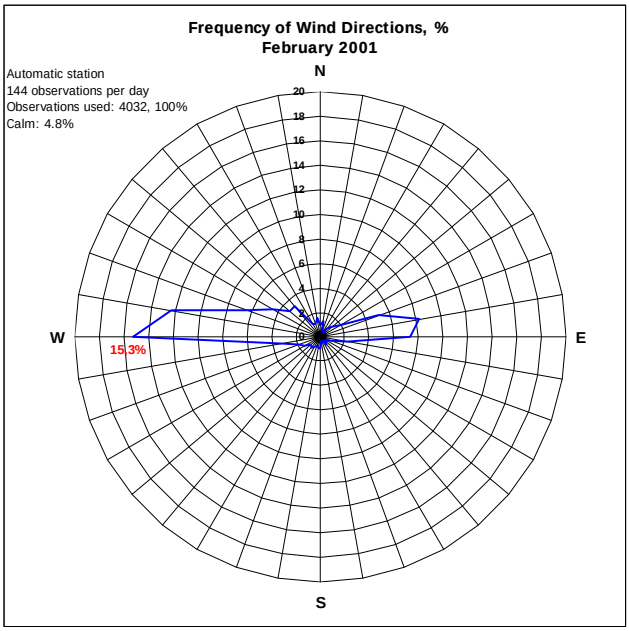

Frequency of Wind Directions, %
December 2000
Automatic station
144 observations per day
Observations used: 4464, 100%
Calm: 10.5%
N
W
E
S
12,7%

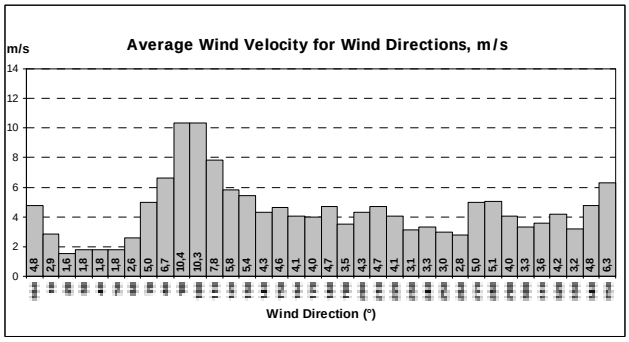

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

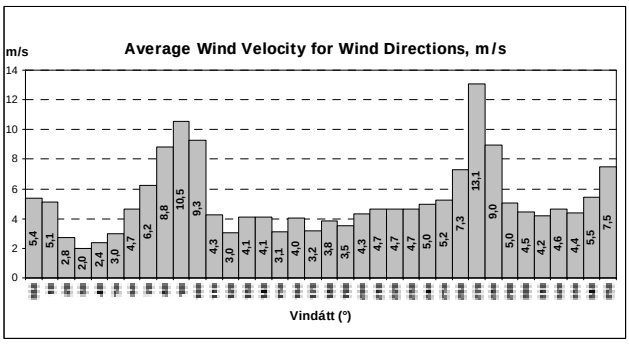

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

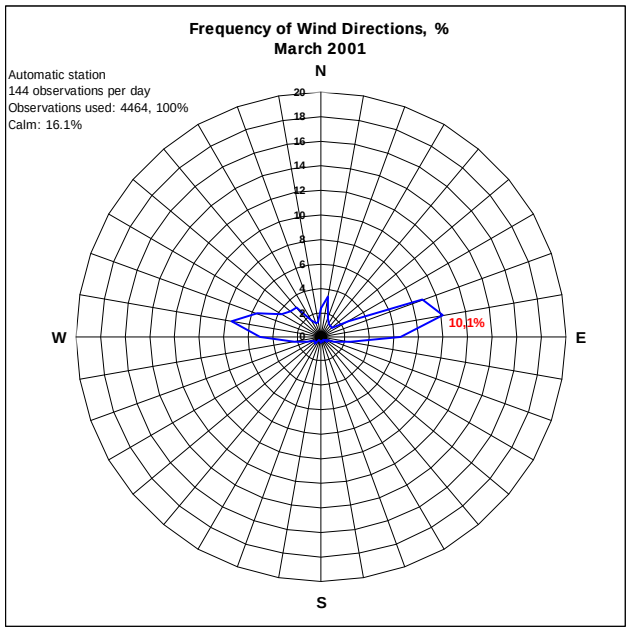
Ljósá

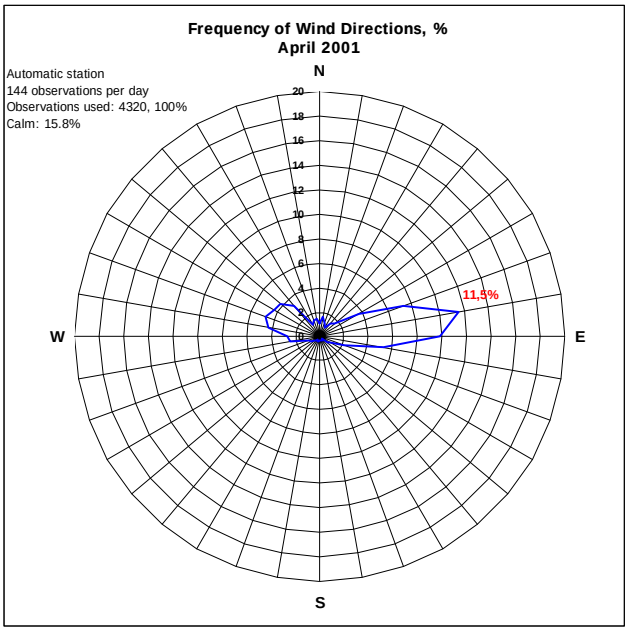


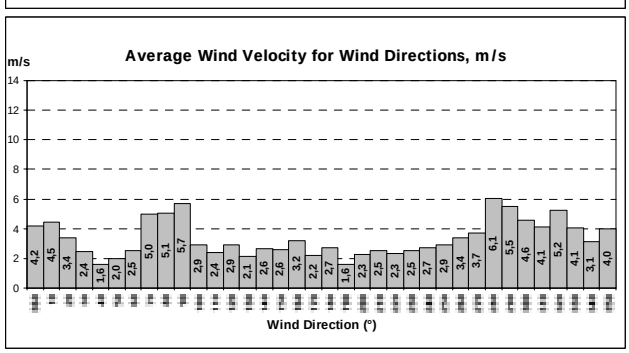


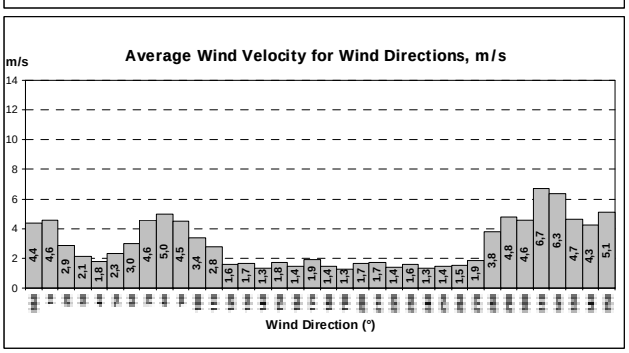






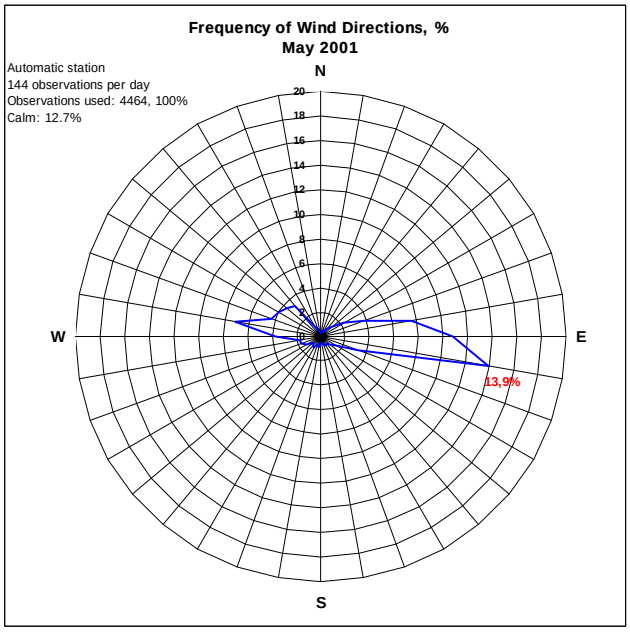


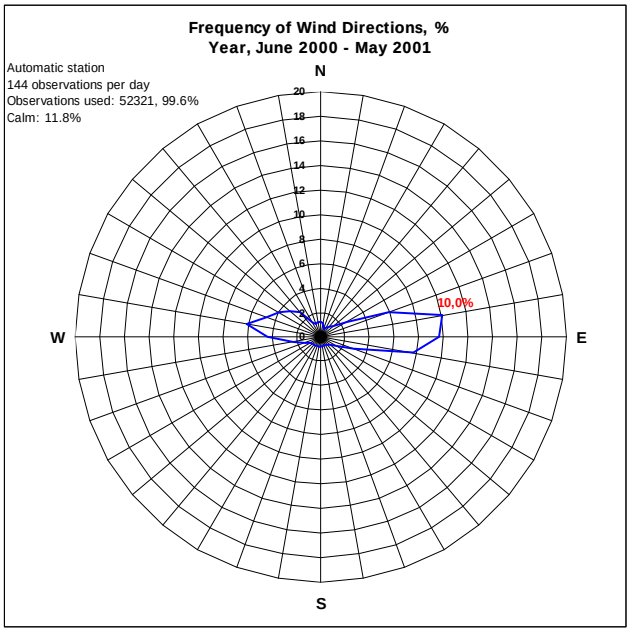


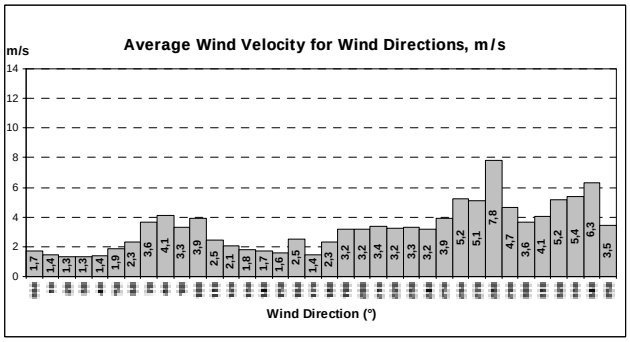


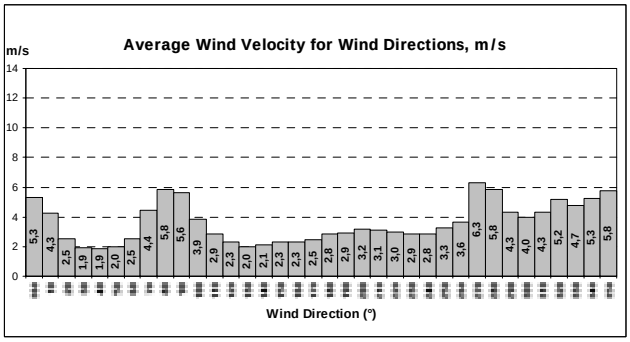
Annex 10

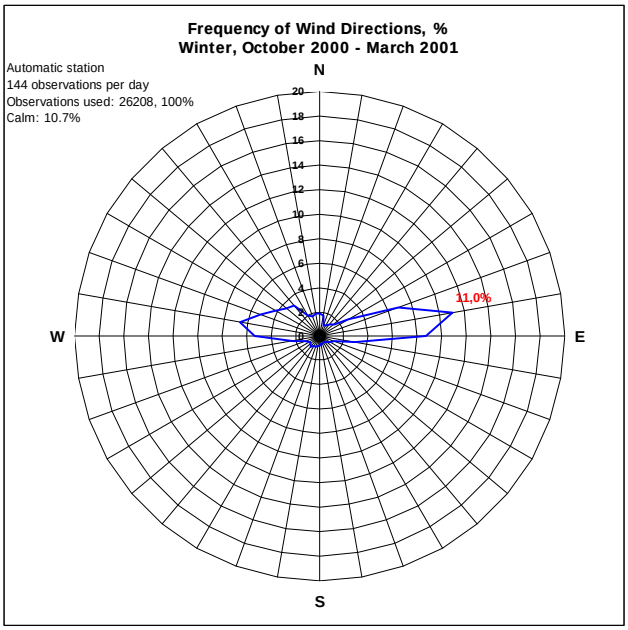
Ljósá

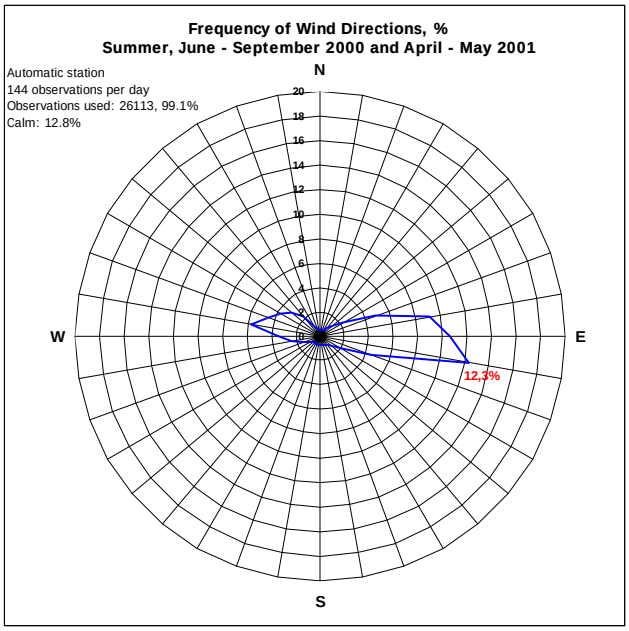

Frequency of Wind Directions, %
May 2001
Automatic station
144 observations per day
Observations used: 4464, 100%
Calm: 12.7%
N
W
E
S
13,9%

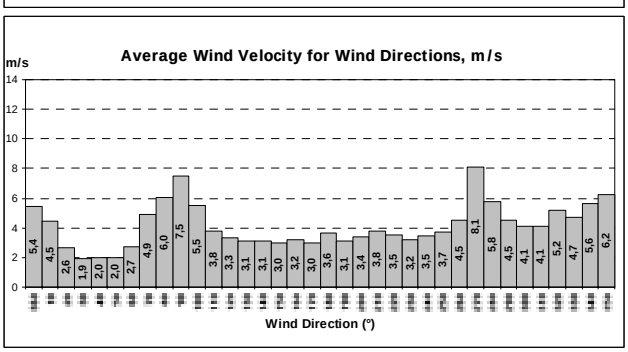

Frequency of Wind Directions, %
Year, June 2000 - May 2001
Automatic station
144 observations per day
Observations used: 52321, 99.6%
Calm: 11.8%
N
W
E
S
10,0%

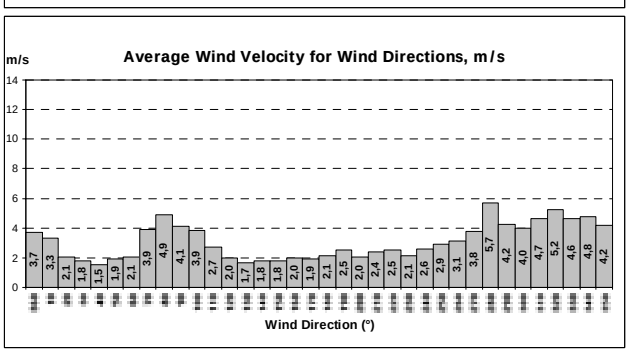

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)


Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

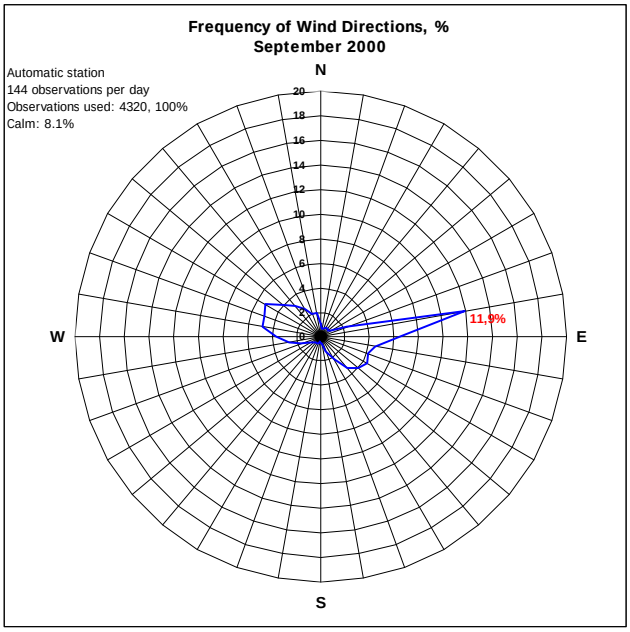

Frequency of Wind Directions, %
Winter, October 2000 - March 2001
Automatic station
144 observations per day
Observations used: 26208, 100%
Calm: 10.7%
N
W
E
S
11,0%

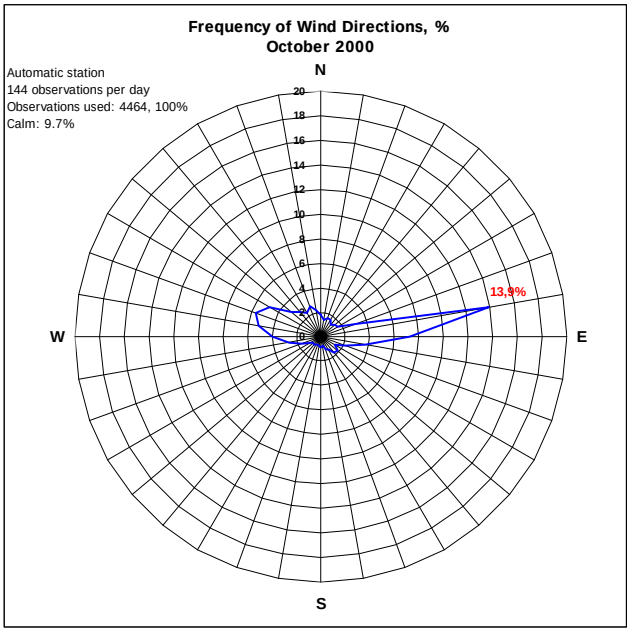

Frequency of Wind Directions, %
Summer, June - September 2000 and April - May 2001
Automatic station
144 observations per day
Observations used: 26113, 99.1%
Calm: 12.8%
N
W
E
S
12,3%

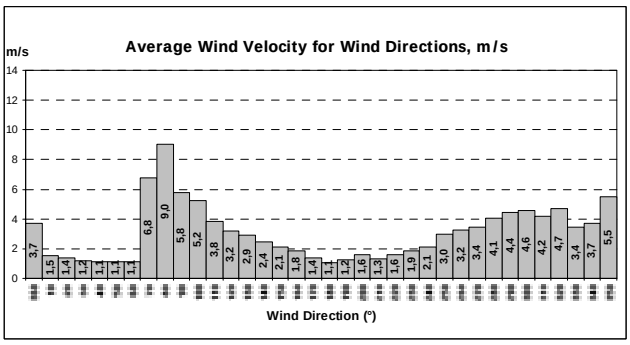

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

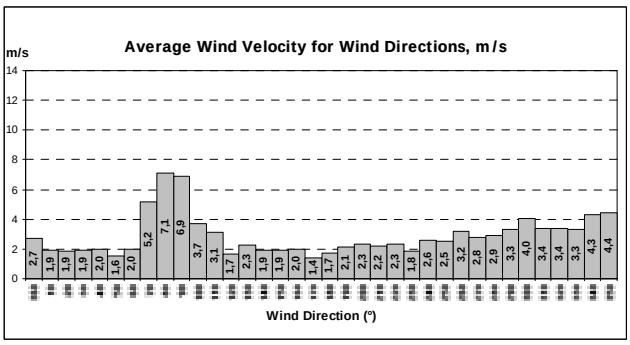

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

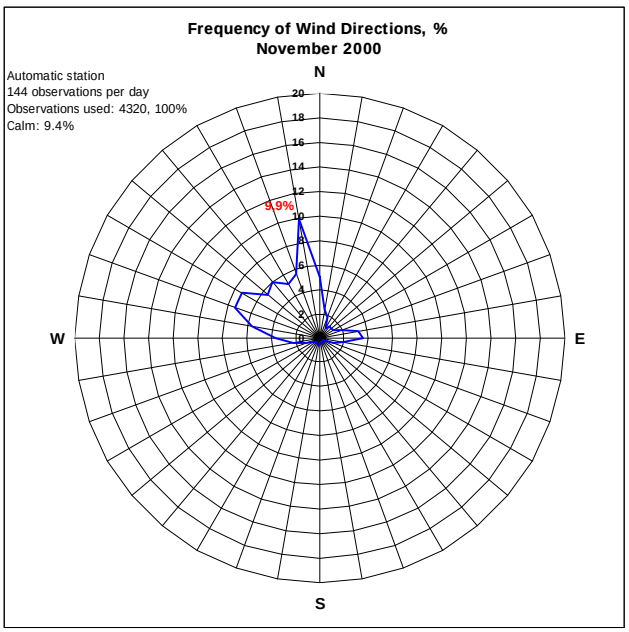
Kollaleira 2

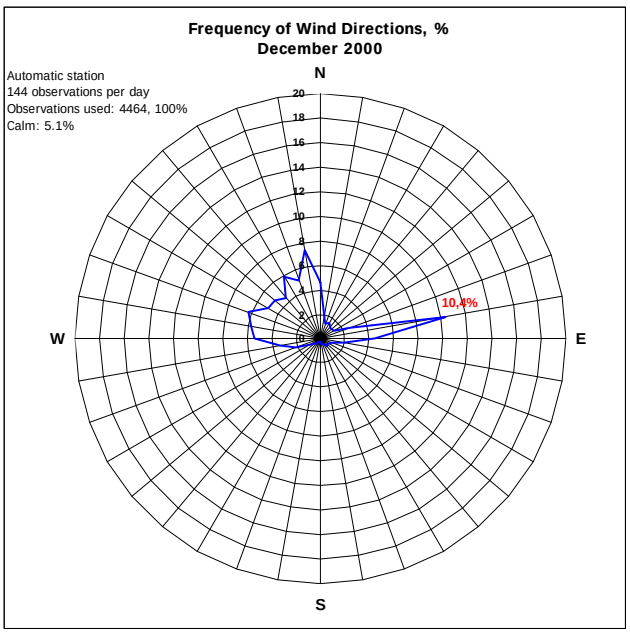


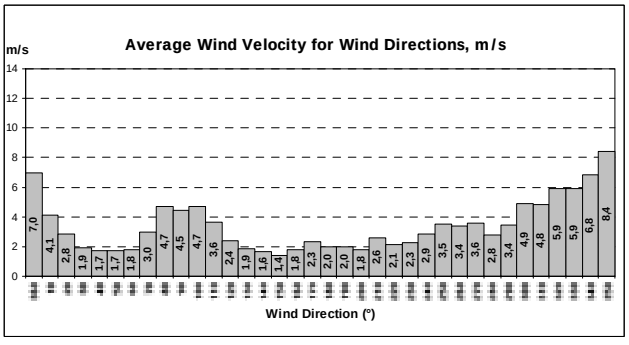


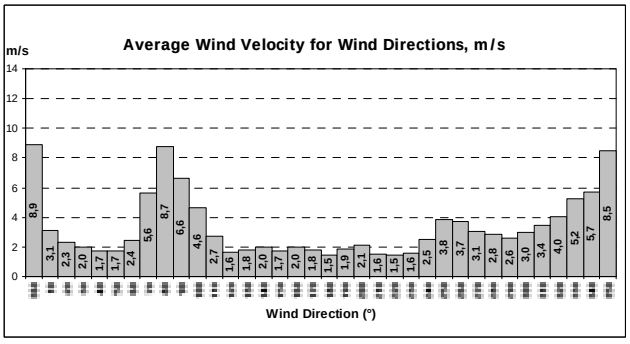






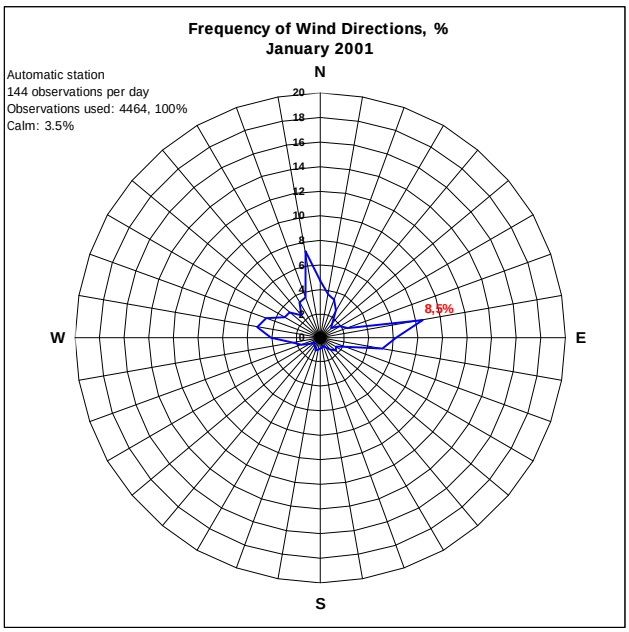


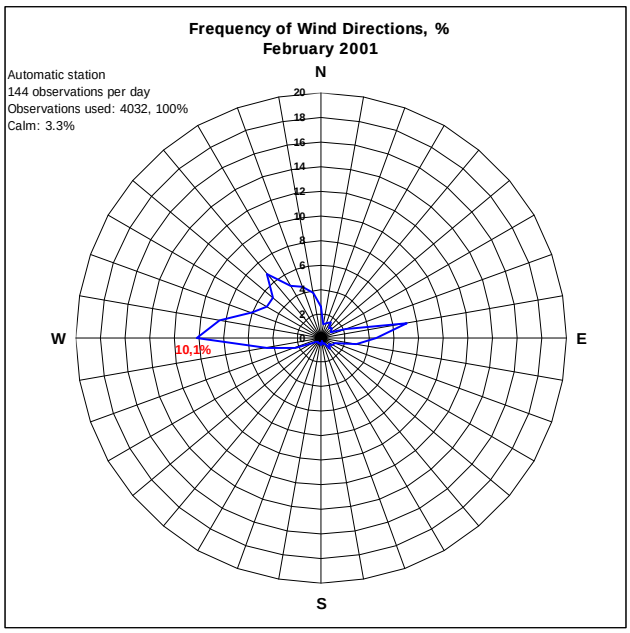


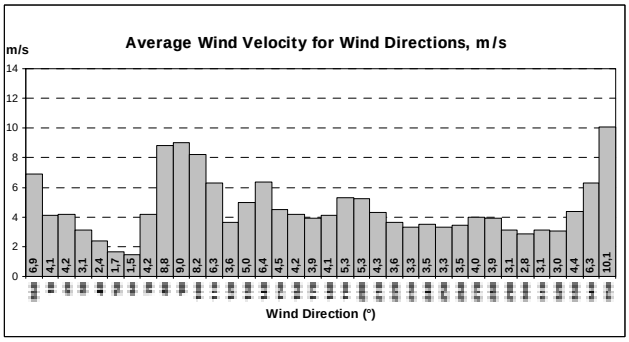


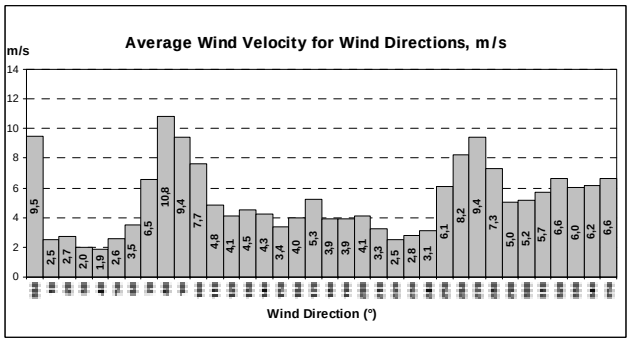
Annex 12

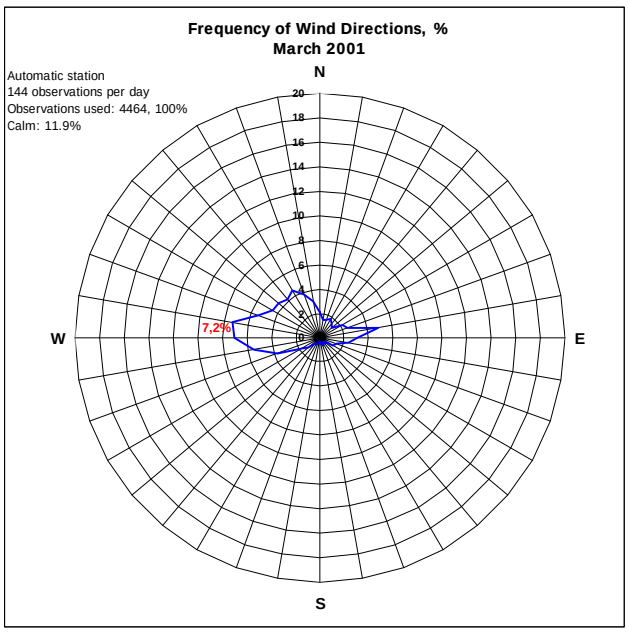
Kollaleira 2

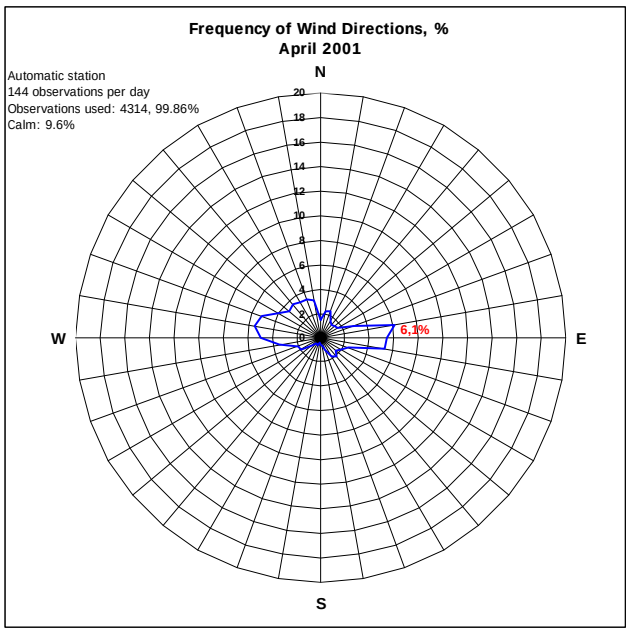


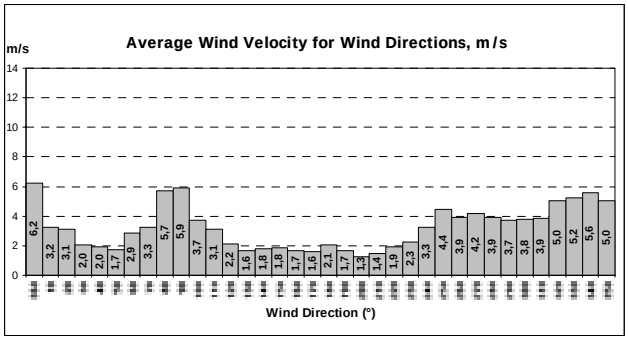


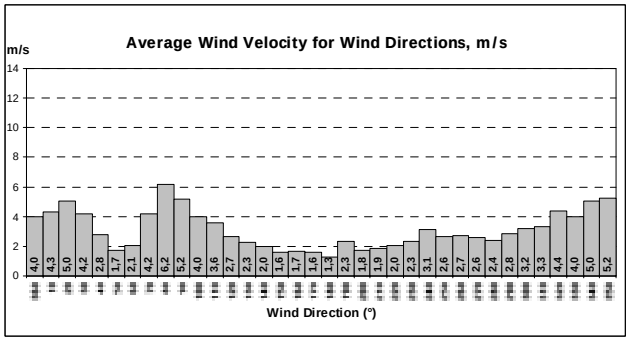




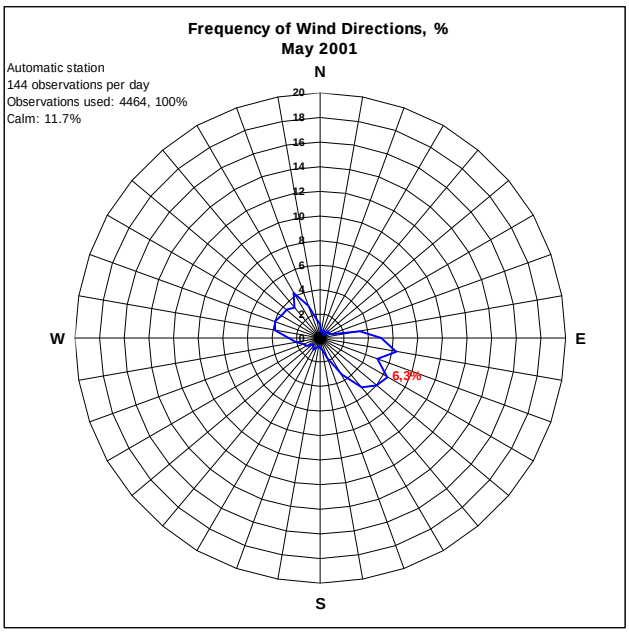


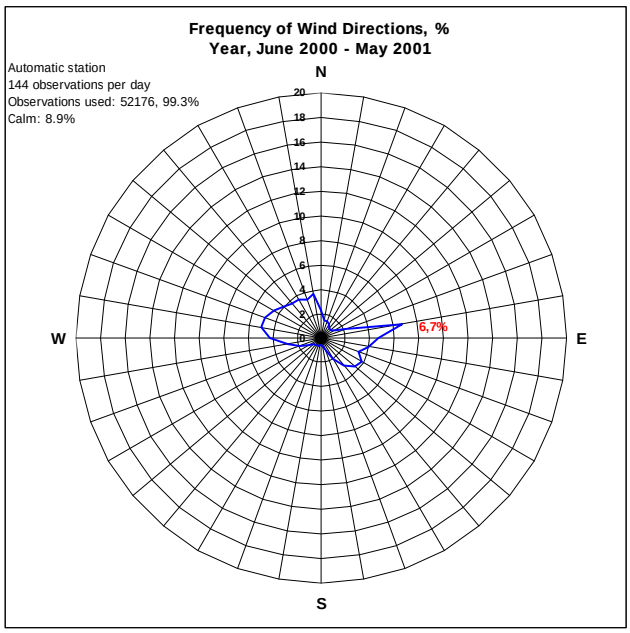


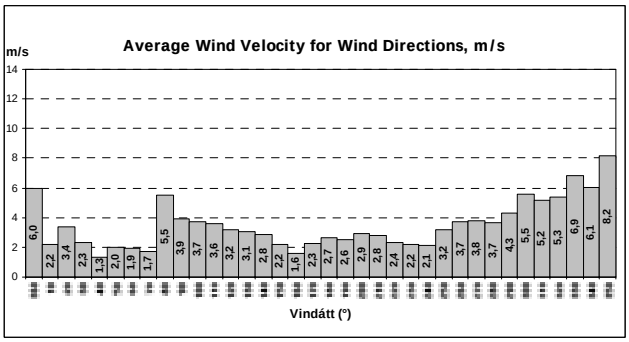


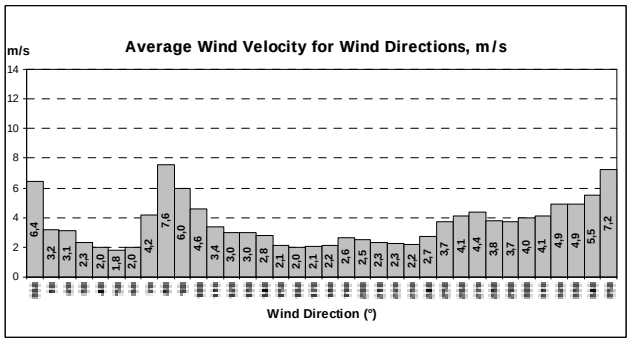


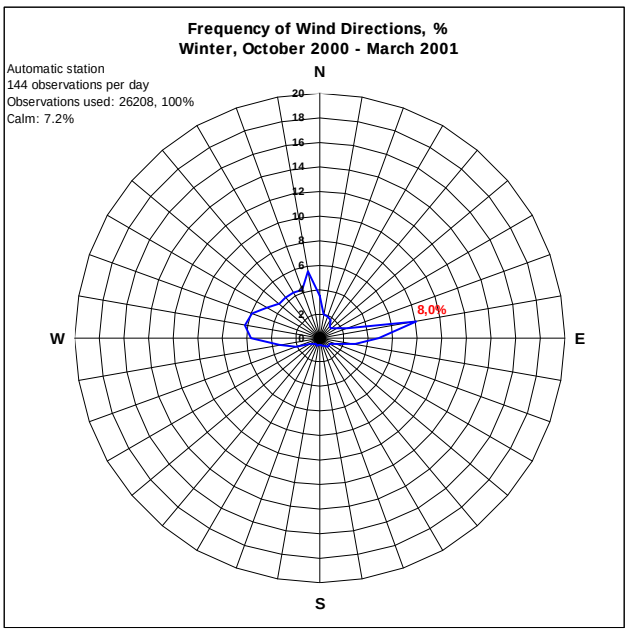
Kollaleira 2

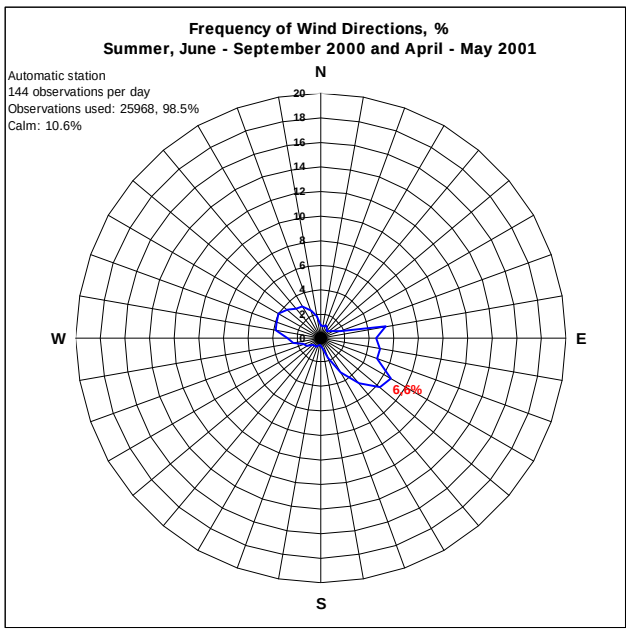


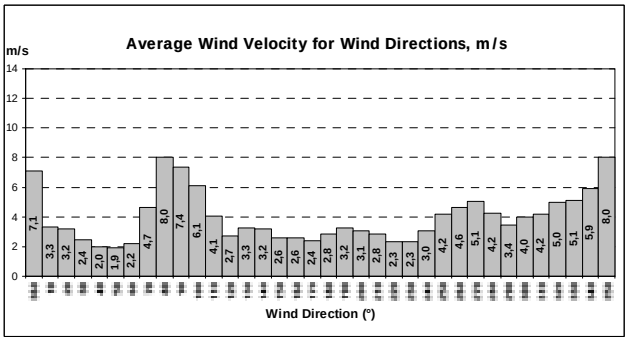


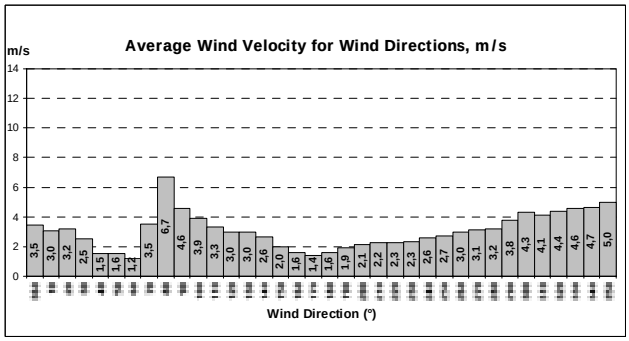




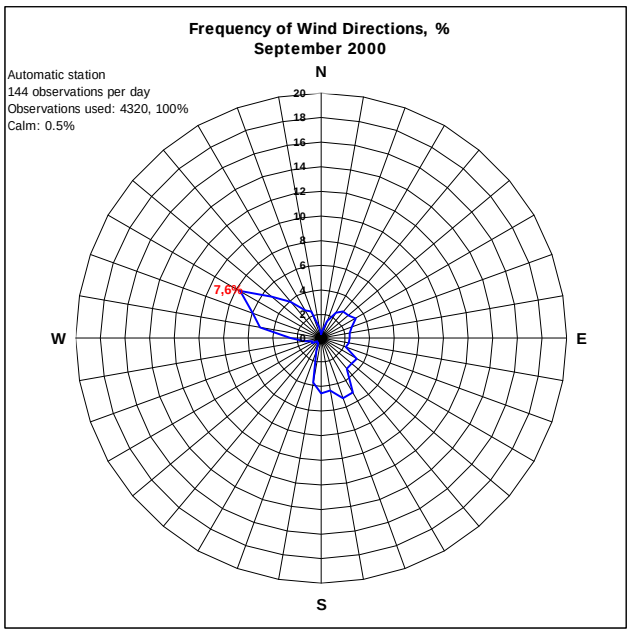


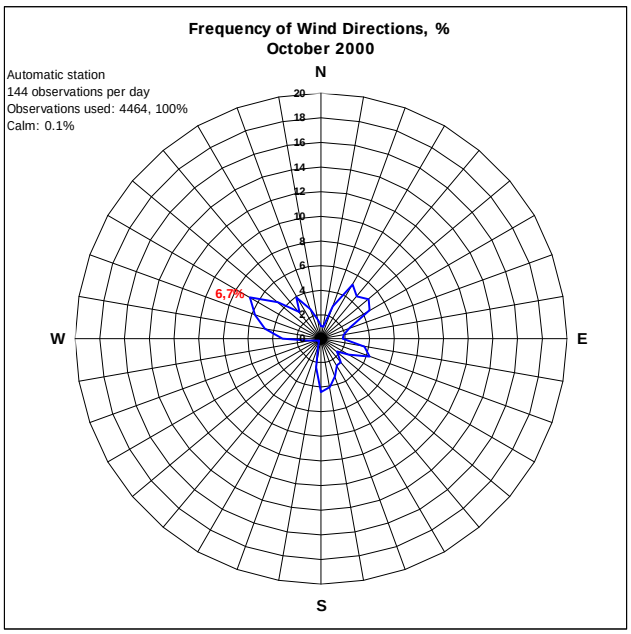


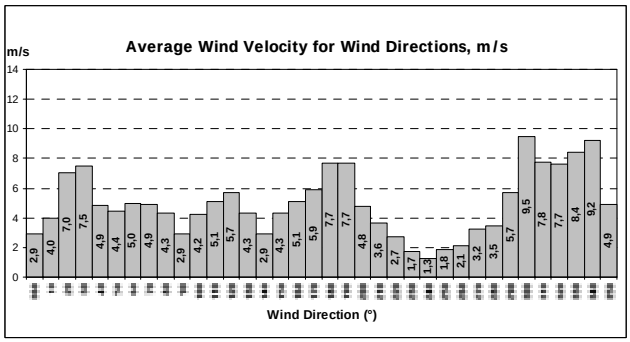


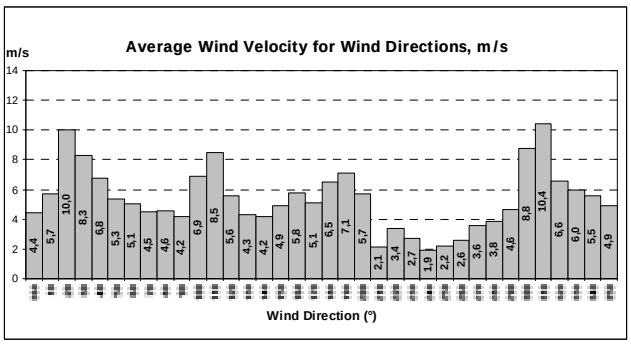


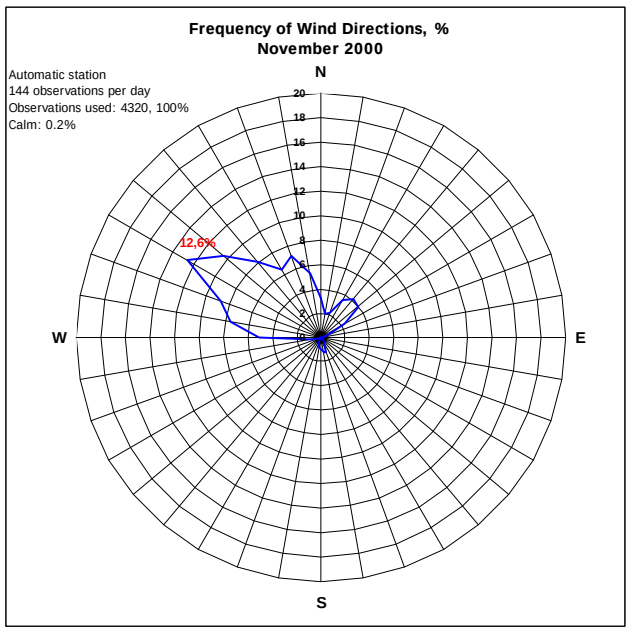
Vattarnes

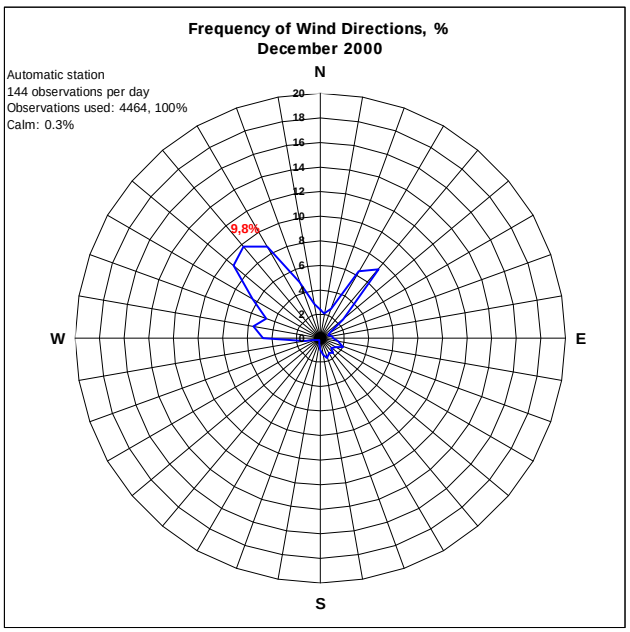

Frequency of Wind Directions, %
September 2000
Automatic station
144 observations per day
Observations used: 4320, 100%
Calm: 0.5%
N
W
E
S
7,6%

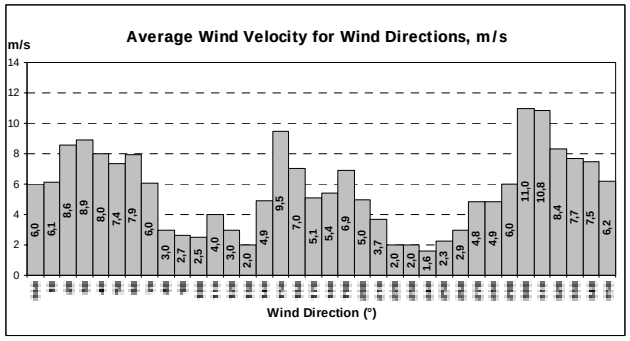

Frequency of Wind Directions, %
October 2000
Automatic station
144 observations per day
Observations used: 4464, 100%
Calm: 0.1%
N
W
E
S
6,7%

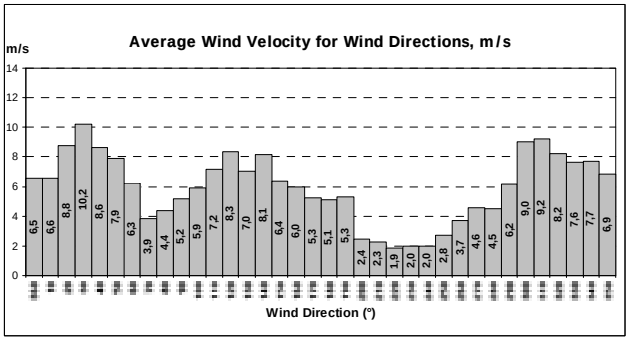

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)


Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

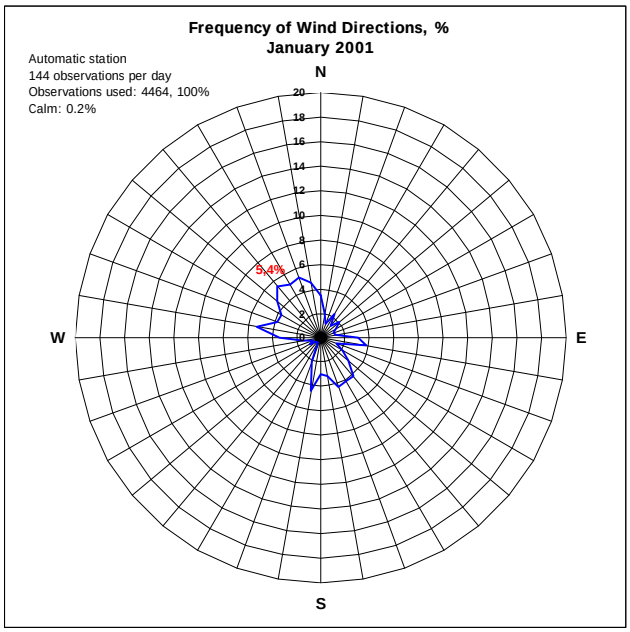

Frequency of Wind Directions, %
November 2000
Automatic station
144 observations per day
Observations used: 4320, 100%
Calm: 0.2%
N
W
E
S
12,6%

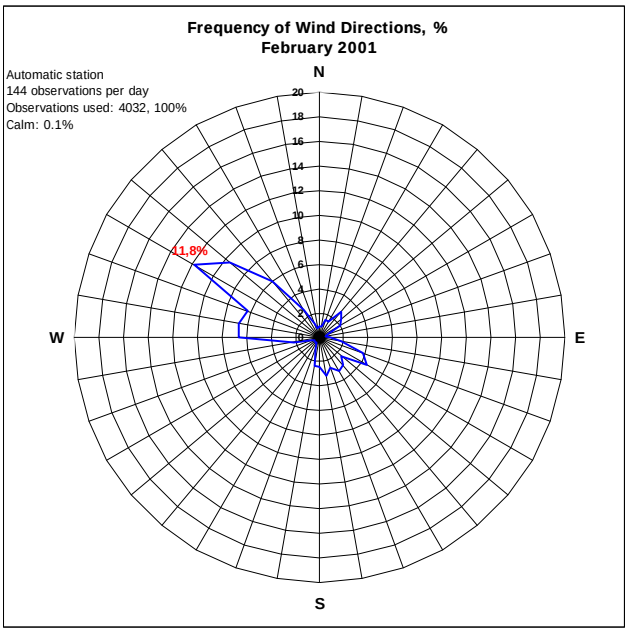

Frequency of Wind Directions, %
December 2000
Automatic station
144 observations per day
Observations used: 4464, 100%
Calm: 0.3%
N
W
E
S
9,8%

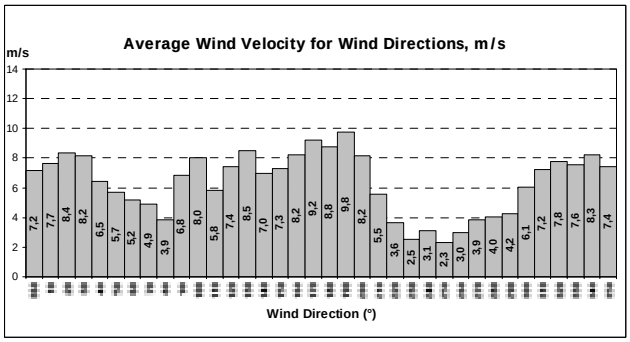

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

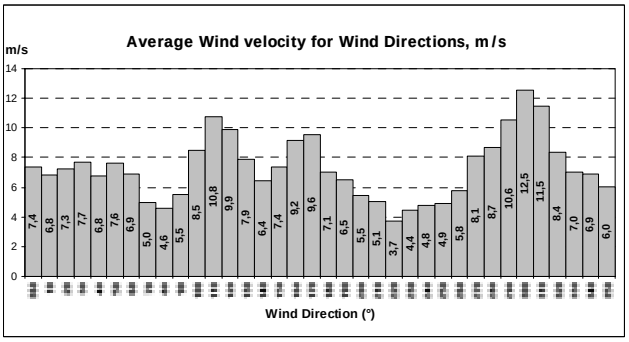

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

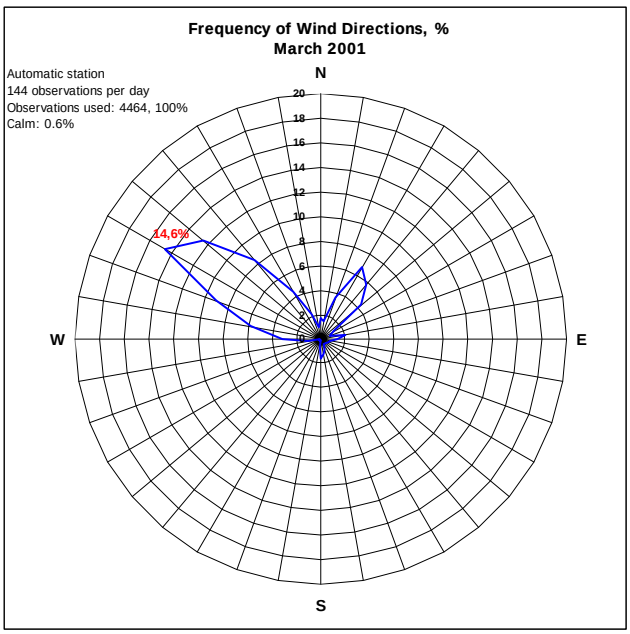
Vattarnes

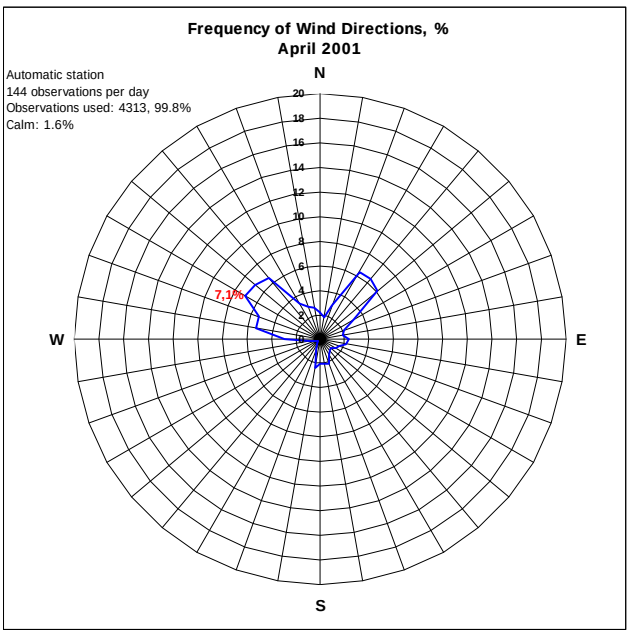


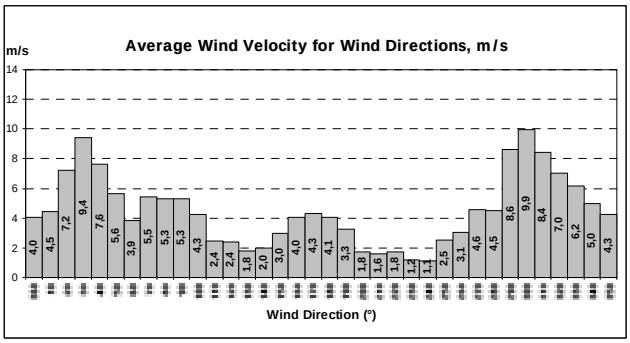


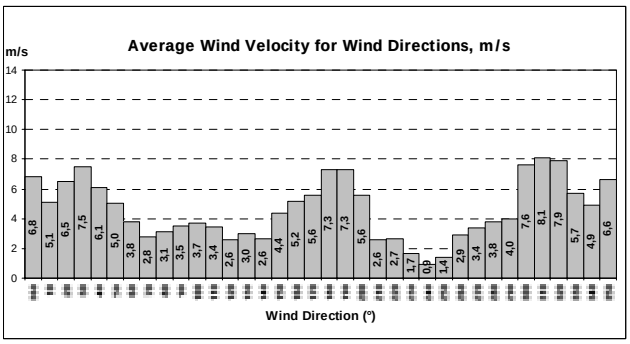






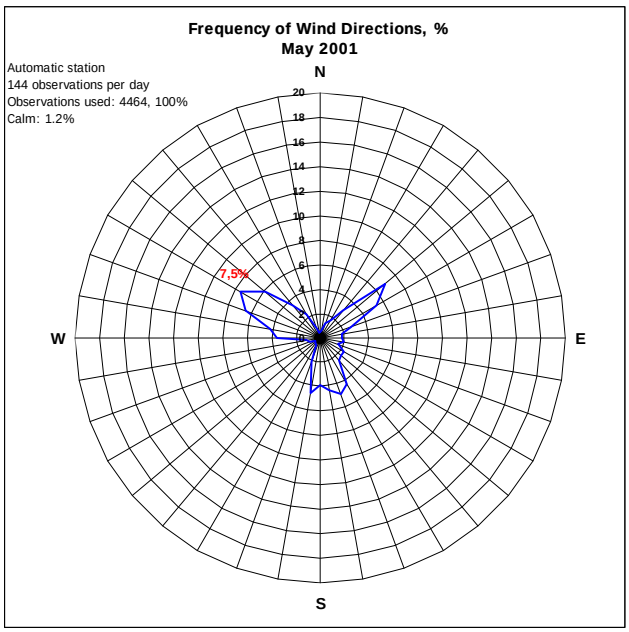


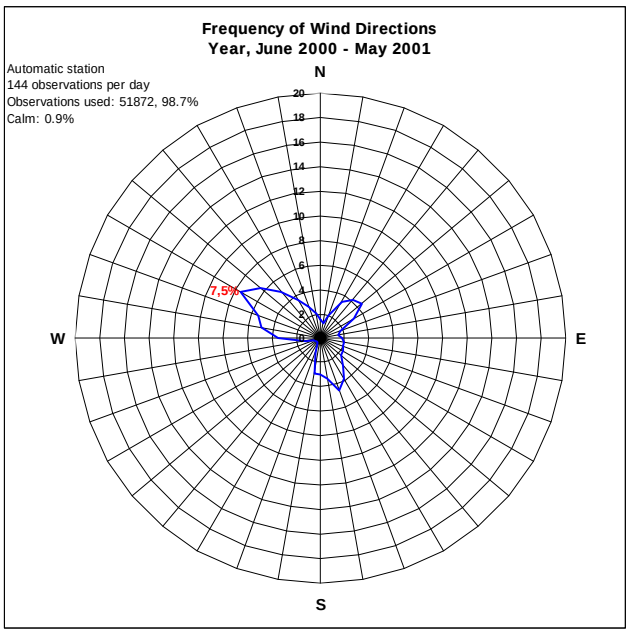


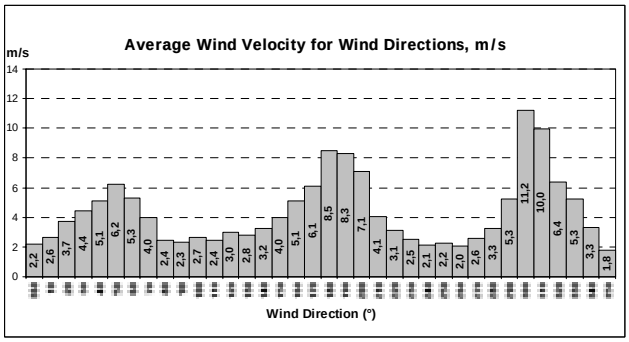


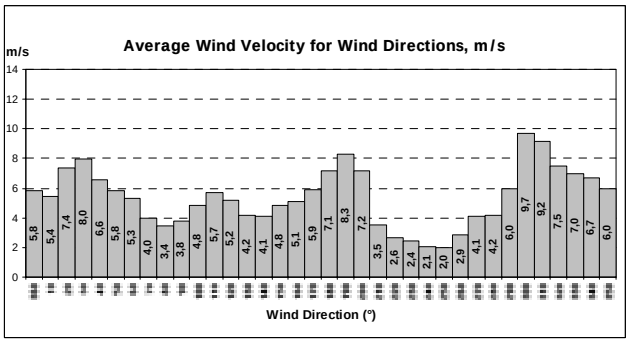
Annex 16

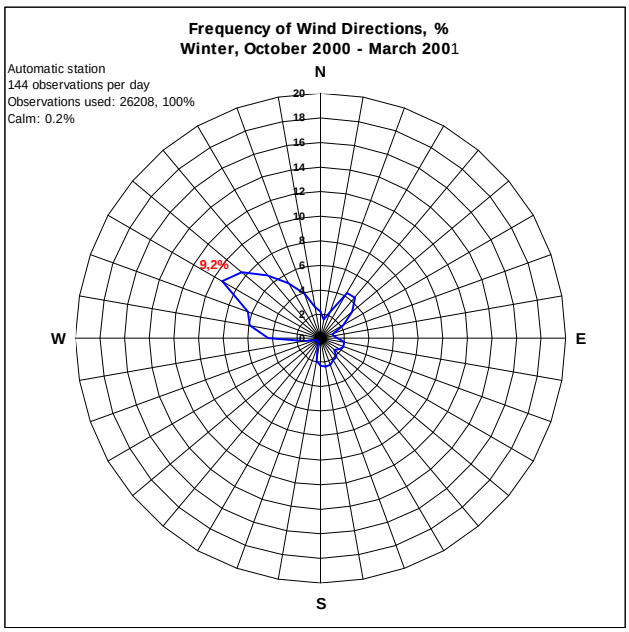
Vattarnes

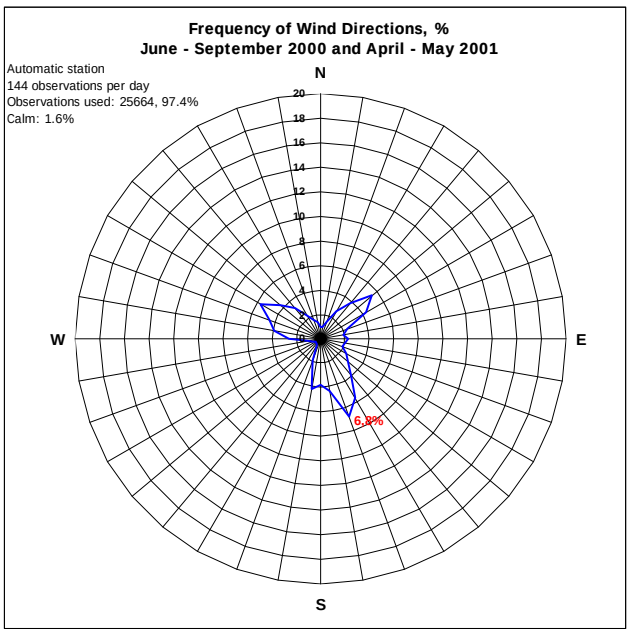

Frequency of Wind Directions, %
May 2001
Automatic station
144 observations per day
Observations used: 4464, 100%
Calm: 1.2%
N
E
S
W
7.5%

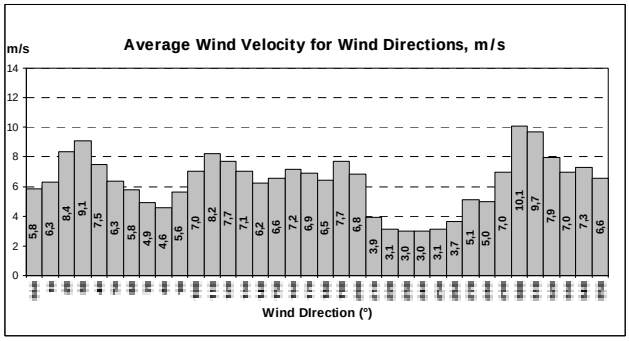

Frequency of Wind Directions
Year, June 2000 - May 2001
Automatic station
144 observations per day
Observations used: 51872, 98.7%
Calm: 0.9%
N
E
S
W
7.5%

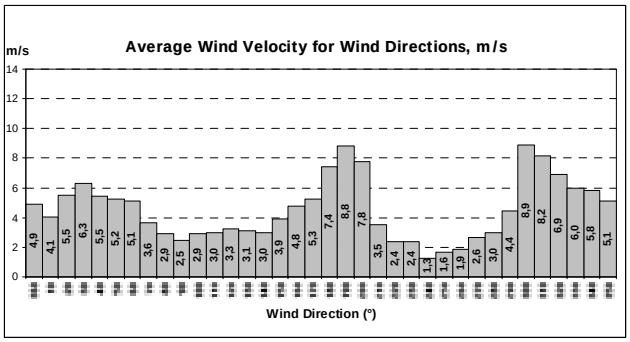

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)


Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

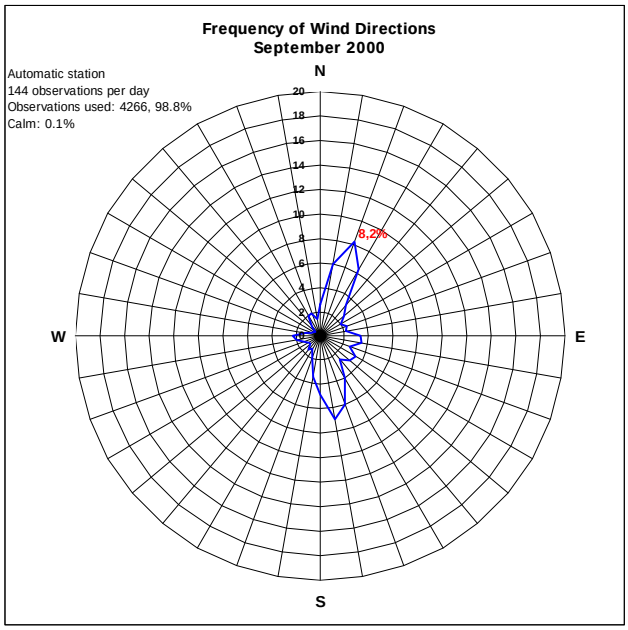

Frequency of Wind Directions, %
Winter, October 2000 - March 2001
Automatic station
144 observations per day
Observations used: 26208, 100%
Calm: 0.2%
N
E
S
W
9.2%

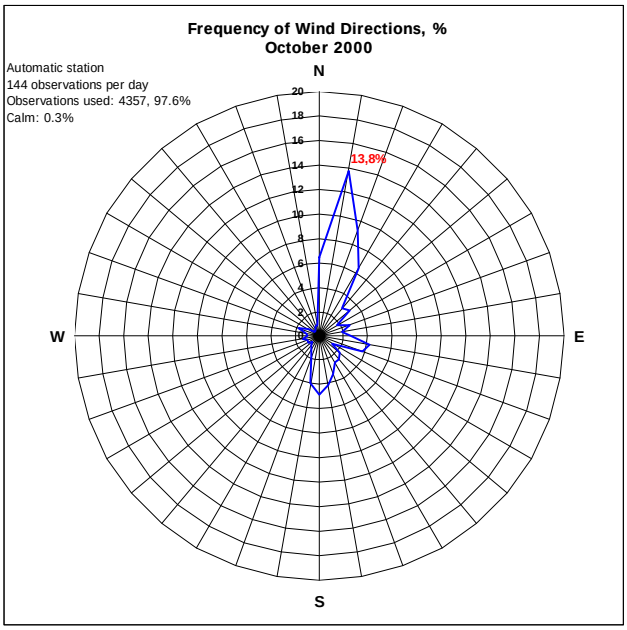

Frequency of Wind Directions, %
June - September 2000 and April - May 2001
Automatic station
144 observations per day
Observations used: 25664, 97.4%
Calm: 1.6%
N
E
S
W
6.3%

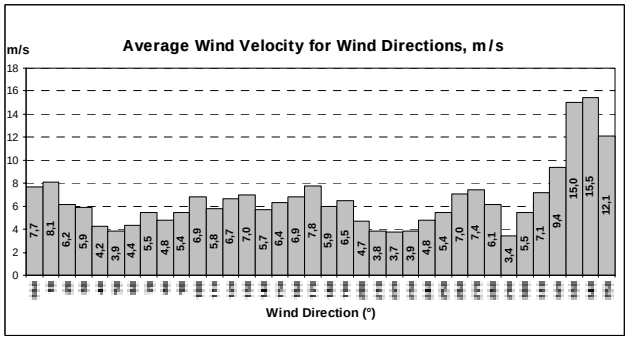

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

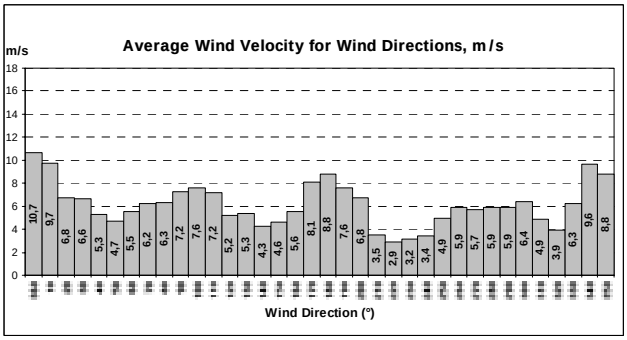

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

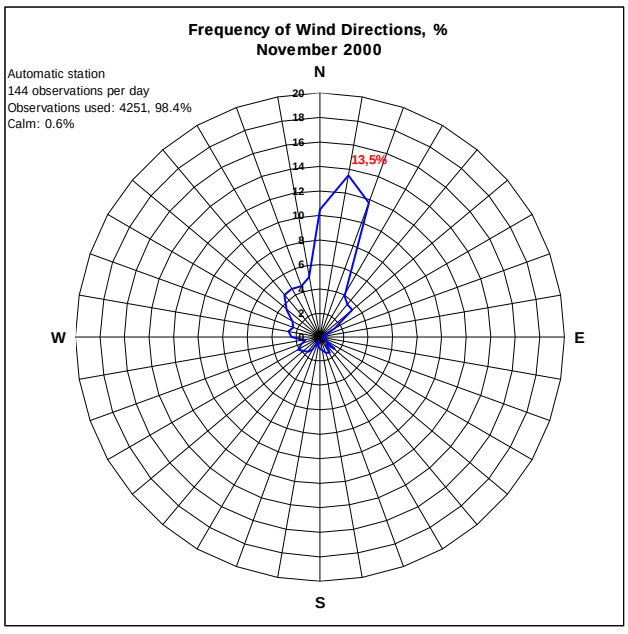
Seley

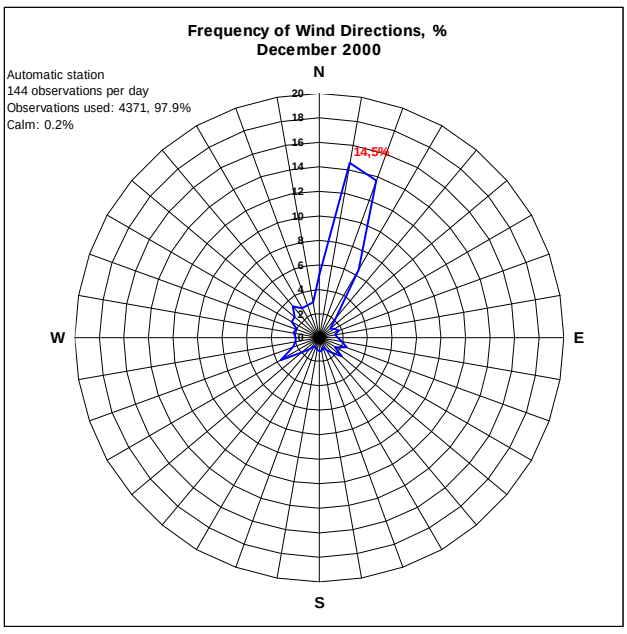

Frequency of Wind Directions
September 2000
Automatic station
144 observations per day
Observations used: 4266, 98.8%
Calm: 0.1%
N
W
E
S
8,2%

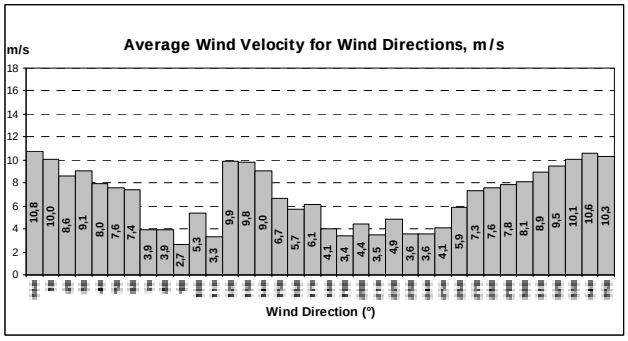

Frequency of Wind Directions, %
October 2000
Automatic station
144 observations per day
Observations used: 4357, 97.6%
Calm: 0.3%
N
W
E
S
13,8%

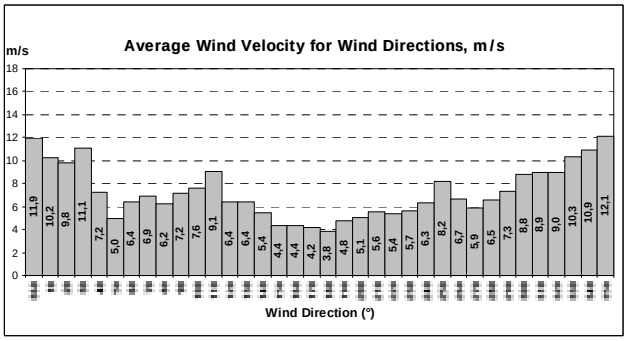

Average Wind Velocity for Wind Directions, m/s
m/s
7,7 8,1 6,2 5,9 4,2 3,9 4,4 5,5 4,8 5,4 6,9 5,8 6,7 7,0 5,7 6,4 6,9 7,8 5,9 6,5 4,7 3,8 3,7 3,9 4,8 5,4 7,0 7,4 6,1 3,4 5,5 7,1 9,4 15,0 15,5 12,1
Wind Direction (°)


Average Wind Velocity for Wind Directions, m/s
m/s
10,7 9,7 6,8 6,6 5,3 4,7 5,5 6,2 6,3 7,2 7,6 7,2 5,2 5,3 4,3 4,6 5,6 8,1 8,8 7,6 6,8 3,5 2,9 3,2 3,4 4,9 5,9 5,7 5,9 5,9 6,4 4,9 3,9 6,3 9,6 8,8
Wind Direction (°)

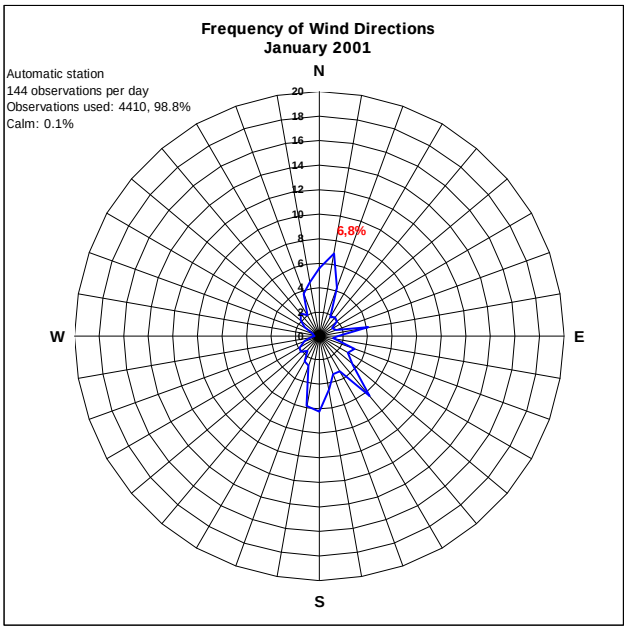

Frequency of Wind Directions, %
November 2000
Automatic station
144 observations per day
Observations used: 4251, 98.4%
Calm: 0.6%
N
W
E
S
13,5%

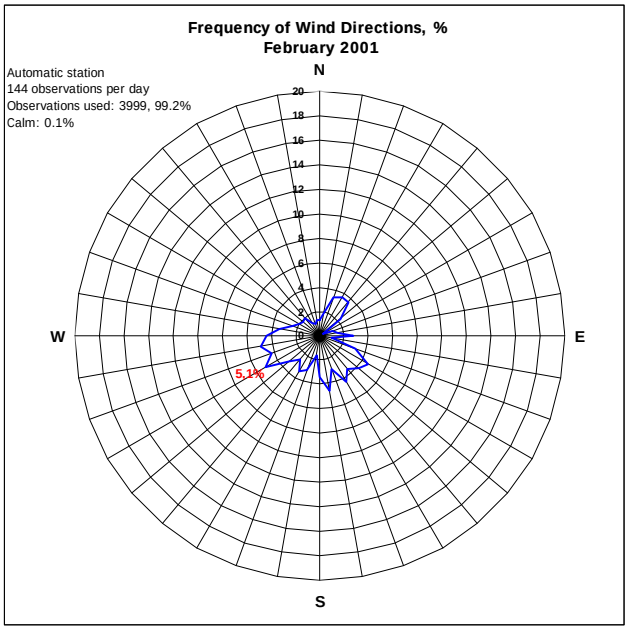

Frequency of Wind Directions, %
December 2000
Automatic station
144 observations per day
Observations used: 4371, 97.9%
Calm: 0.2%
N
W
E
S
14,5%

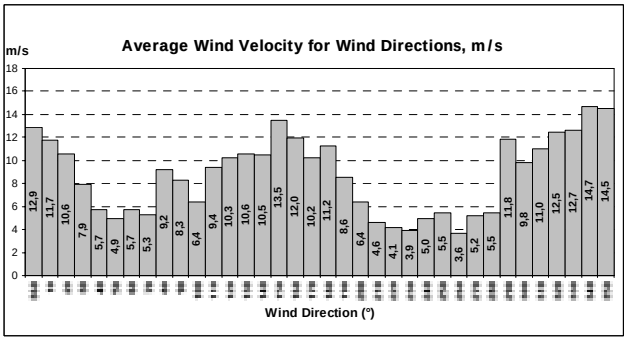

Average Wind Velocity for Wind Directions, m/s
m/s
10,8 10,0 8,6 9,1 8,0 7,6 7,4 3,9 3,9 2,7 5,3 3,3 9,9 9,8 9,0 6,7 5,7 6,1 4,1 3,4 4,4 3,5 4,9 3,6 3,6 4,1 5,9 7,3 7,6 7,8 8,1 8,9 9,5 10,1 10,6 10,3
Wind Direction (°)

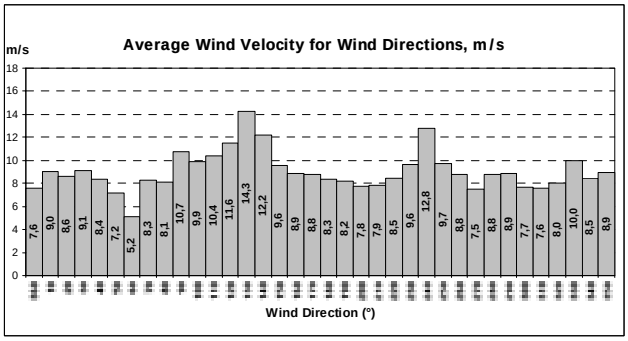

Average Wind Velocity for Wind Directions, m/s
m/s
11,9 10,2 9,8 11,1 7,2 5,0 6,4 6,9 6,2 7,2 7,6 9,1 6,4 6,4 5,4 4,4 4,4 4,2 3,8 4,8 5,1 5,6 5,4 5,7 6,3 8,2 6,7 5,9 6,5 7,3 8,8 8,9 9,0 10,3 10,9 12,1
Wind Direction (°)

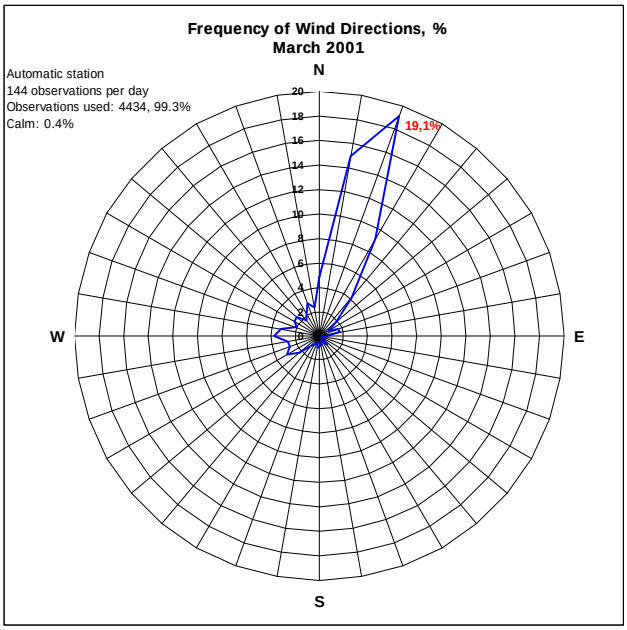
Seley

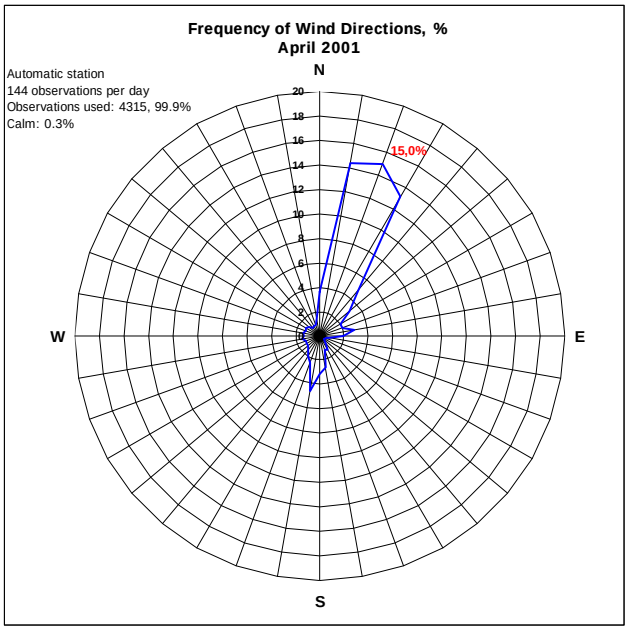

Frequency of Wind Directions
January 2001
Automatic station
144 observations per day
Observations used: 4410, 98.8%
Calm: 0.1%
N
W
E
S
6,8%

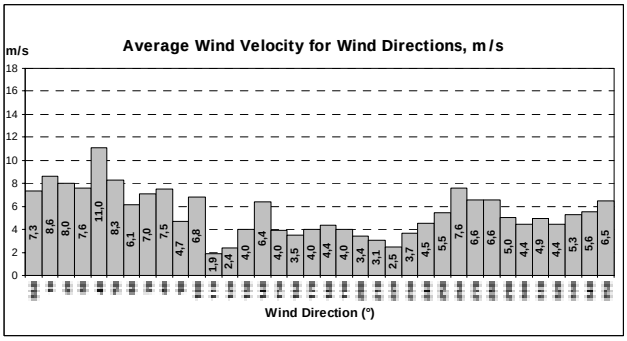

Frequency of Wind Directions, %
February 2001
Automatic station
144 observations per day
Observations used: 3999, 99.2%
Calm: 0.1%
N
W
E
S
5,1%

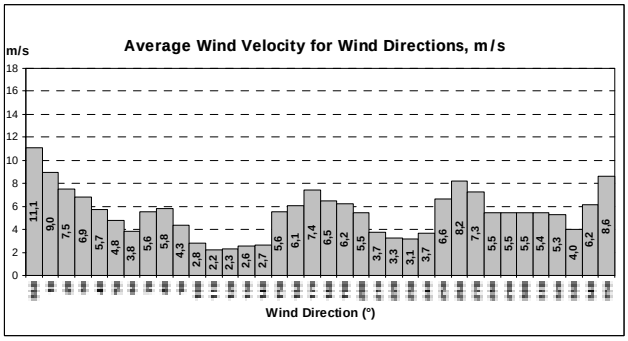

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)


Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

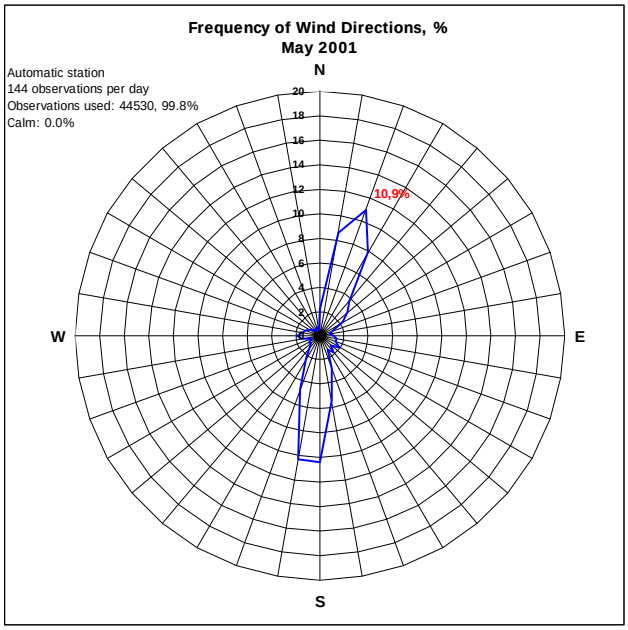

Frequency of Wind Directions, %
March 2001
Automatic station
144 observations per day
Observations used: 4434, 99.3%
Calm: 0.4%
N
W
E
S
19,1%

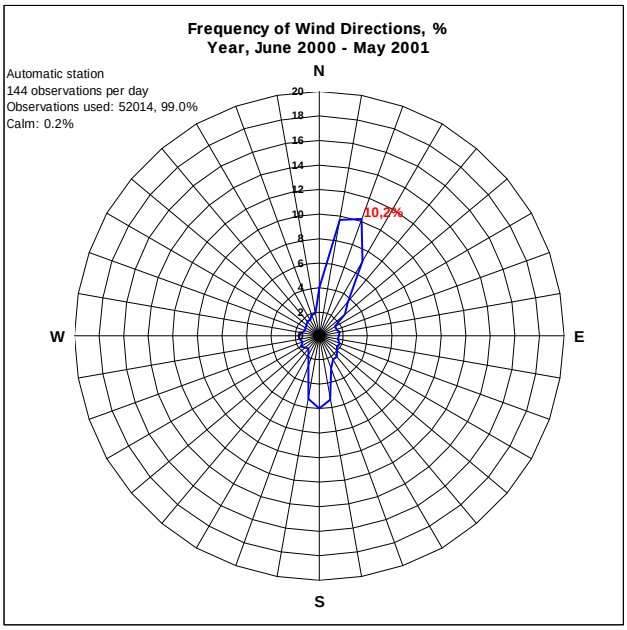

Frequency of Wind Directions, %
April 2001
Automatic station
144 observations per day
Observations used: 4315, 99.9%
Calm: 0.3%
N
W
E
S
15,0%

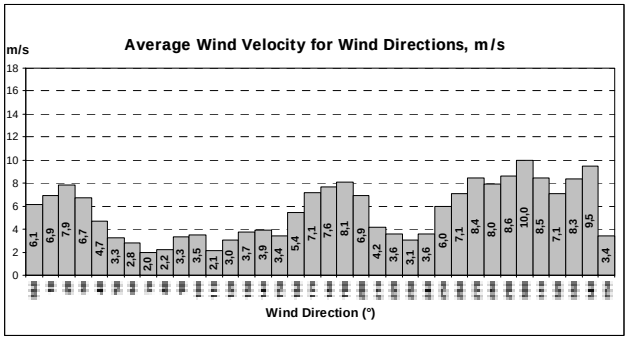

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

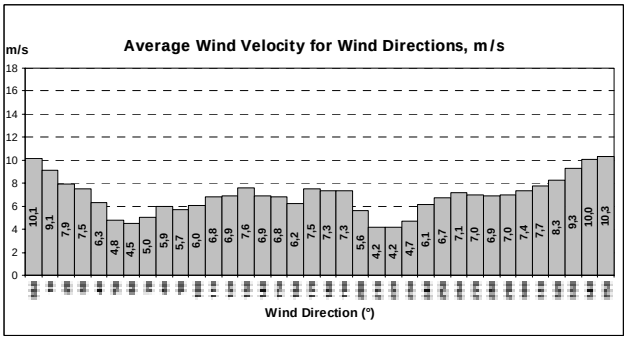

Average Wind Velocity for Wind Directions, m/s
m/s
Wind Direction (°)

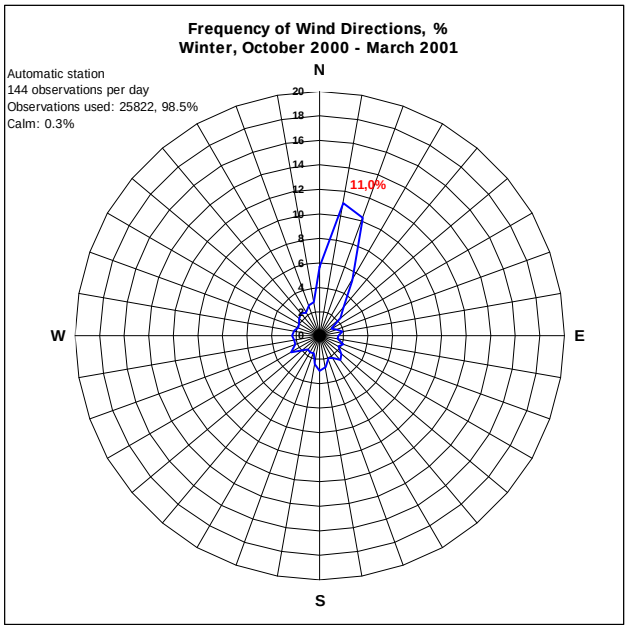
Seley

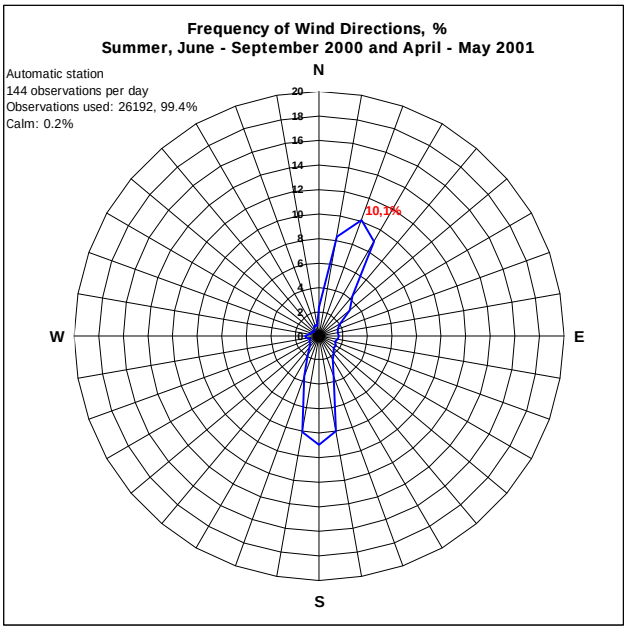


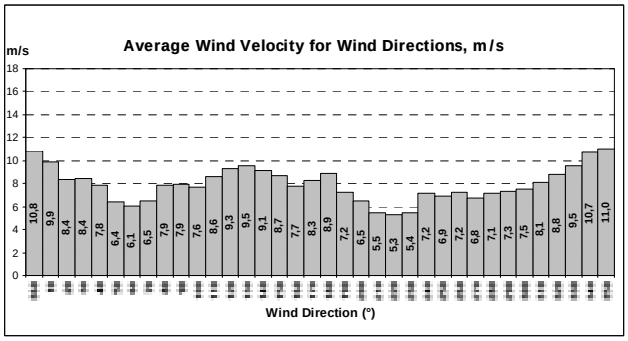


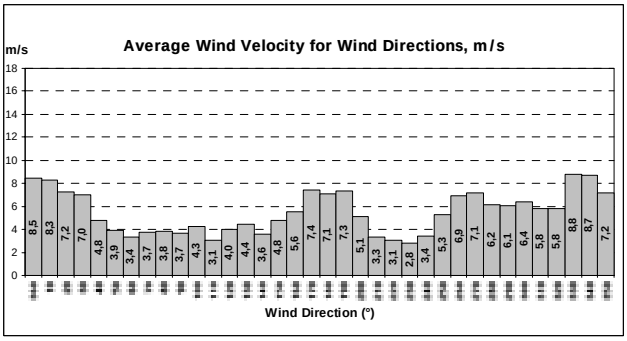






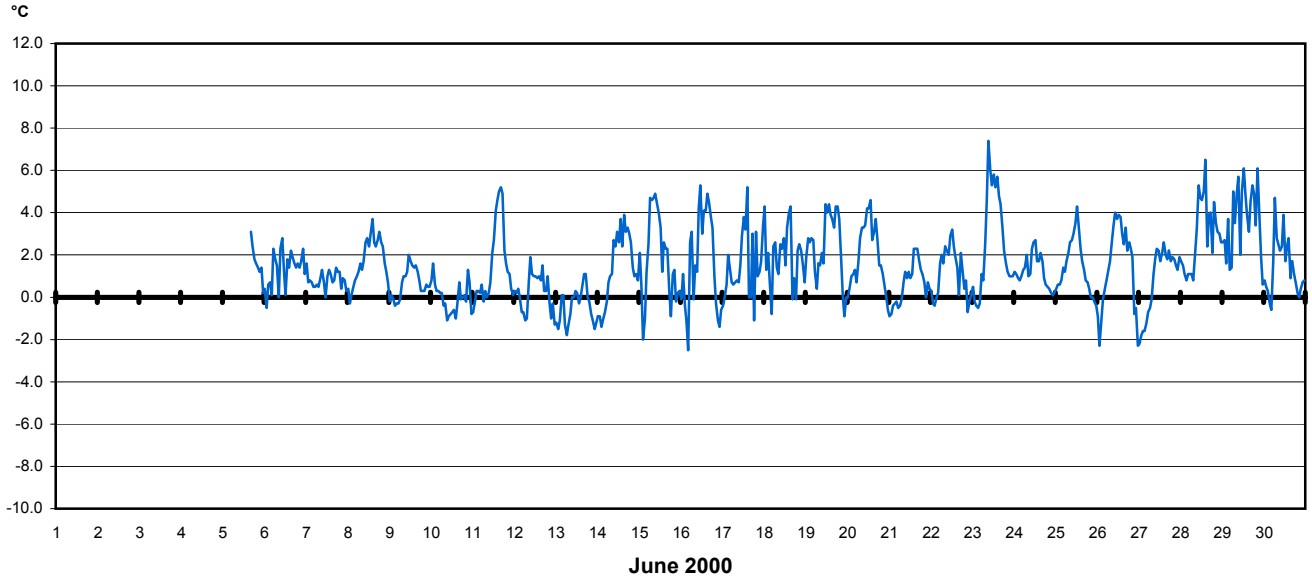




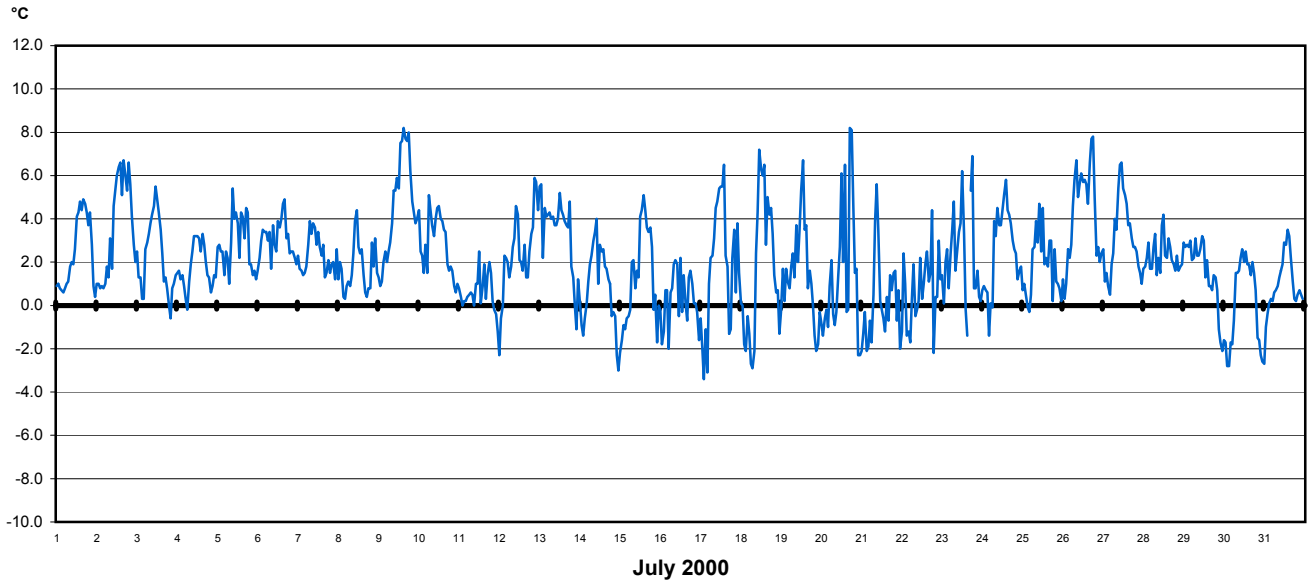


Annex 20

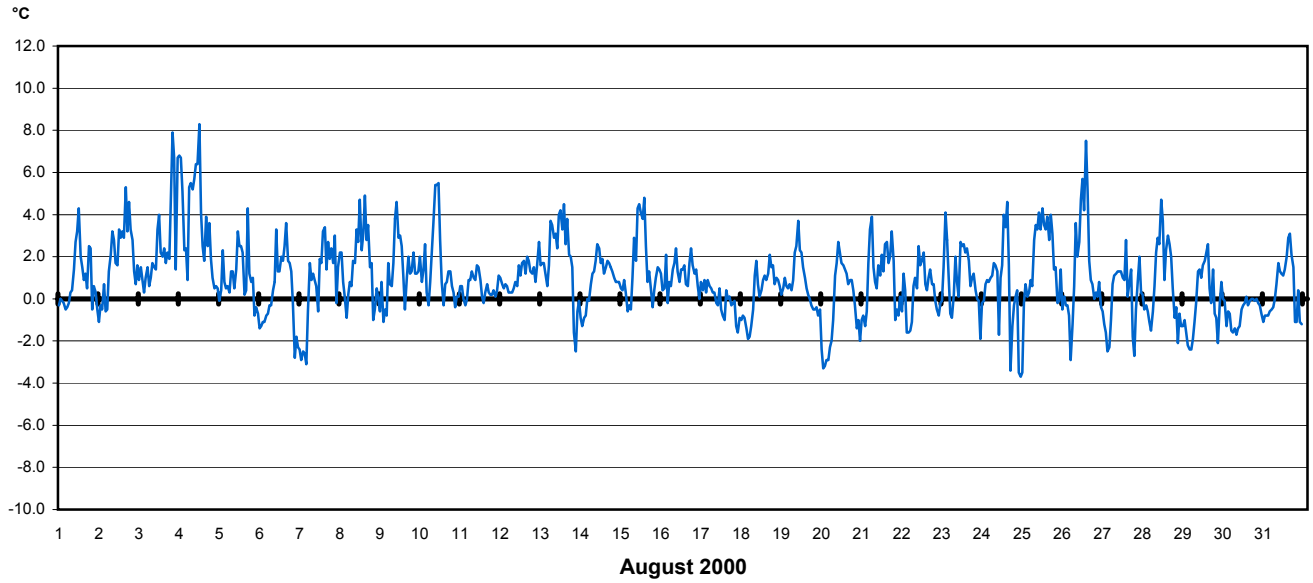
Temperature Difference Kollaleira 2 - Vattarnes, °C



June 2000



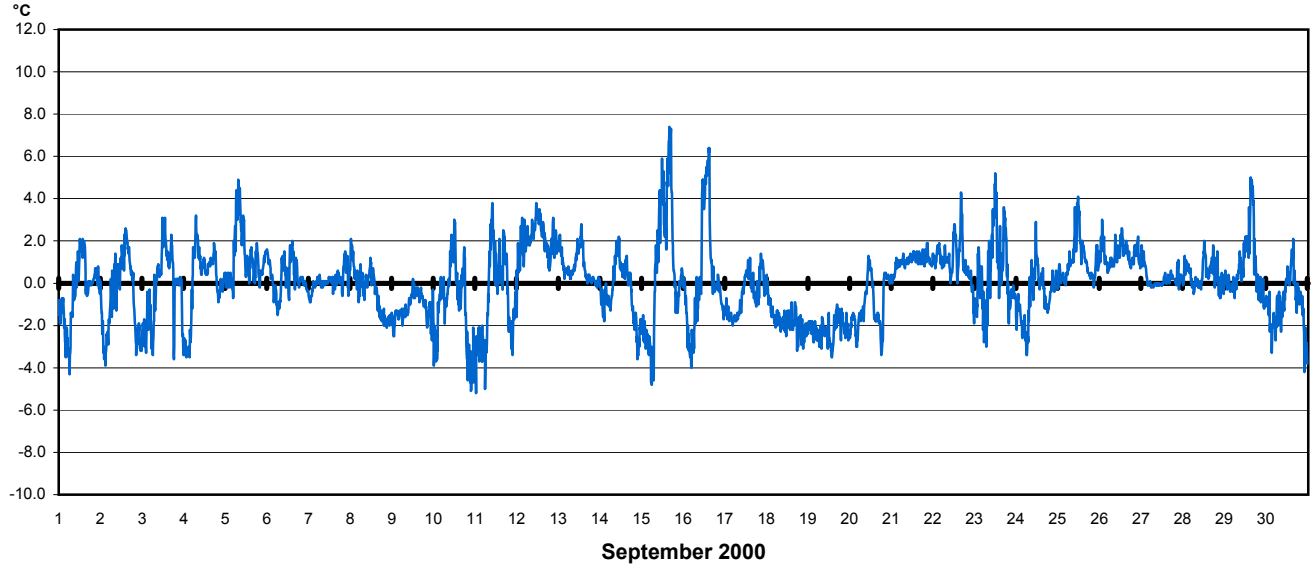
July 2000

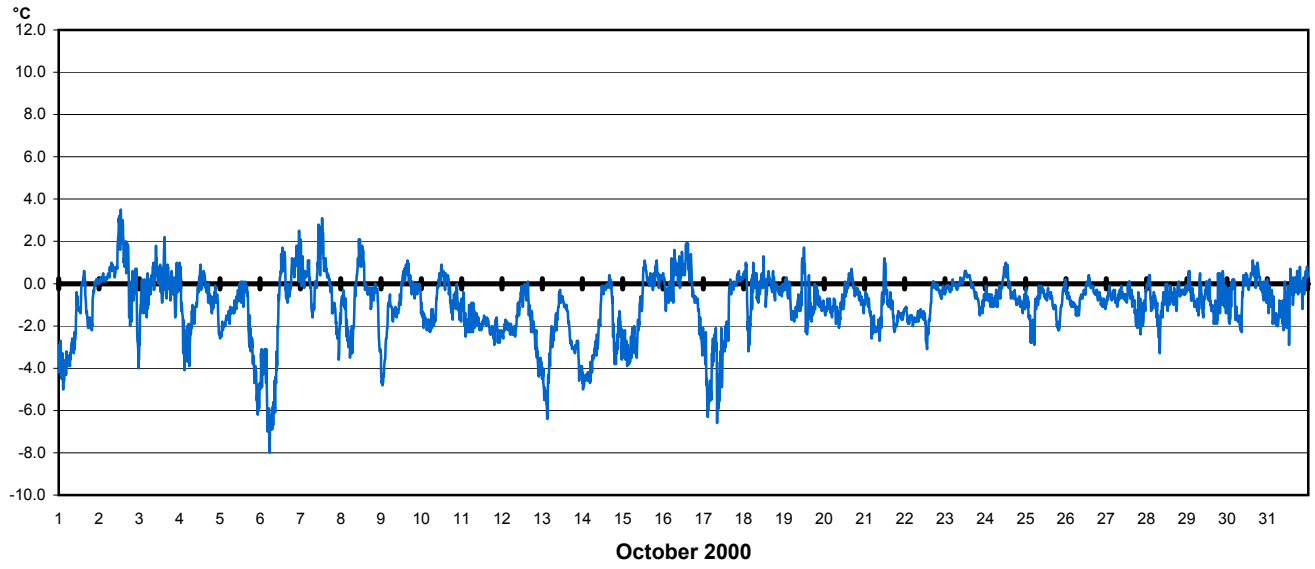


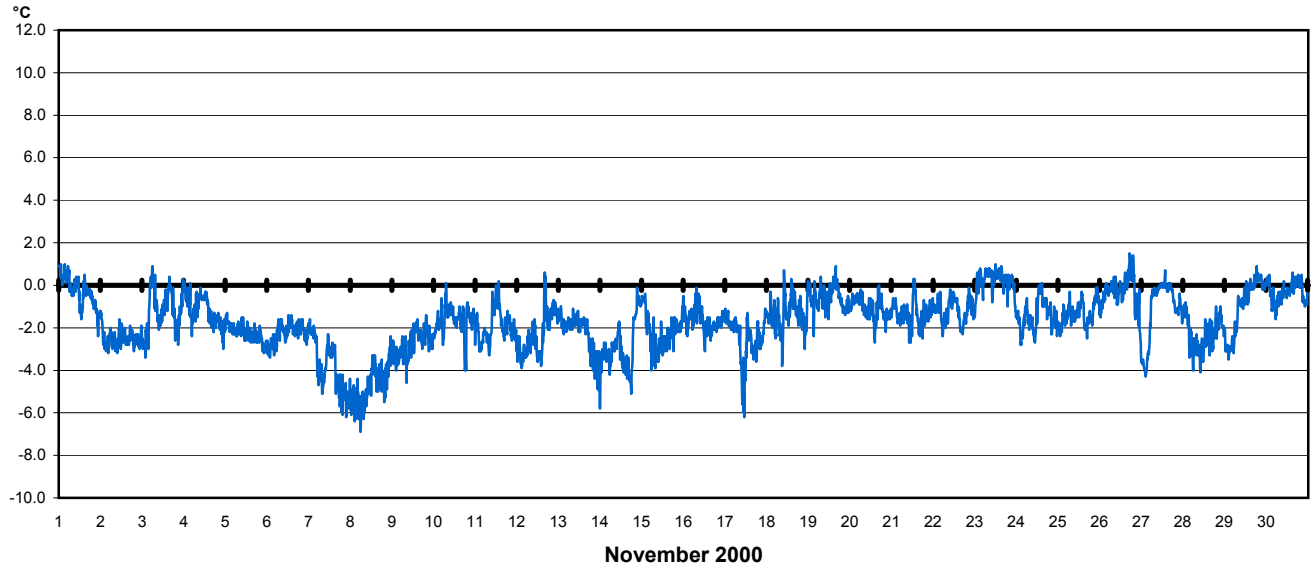
August 2000

Annex 21

Temperature Difference Kollaleira 2 - Vattarnes, °C

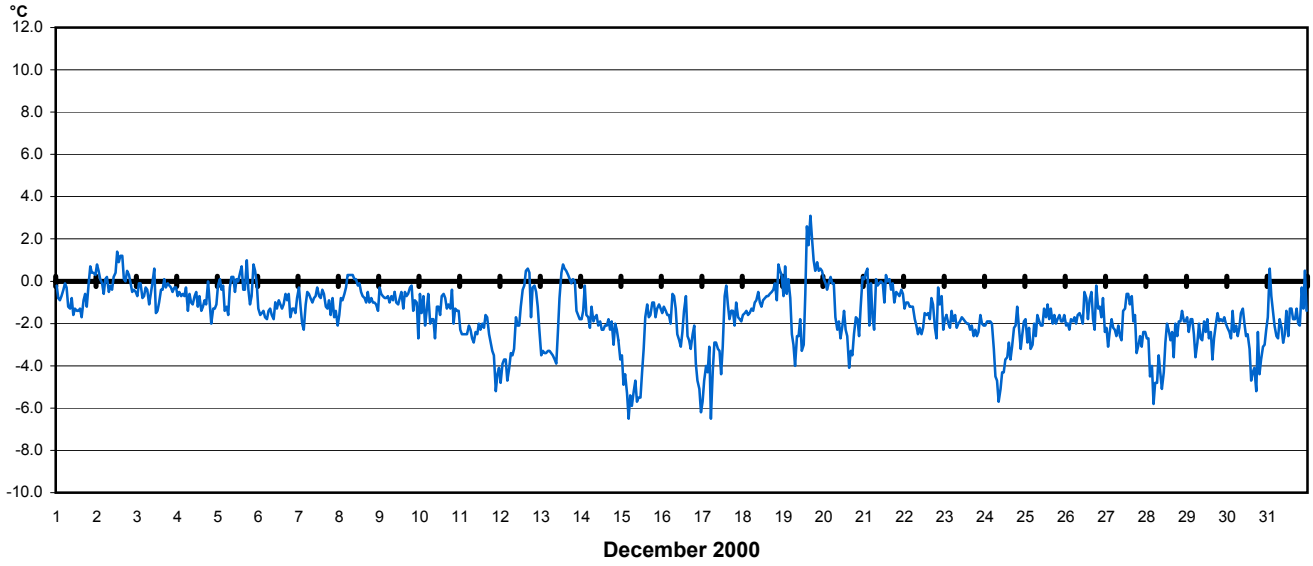




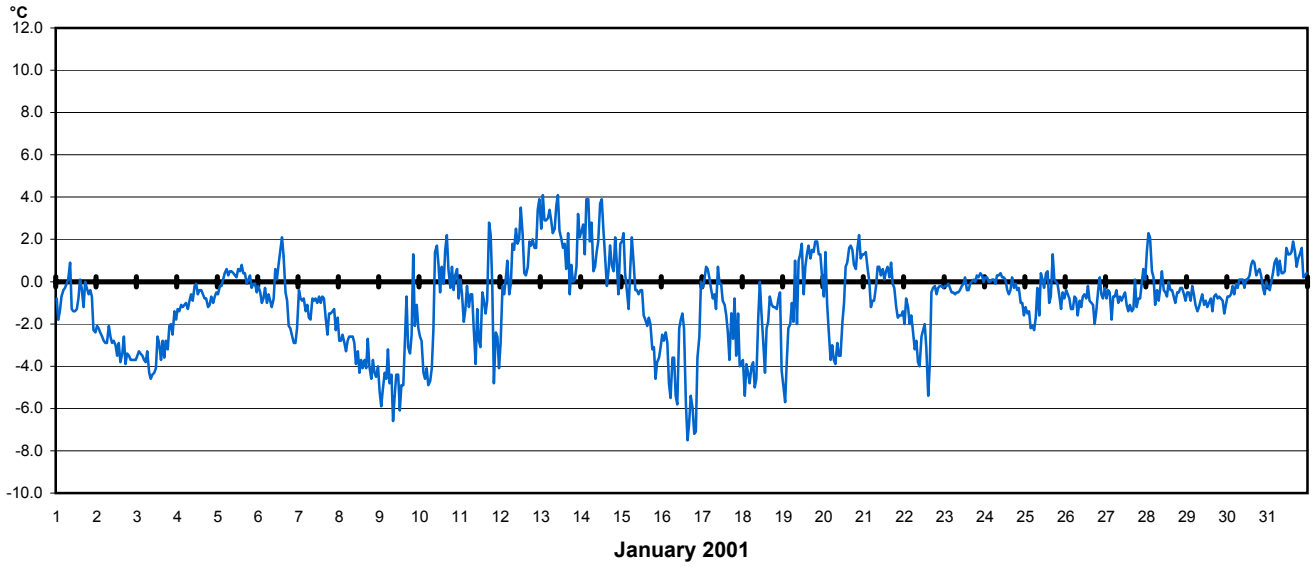


Annex 22

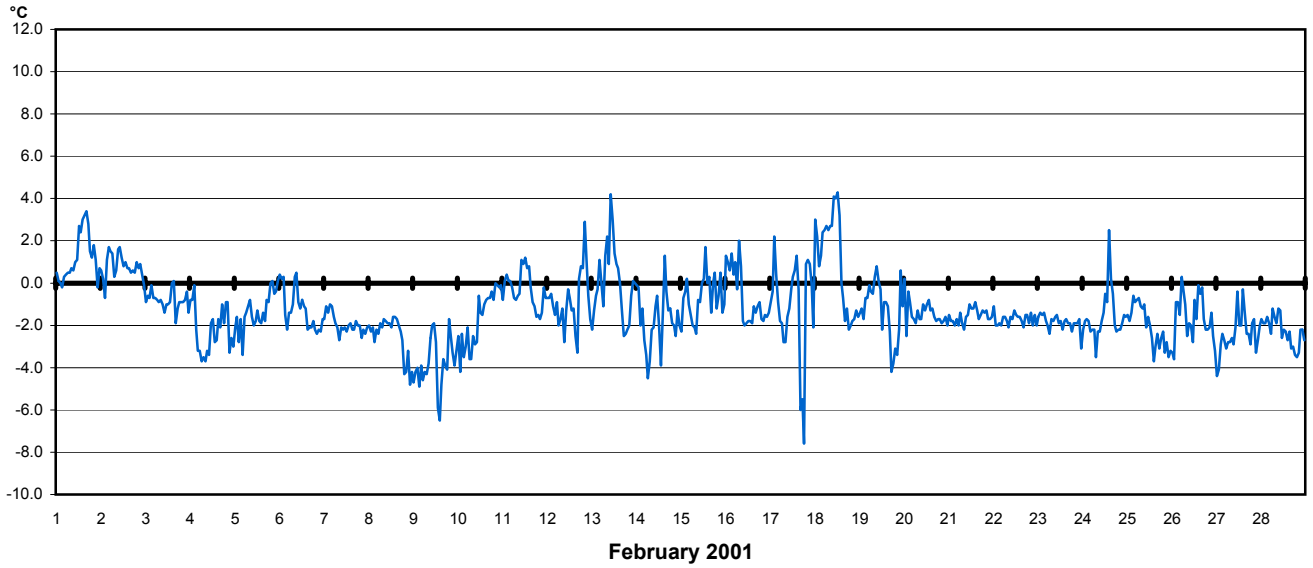
Temperature Difference Kollaleira 2 - Vattarnes, °C



December 2000



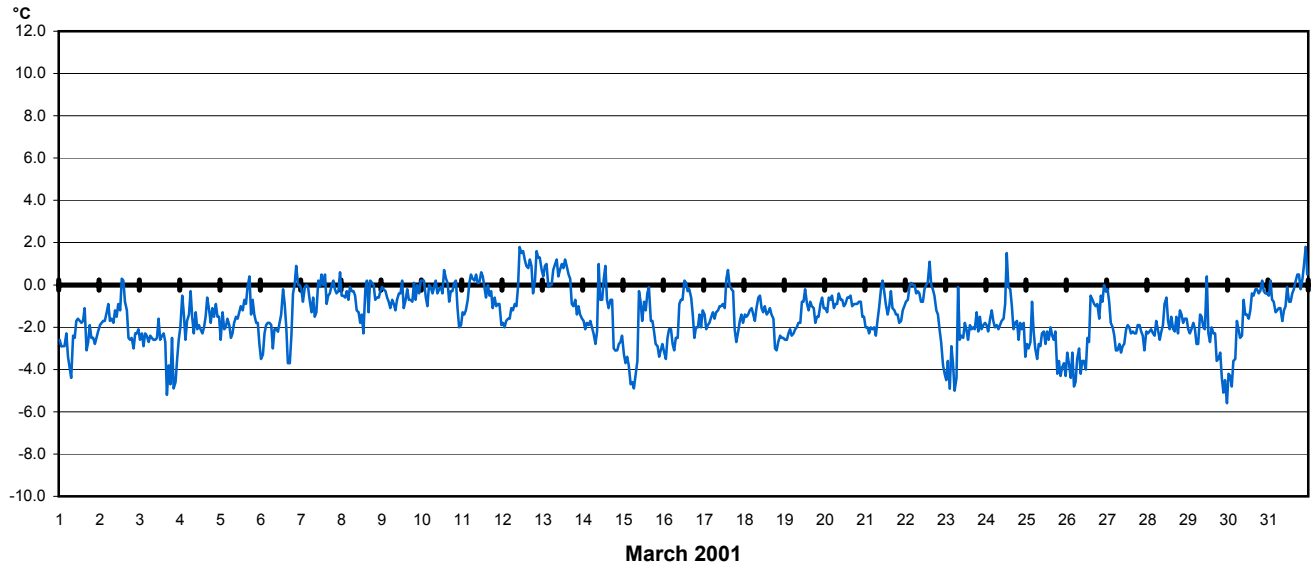
January 2001



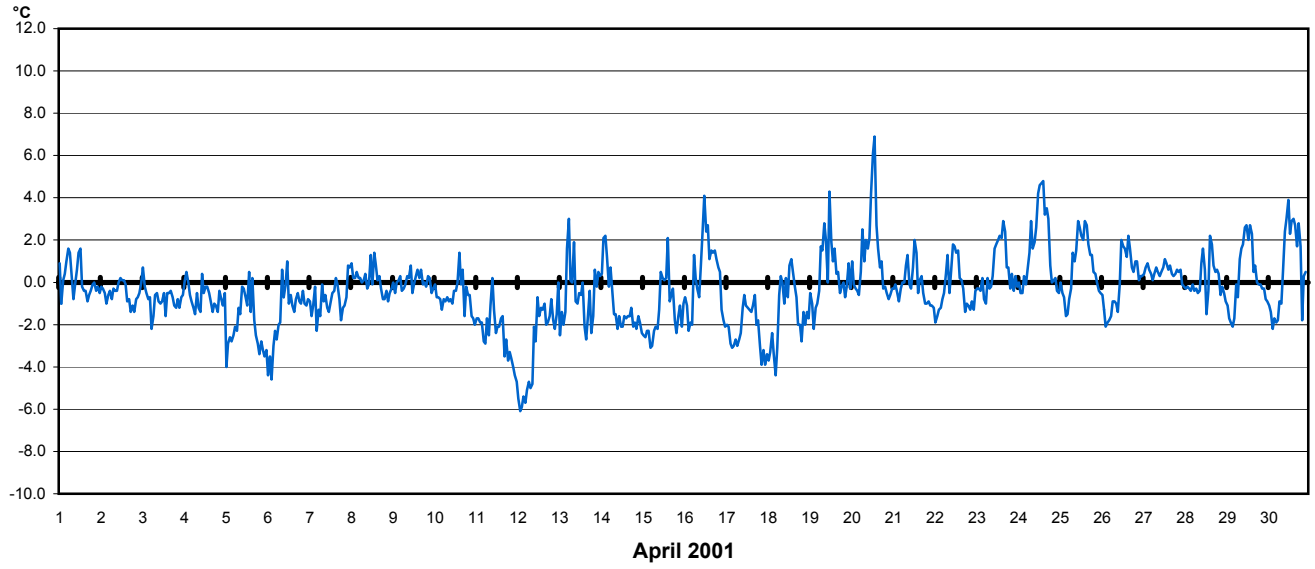
February 2001

Annex 23

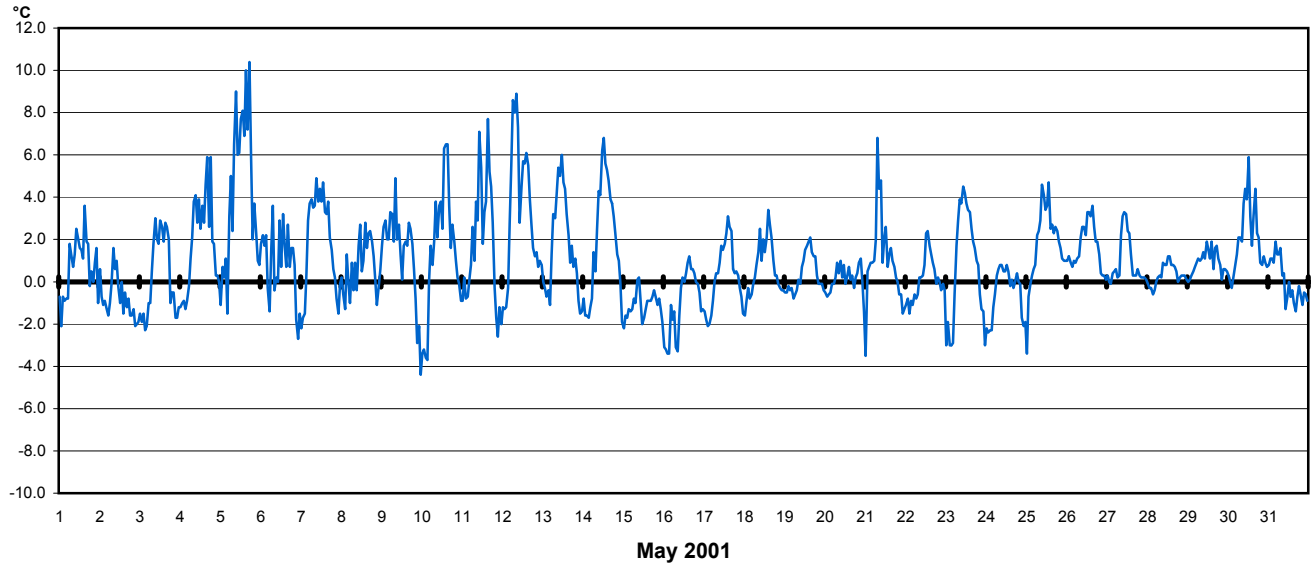
Temperature Difference Kollaleira 2 - Vattarnes, °C



March 2001



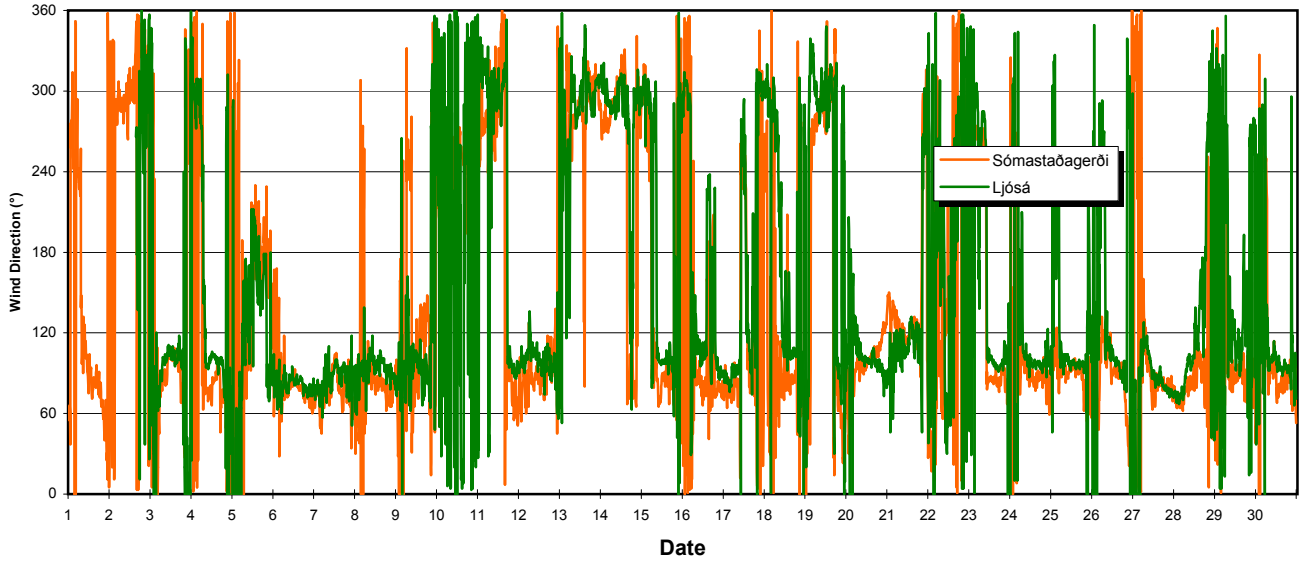
April 2001

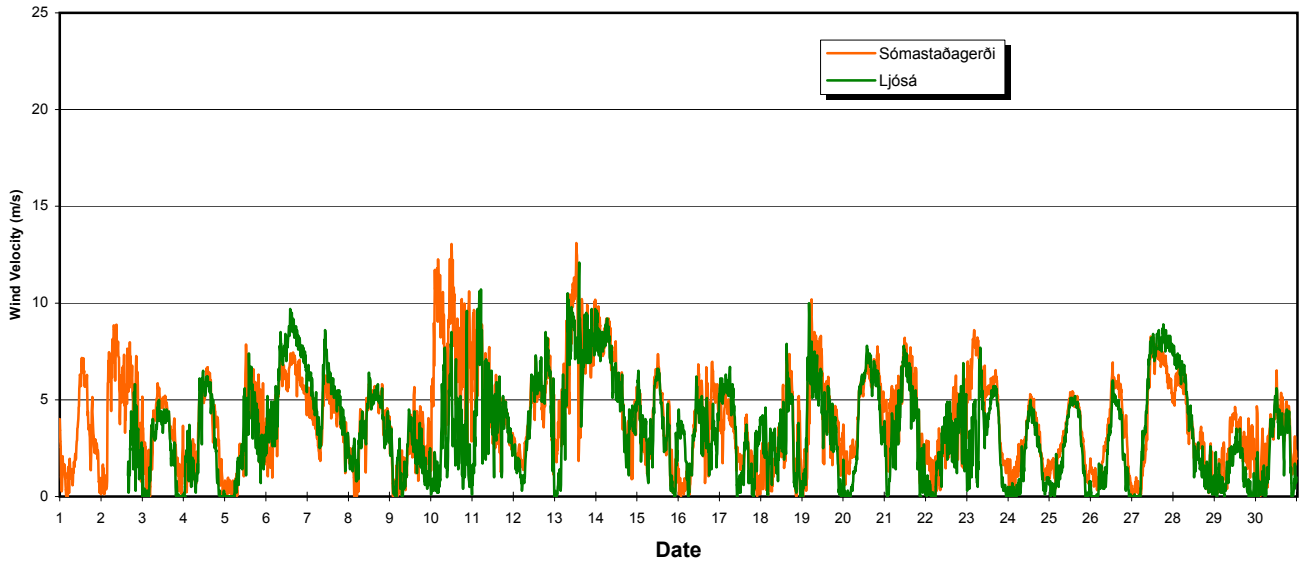


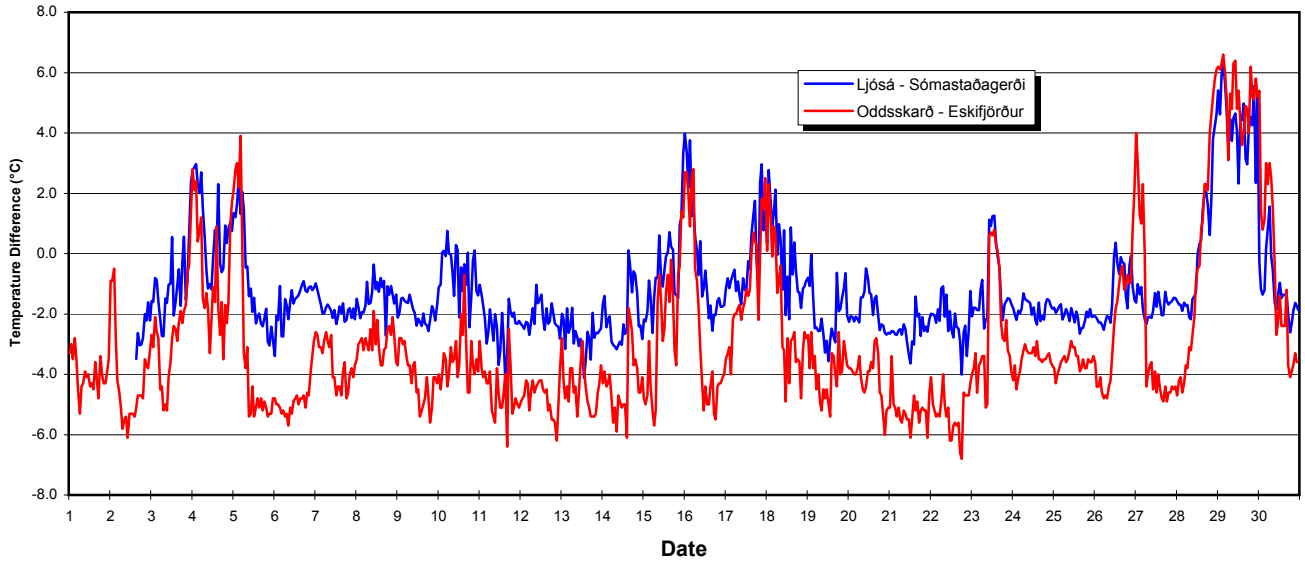
May 2001

Annex 24

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Difference at Ljósá and Sómastaðagerði June 2000

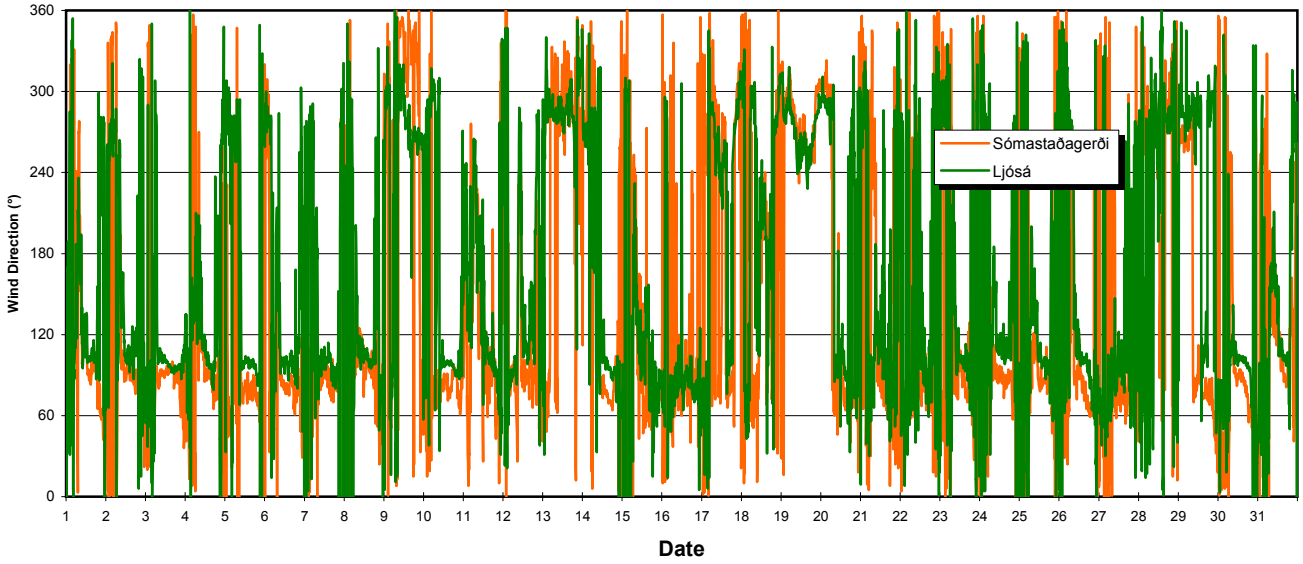


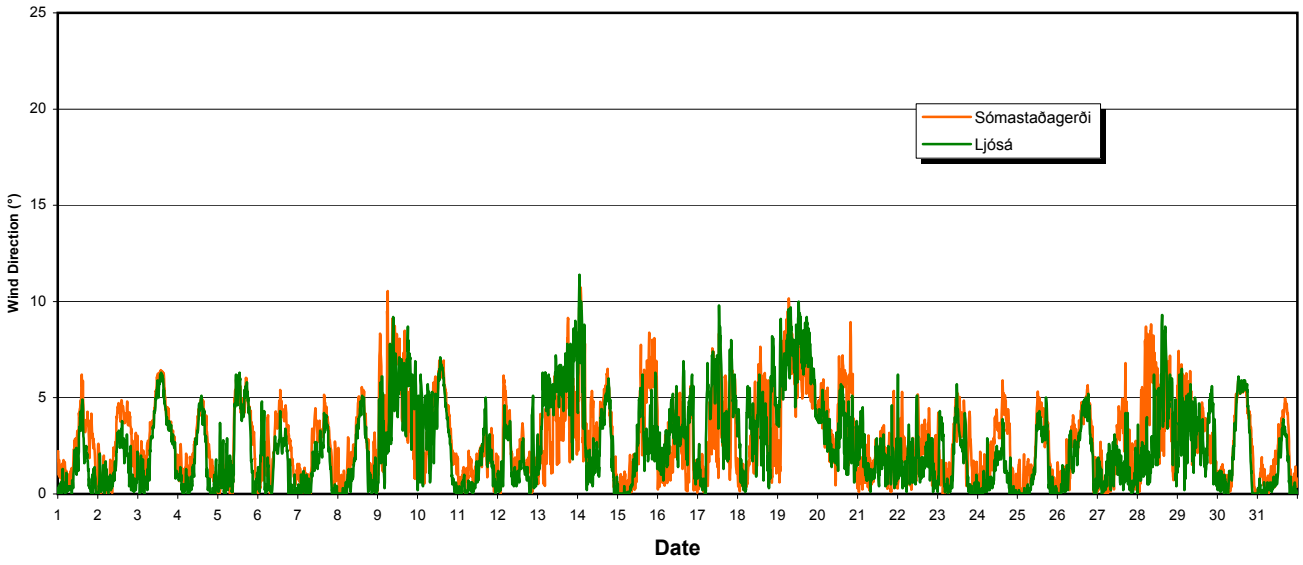


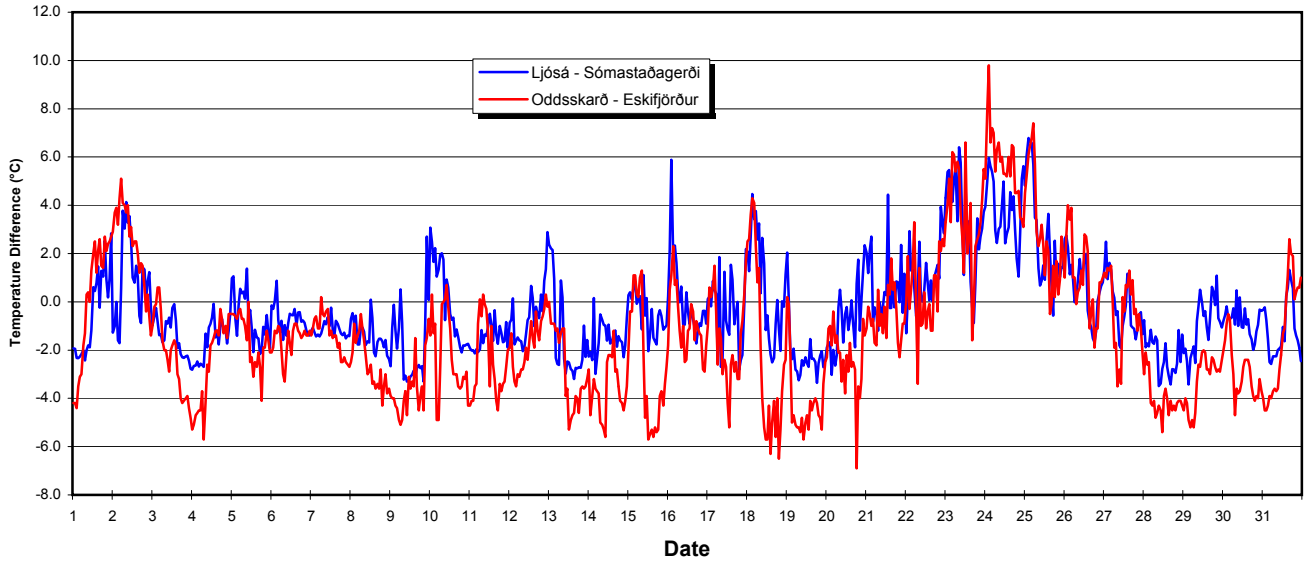


Annex 25

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Differenceat Ljósá and Sómastaðagerði July 2000

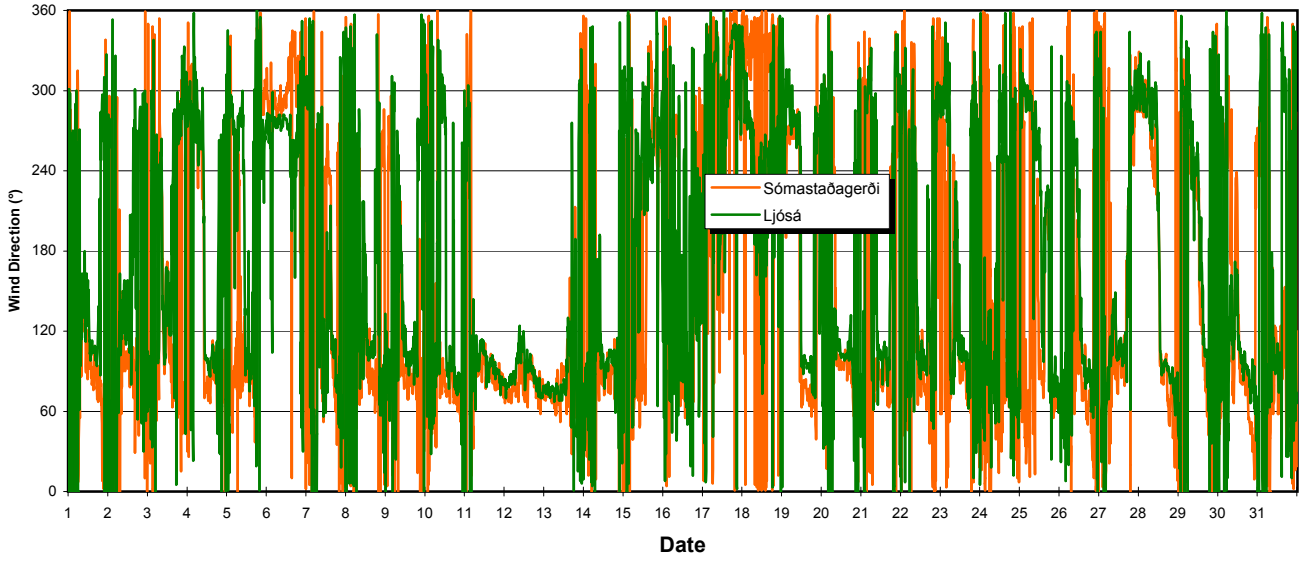


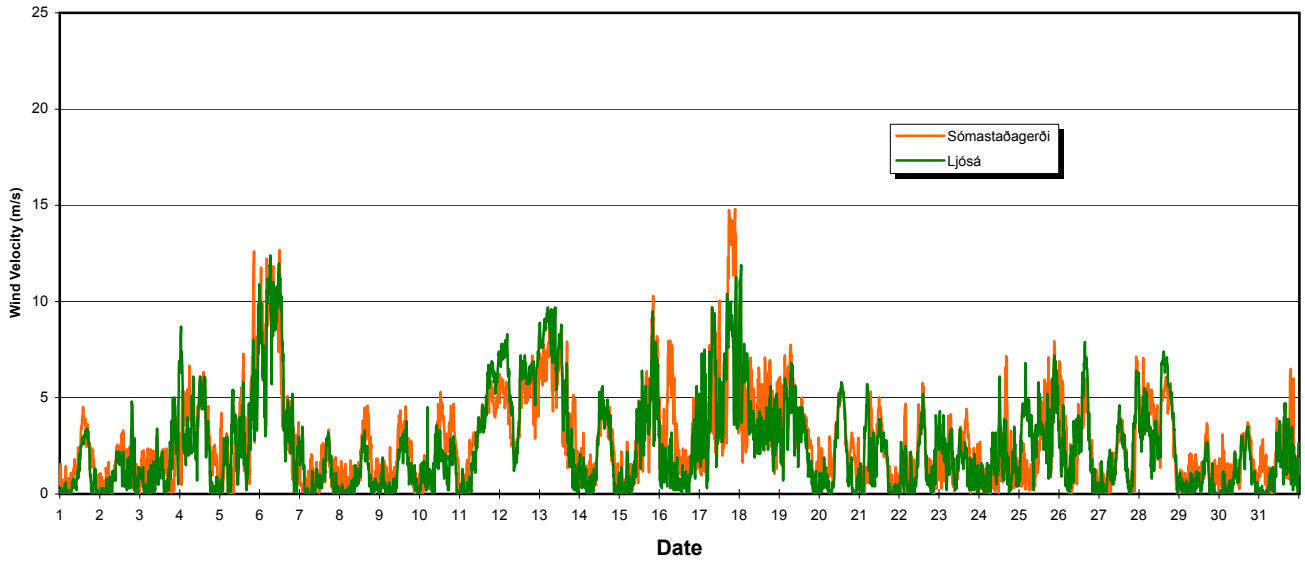


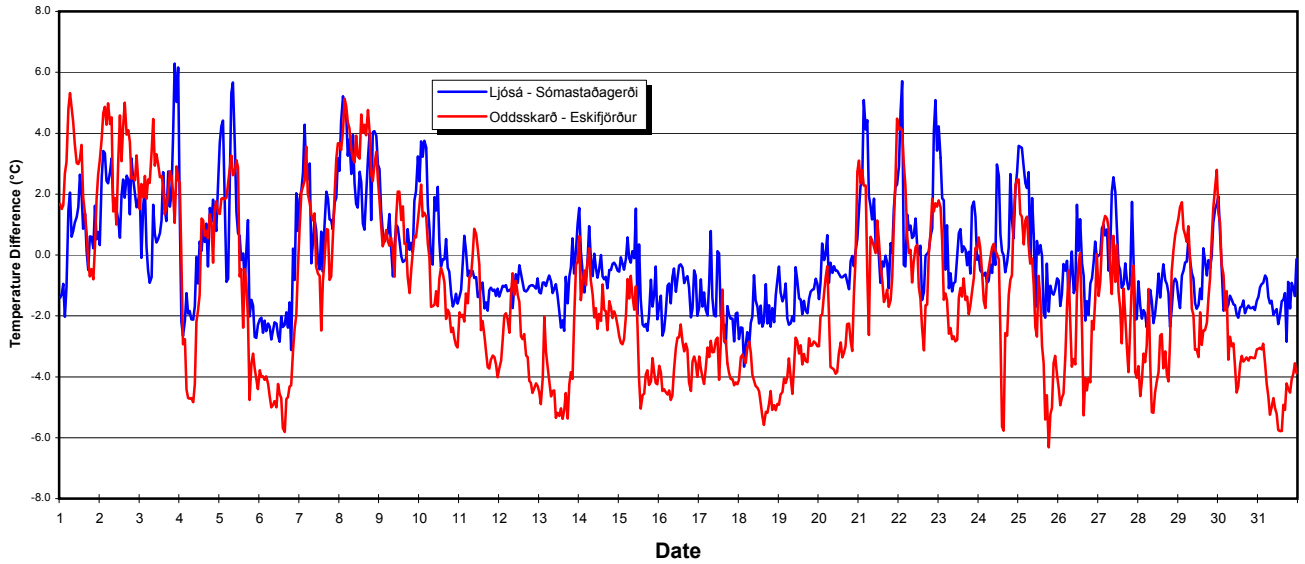


Annex 26

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Difference at Ljósá and Sómastaðagerði August 2000

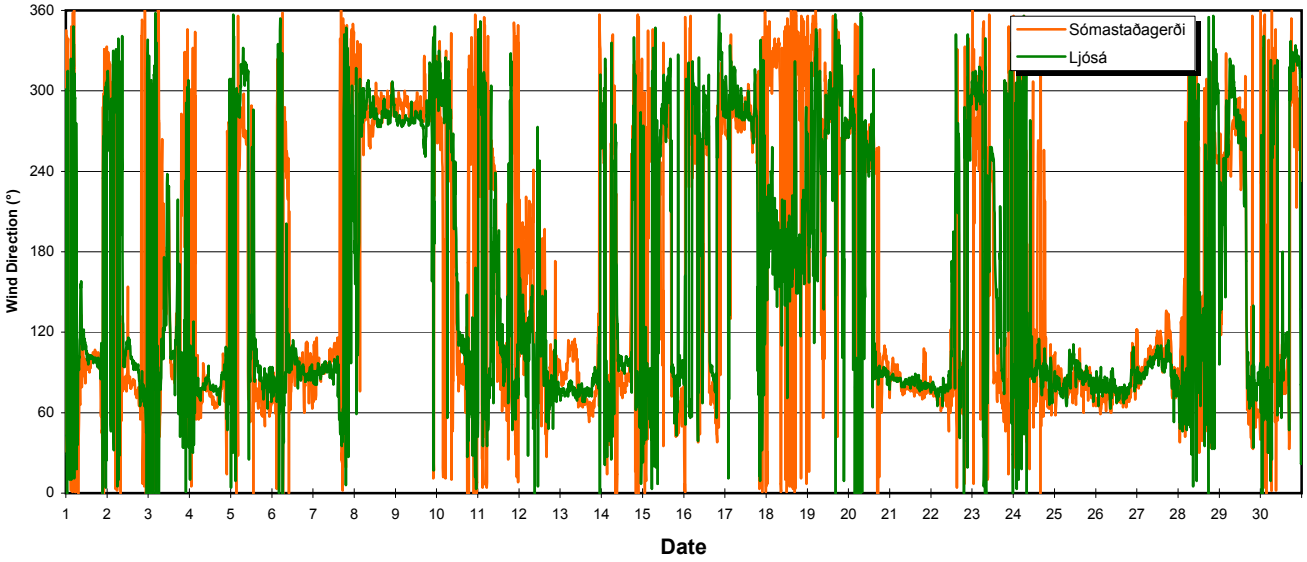


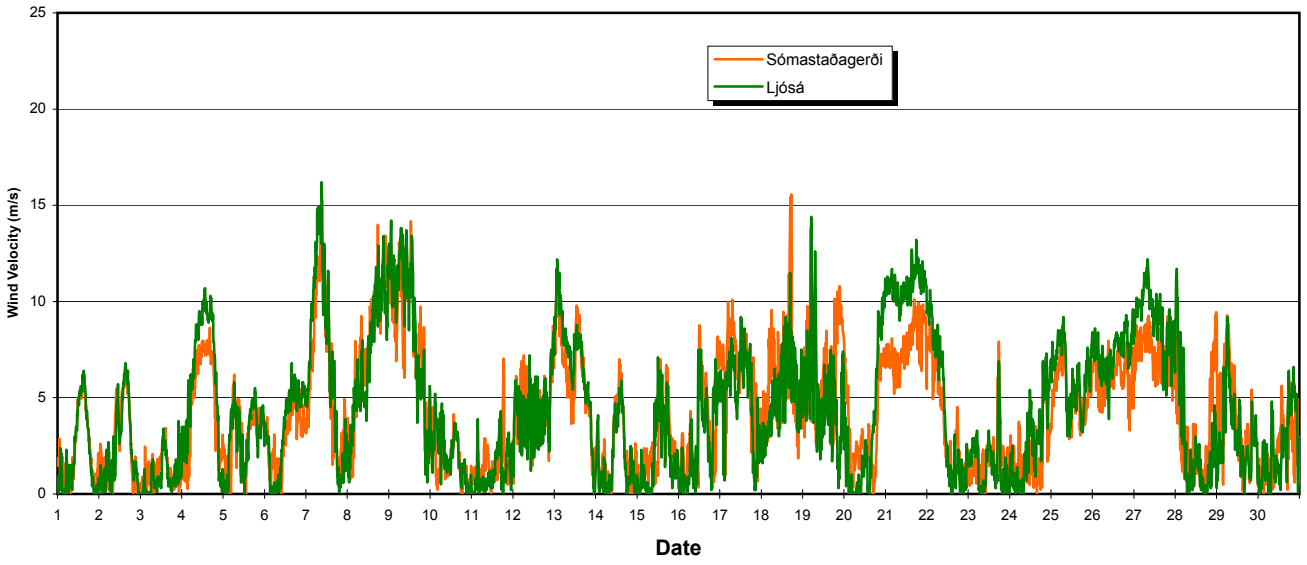


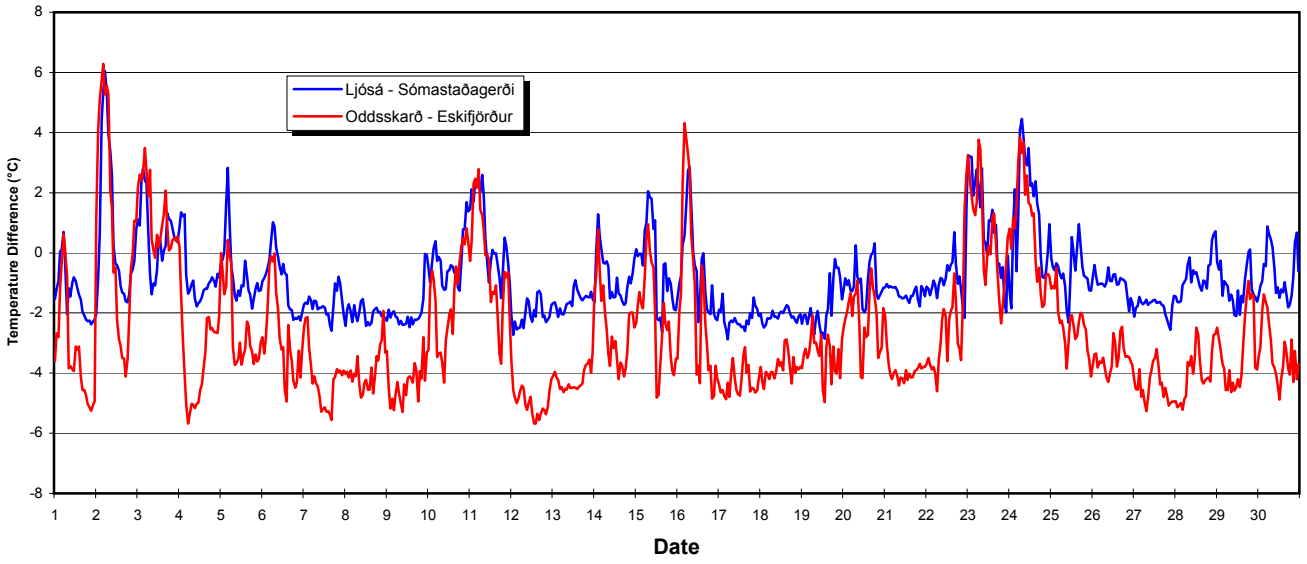


Annex 27

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Difference at Ljósá and Sómastaðagerði September 2000

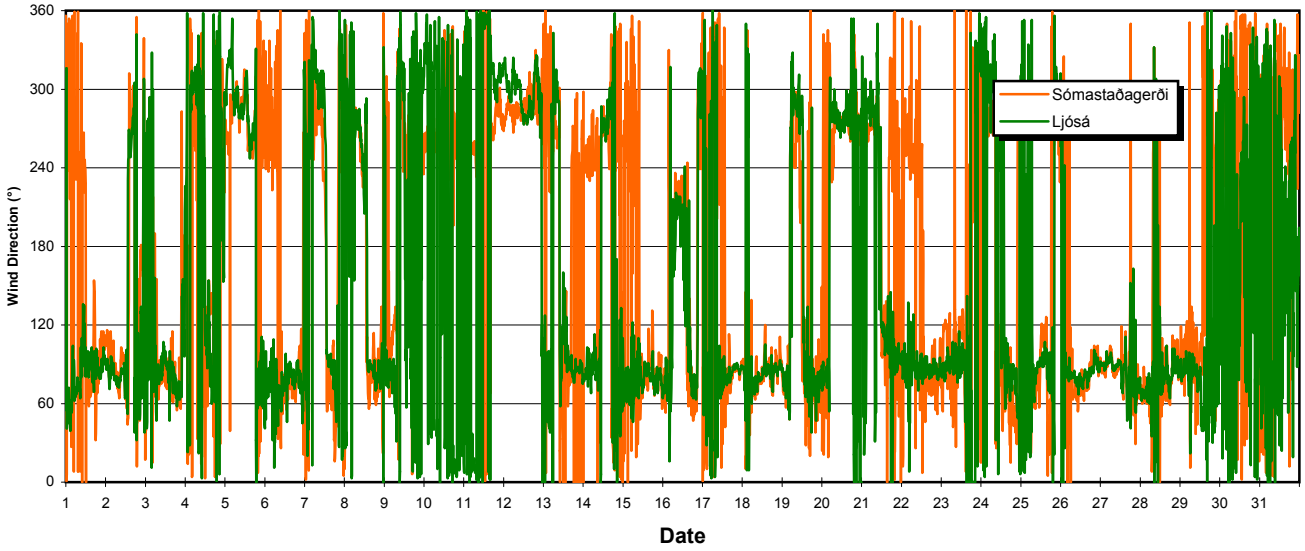


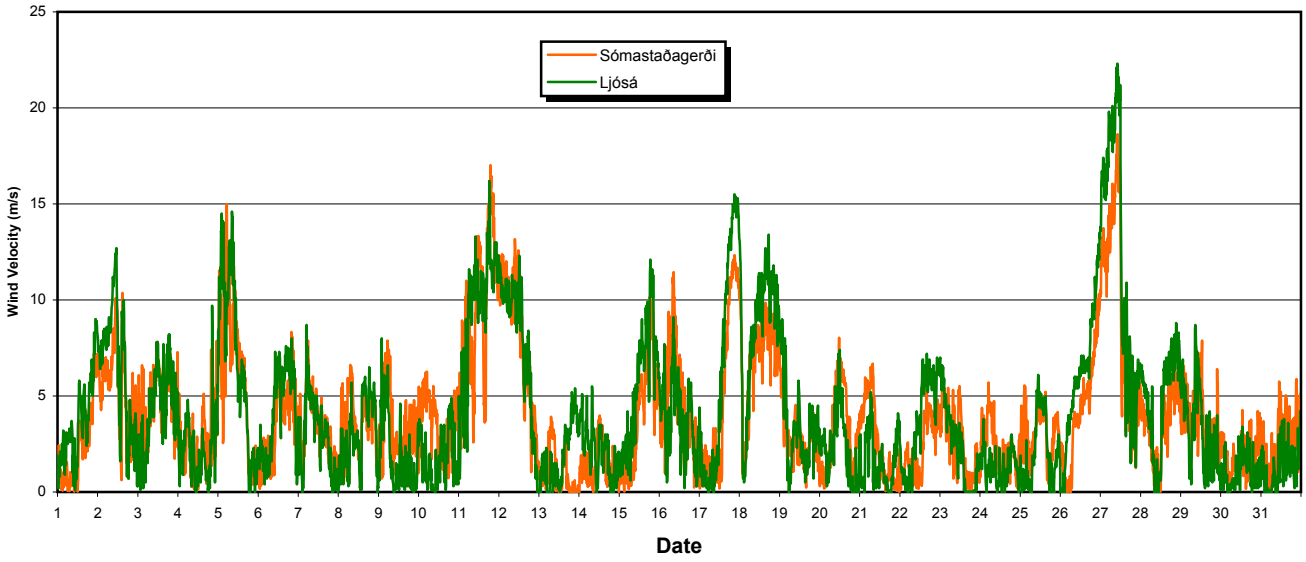


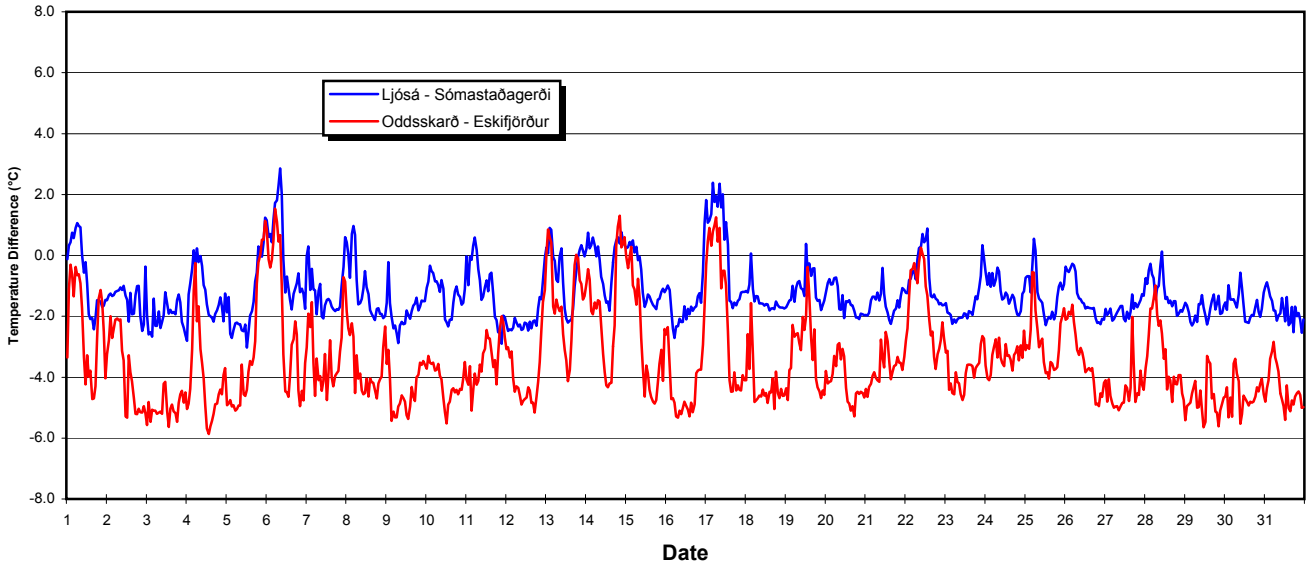


Annex 28

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Difference at Ljósá and Sómastaðagerði October 2000

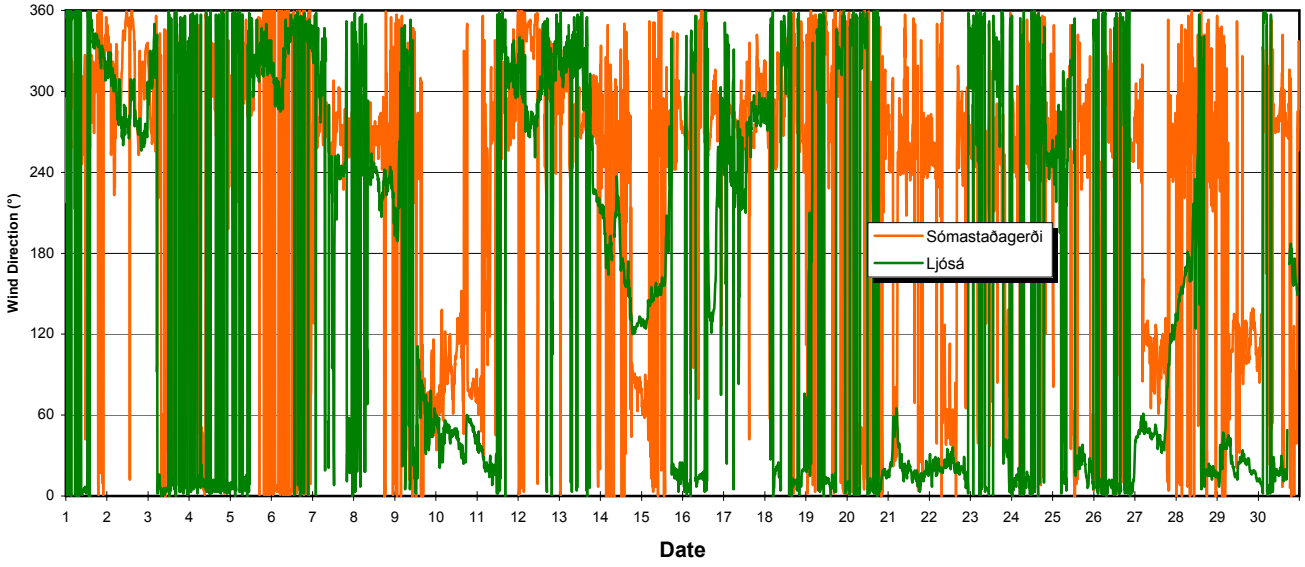


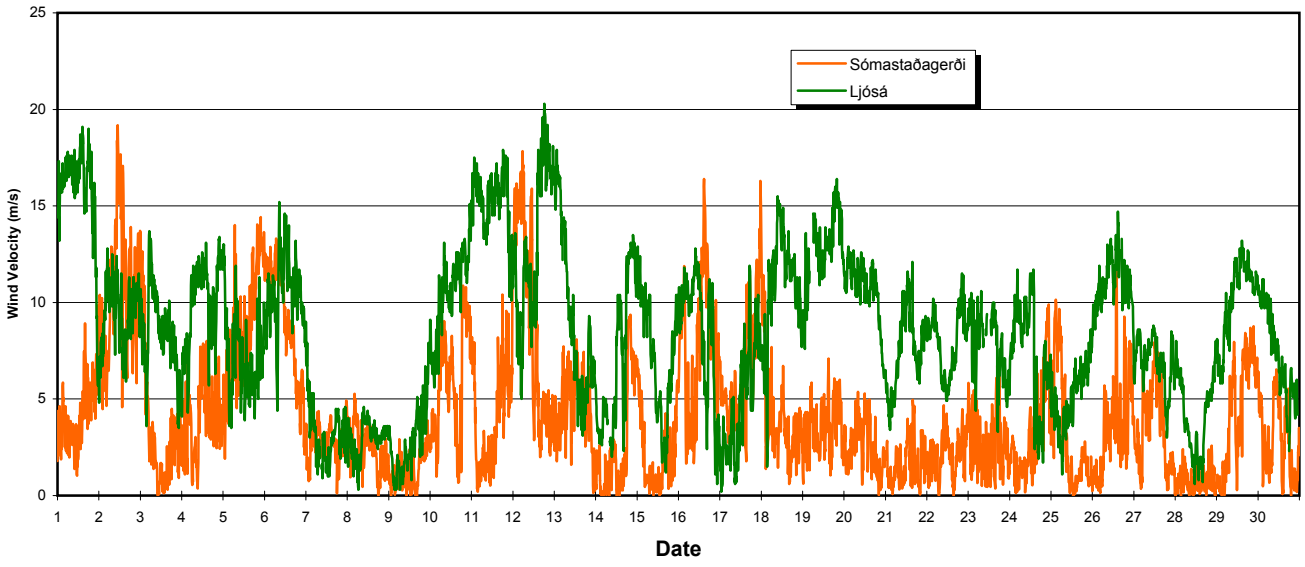


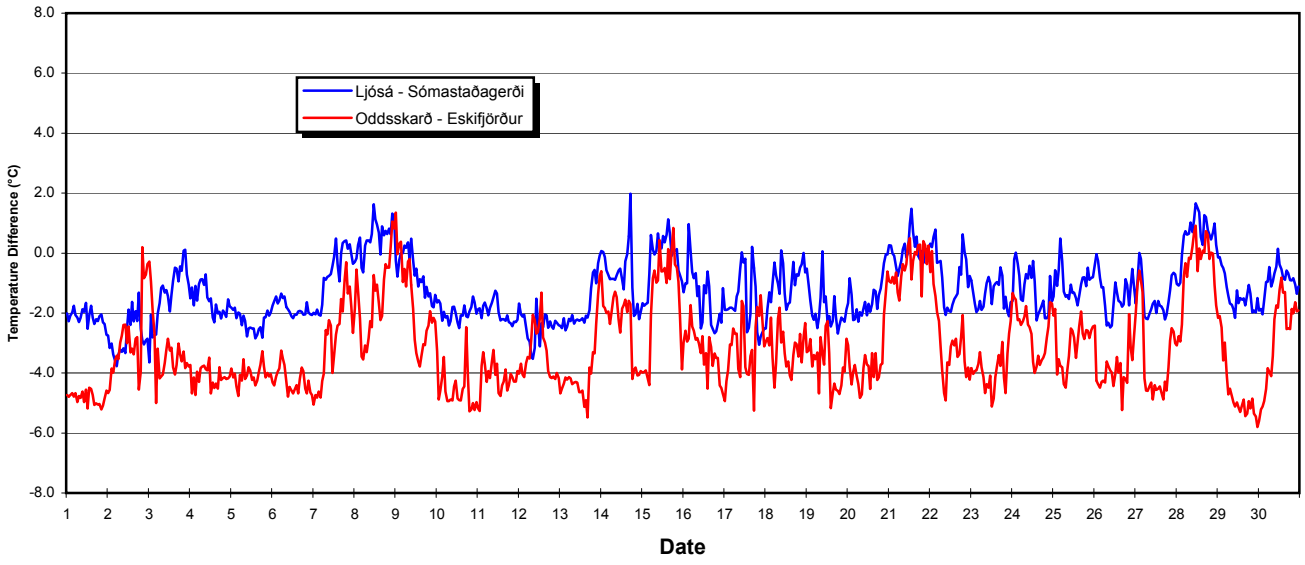


Annex 29

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Difference at Ljósá and Sómastaðagerði November 2000

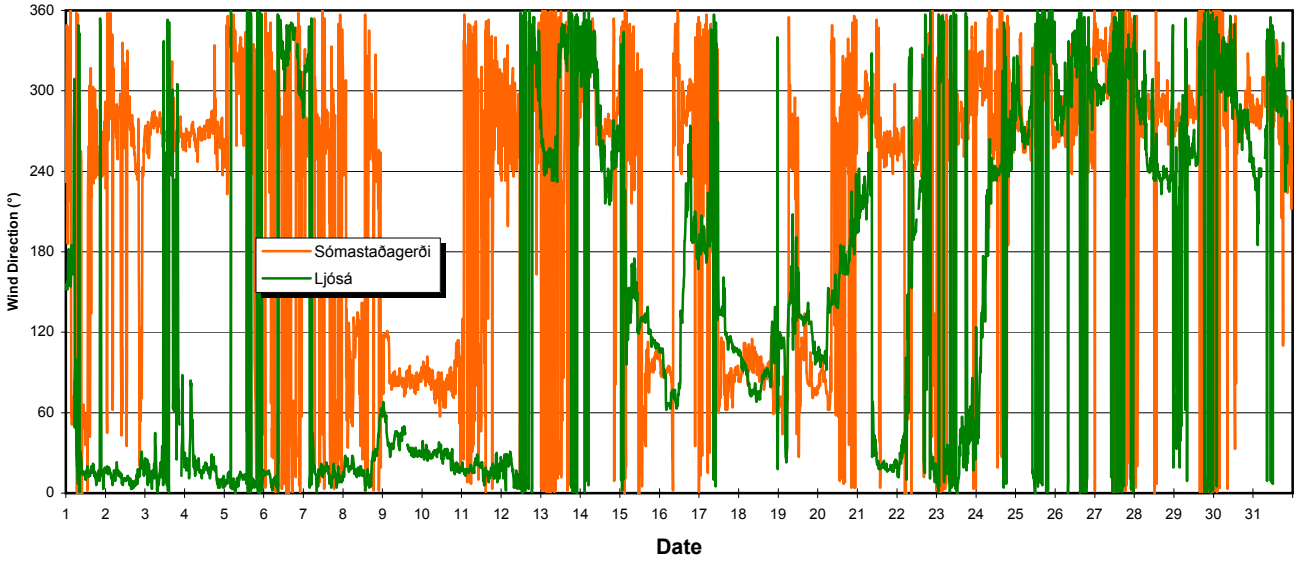


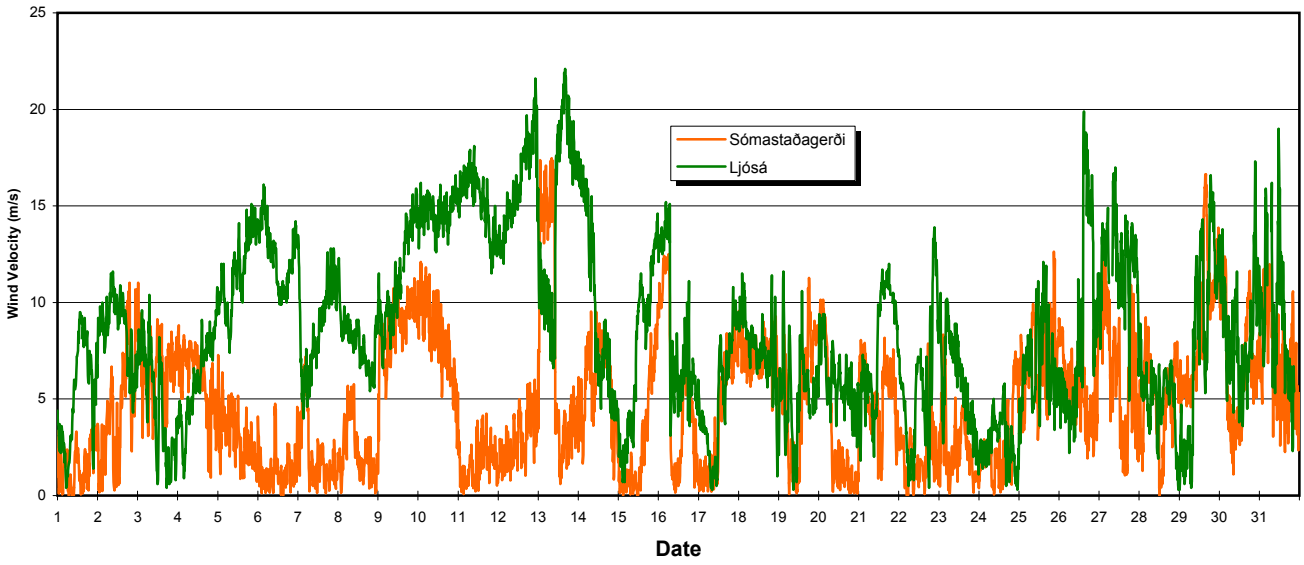


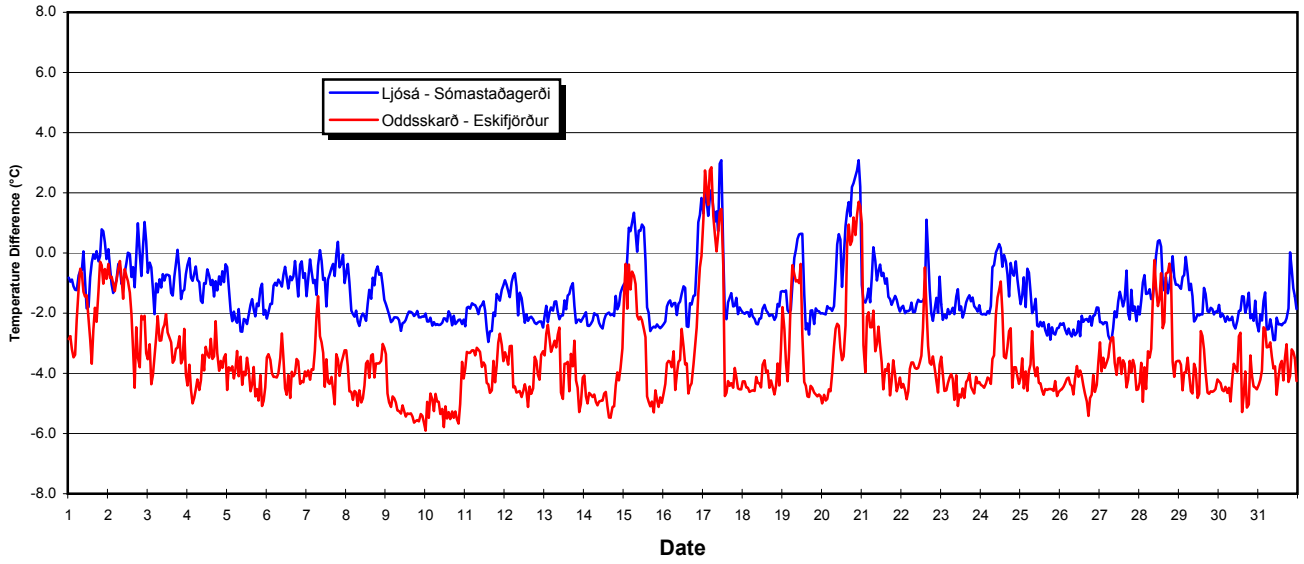


Annex 30

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Difference at Ljósá and Sómastaðagerði December 2000

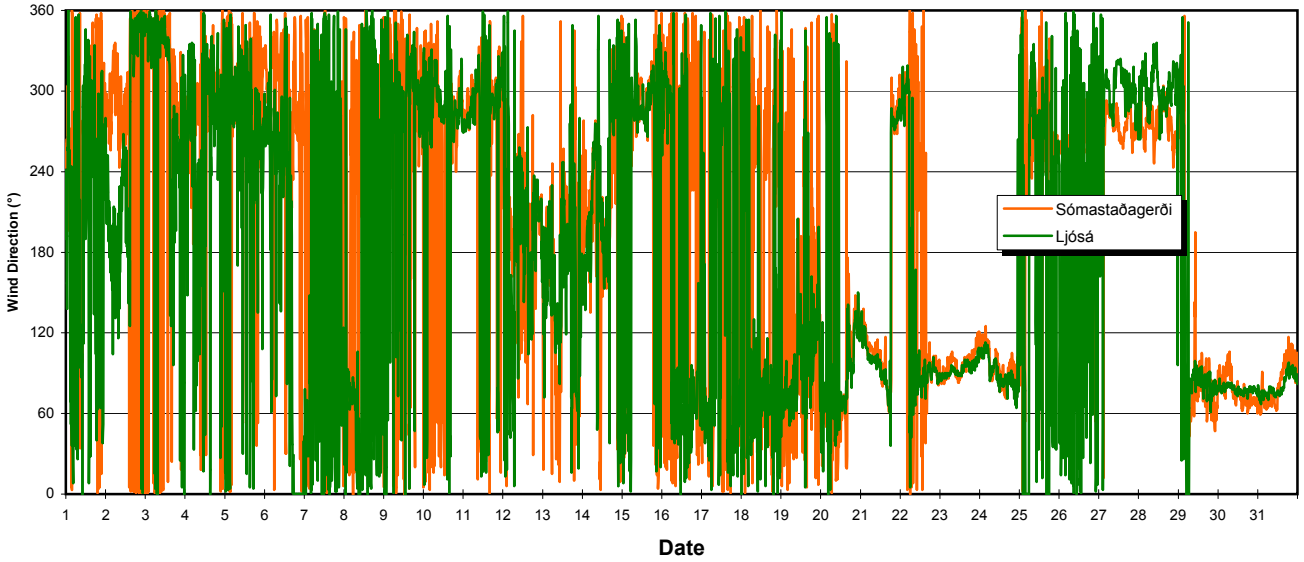


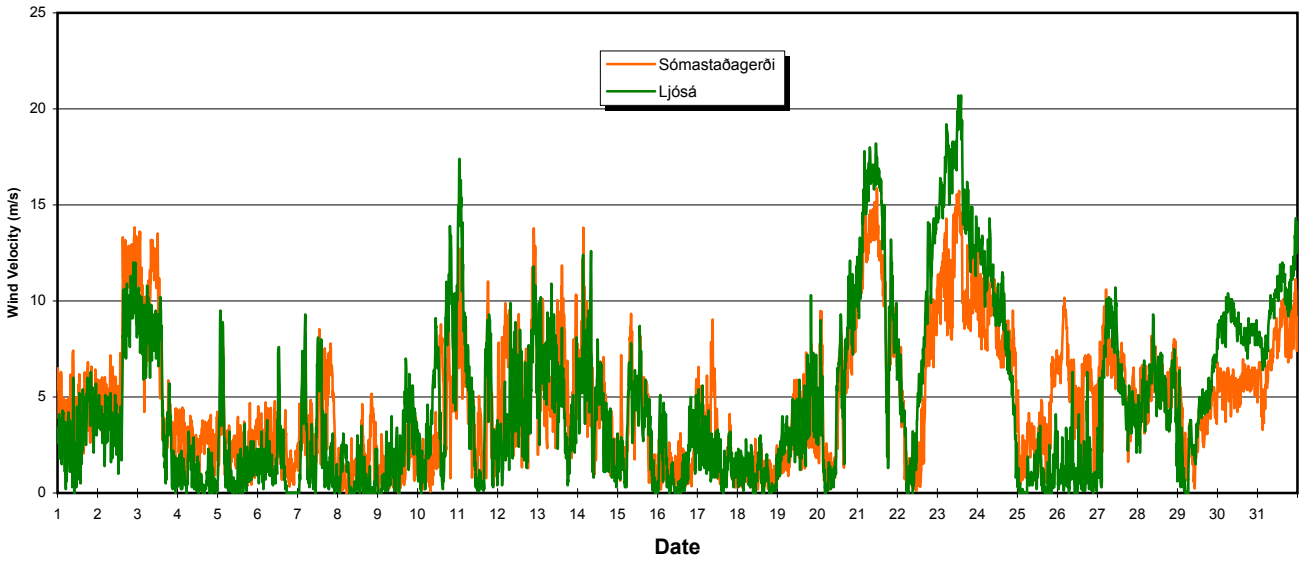


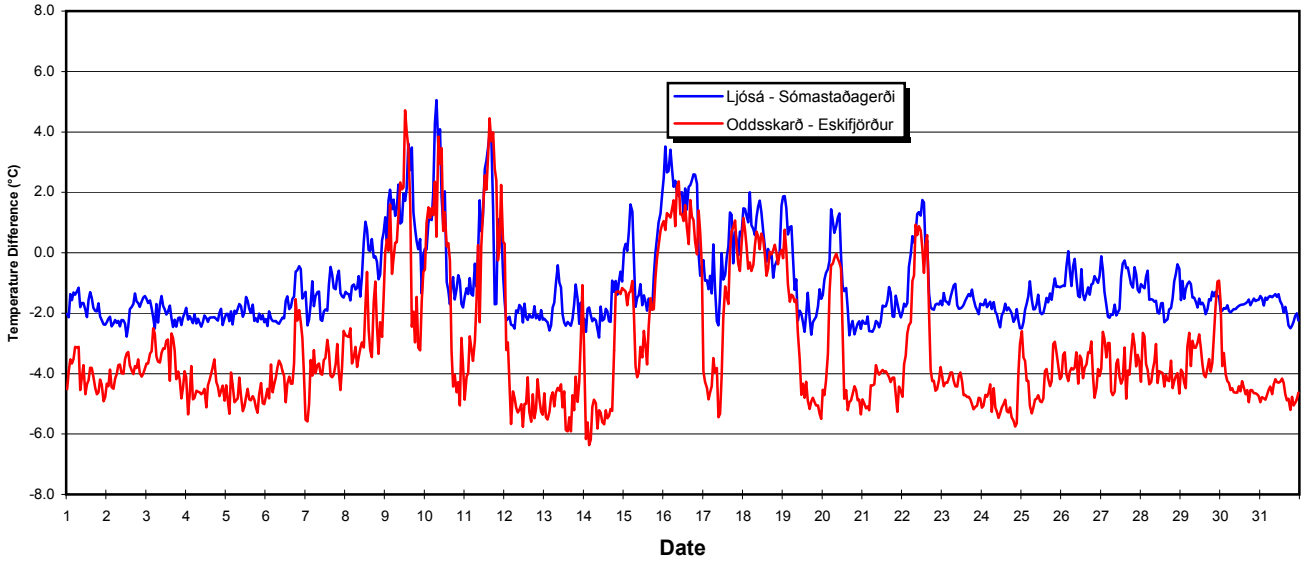


Annex 31

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Difference at Ljósá and Sómastaðagerði January 2001

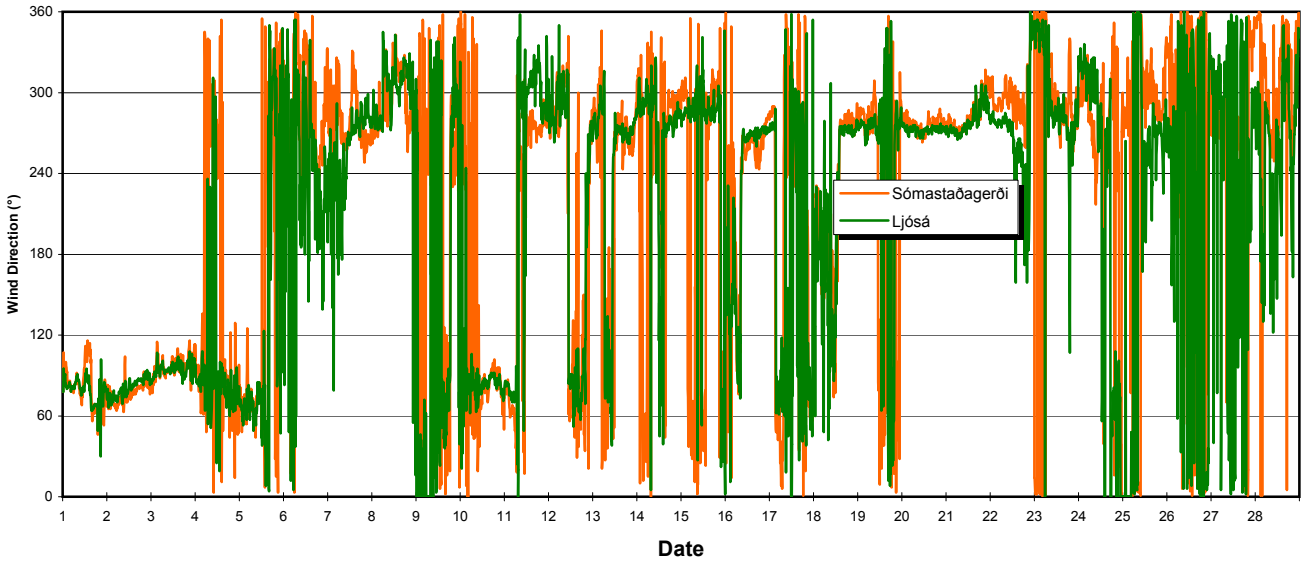


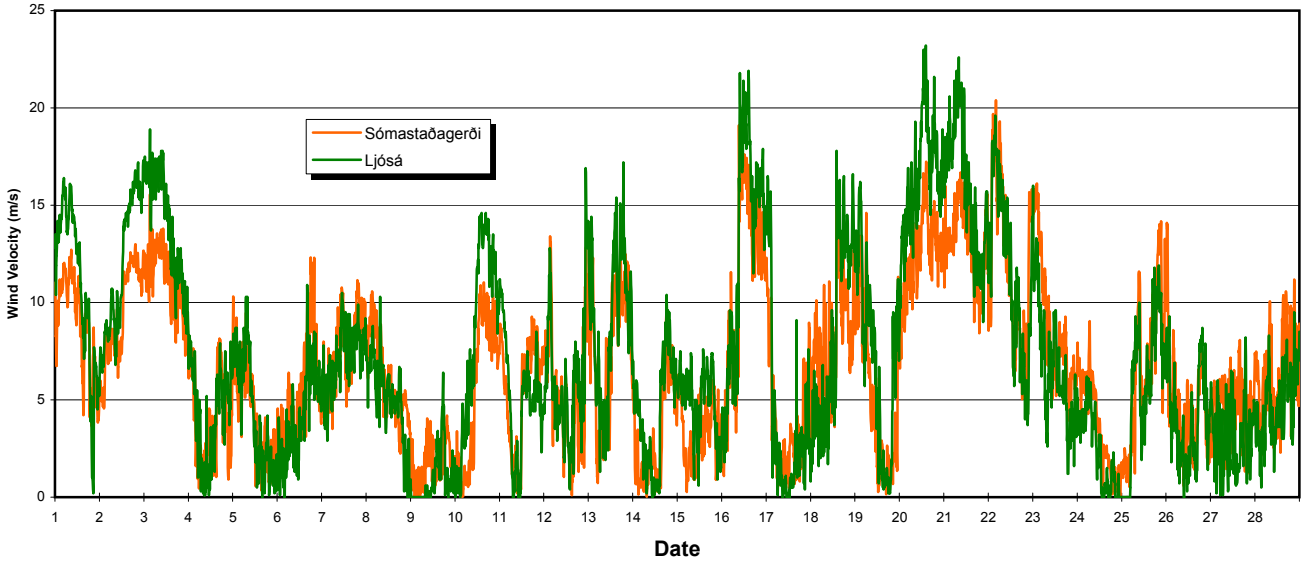


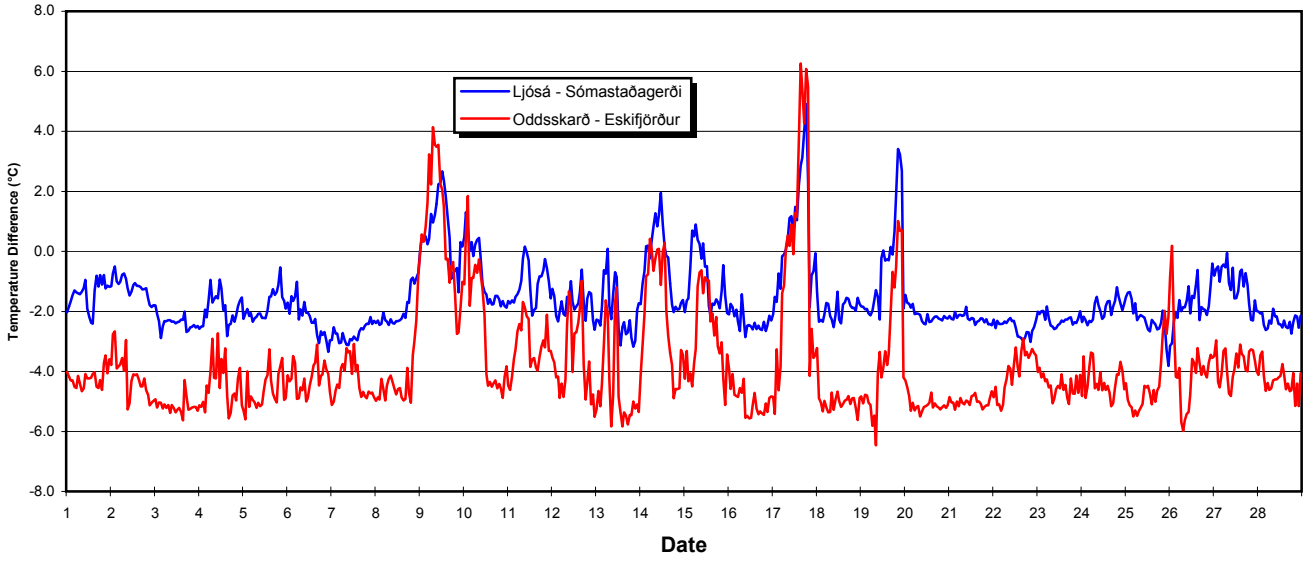


Annex 32

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Difference at Ljósá and Sómastaðagerði February 2001

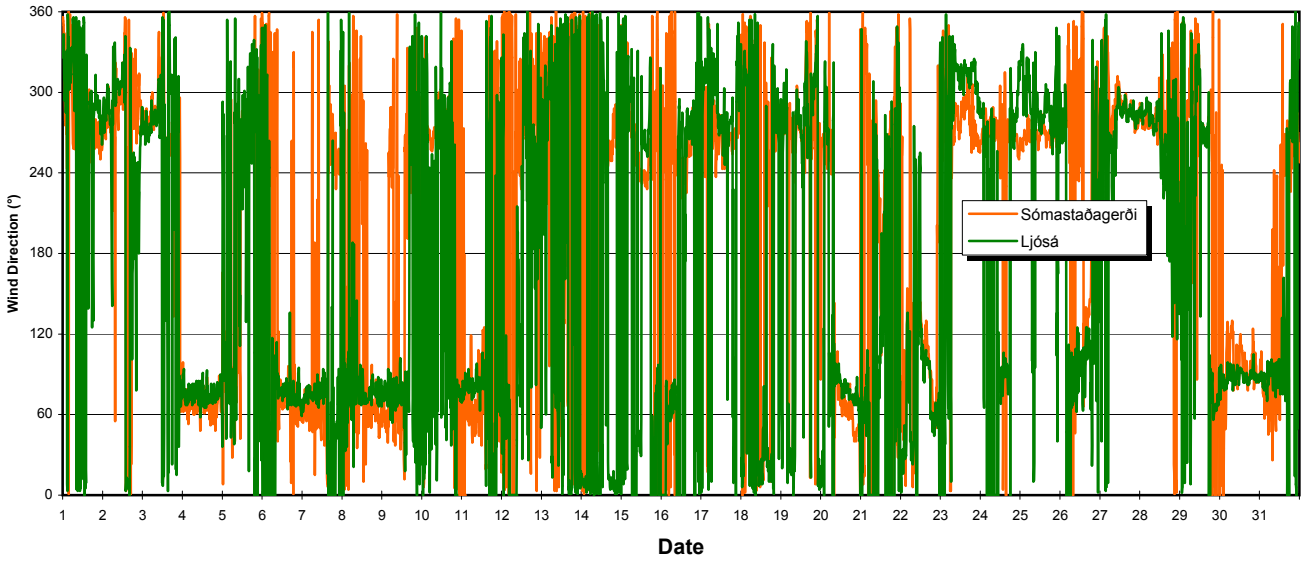


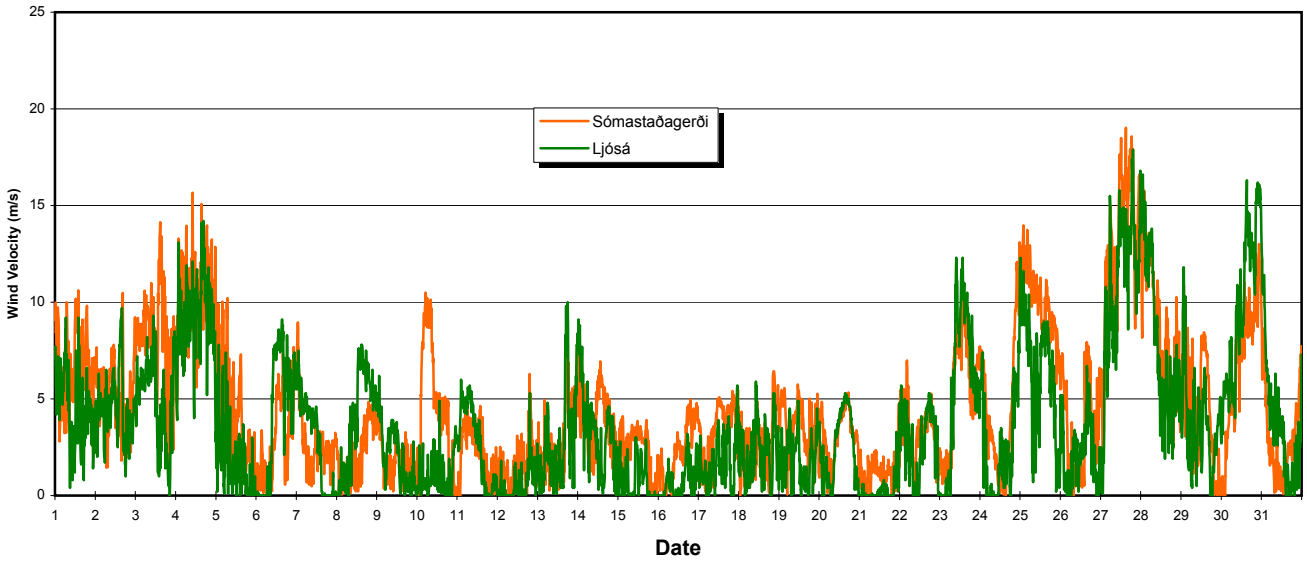


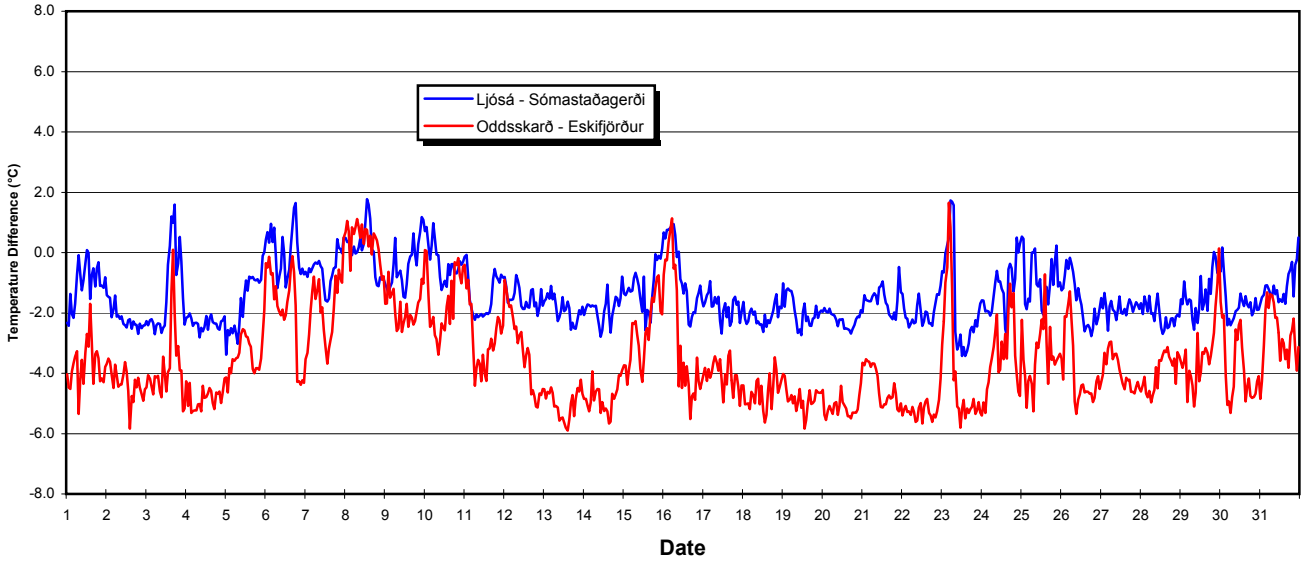


Annex 33

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Difference at Ljósá and Sómastaðagerði March 2001

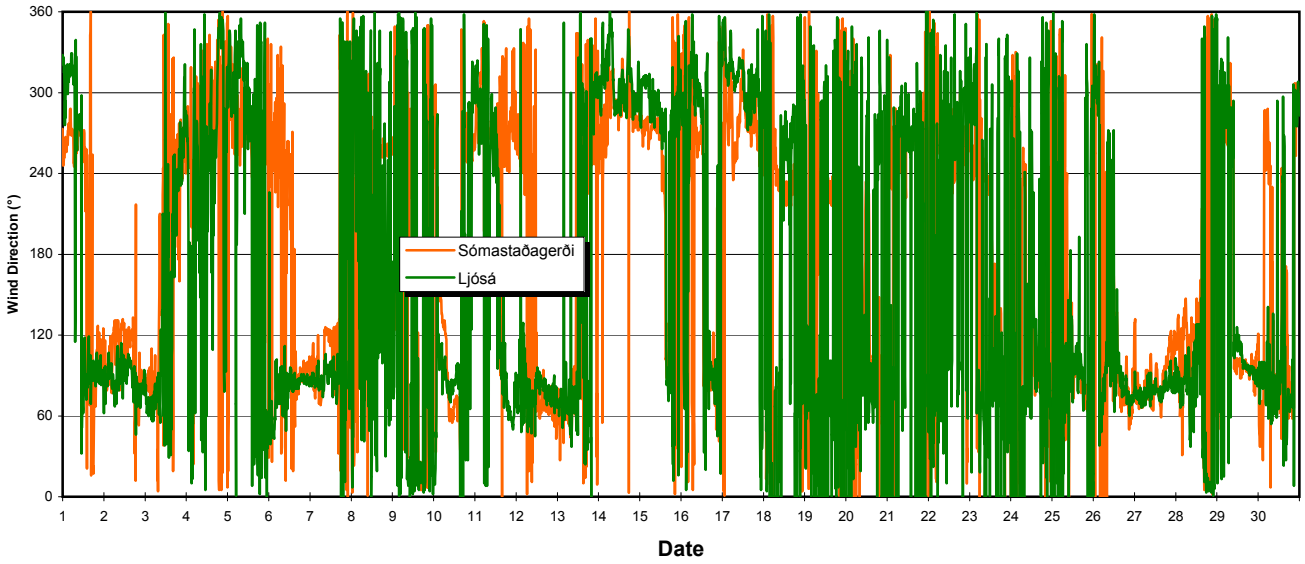


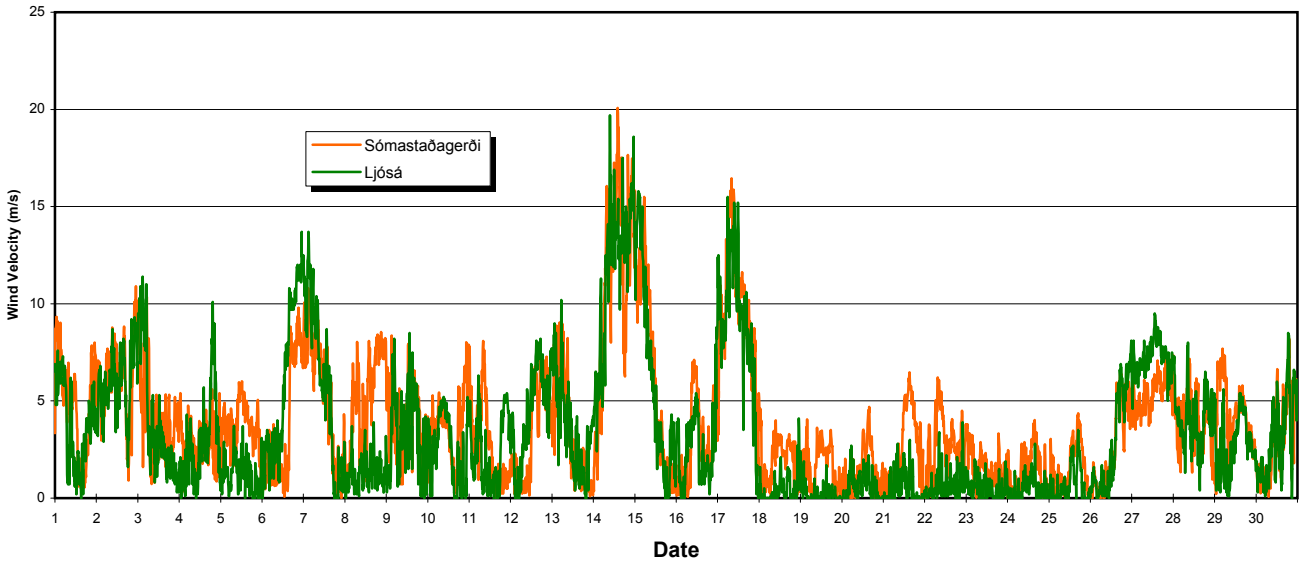


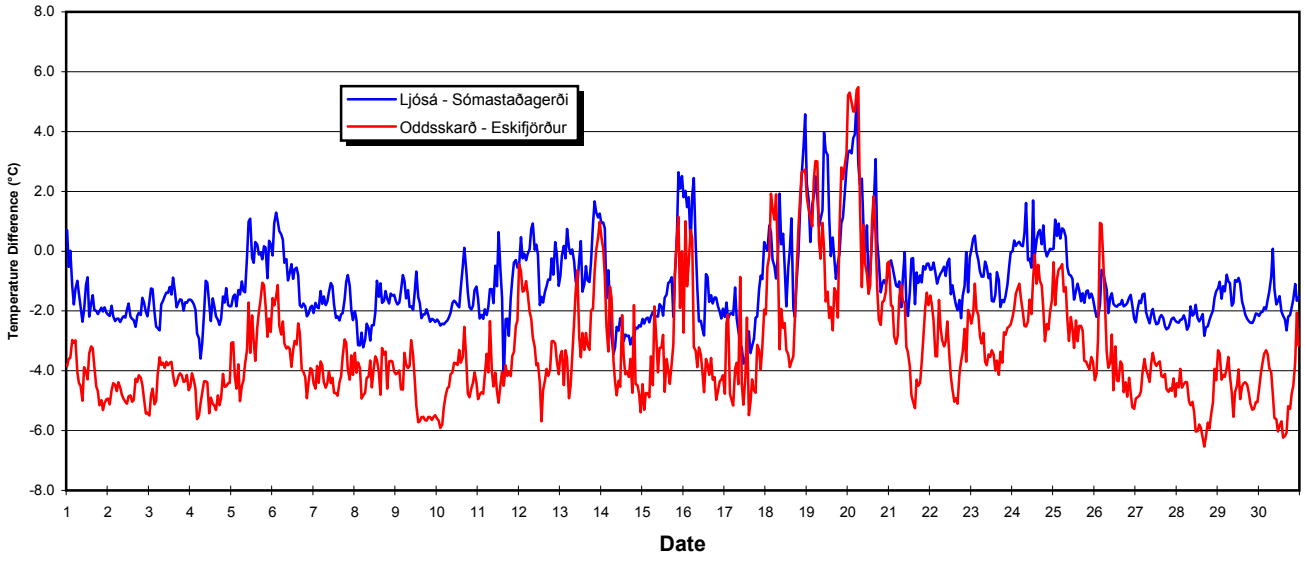


Annex 34

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Difference at Ljósá and Sómastaðagerði April 2001

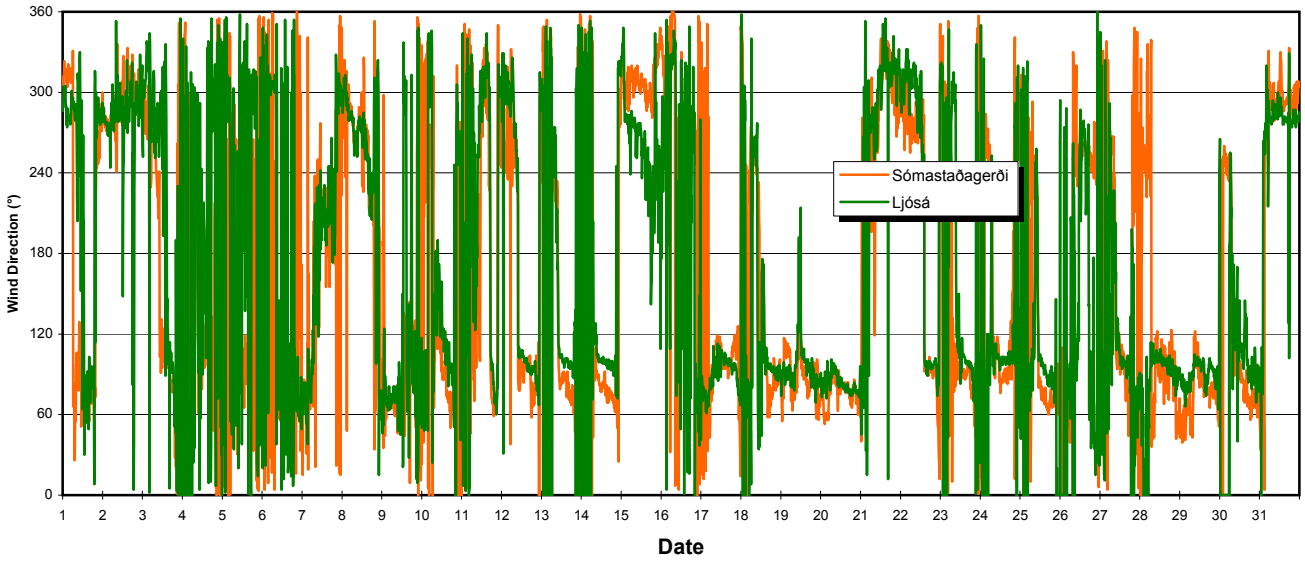


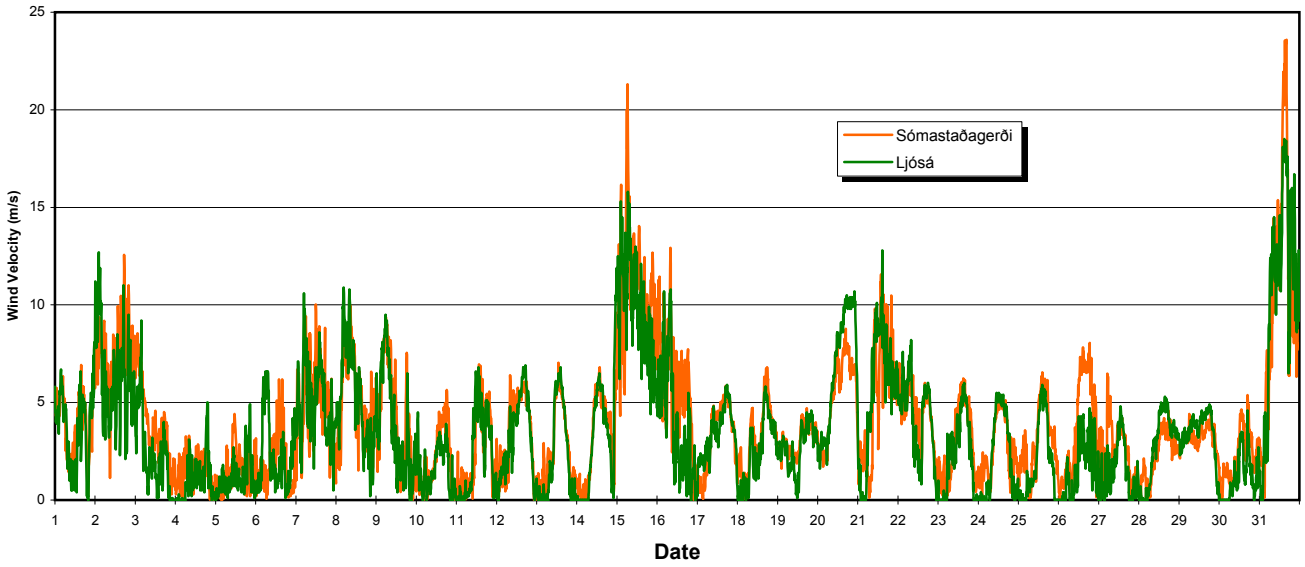


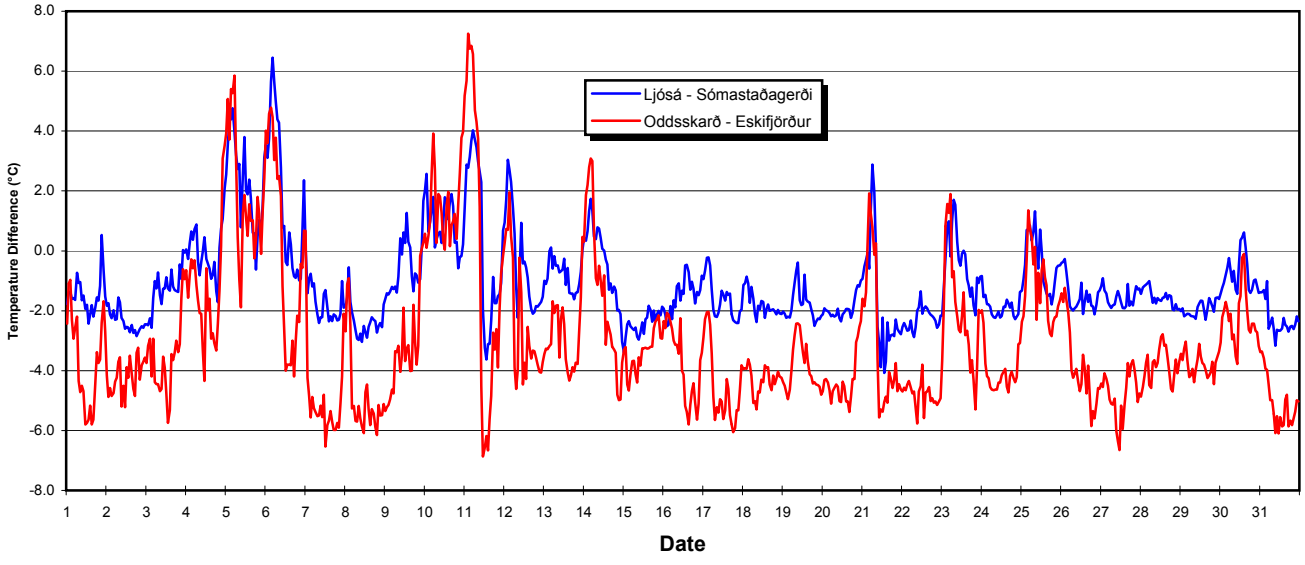


Annex 35

Simultaneous Observations of Wind Direction, Wind Velocity and Temperature Difference at Ljósá and Sómastaðagerði May 2001



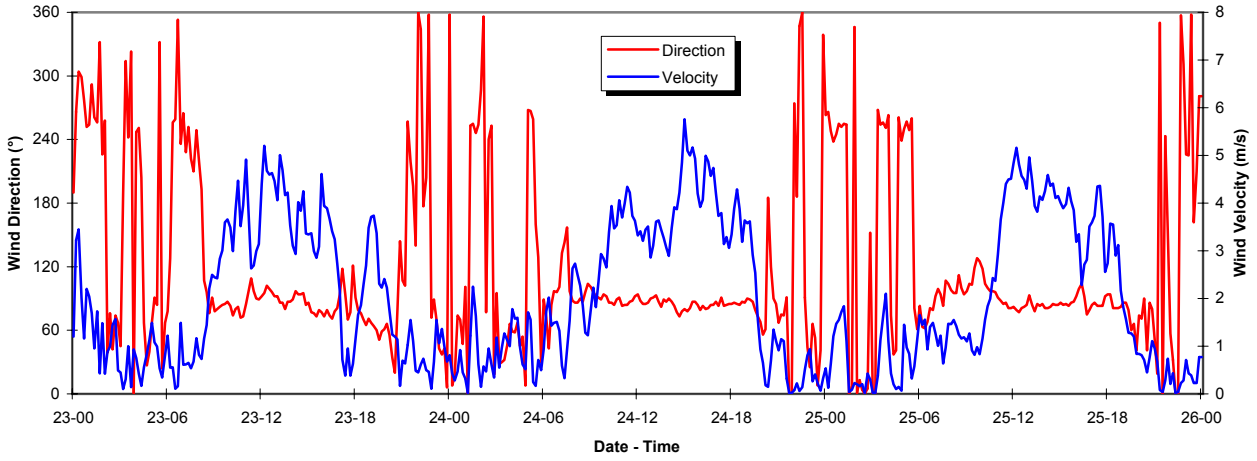




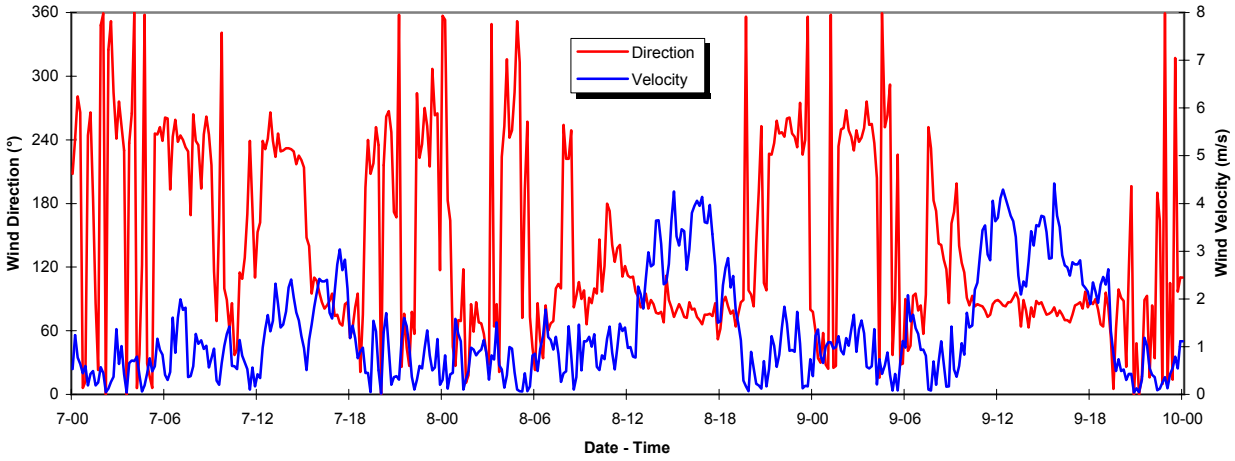
Annex 36

Wind Direction and Wind Velocity

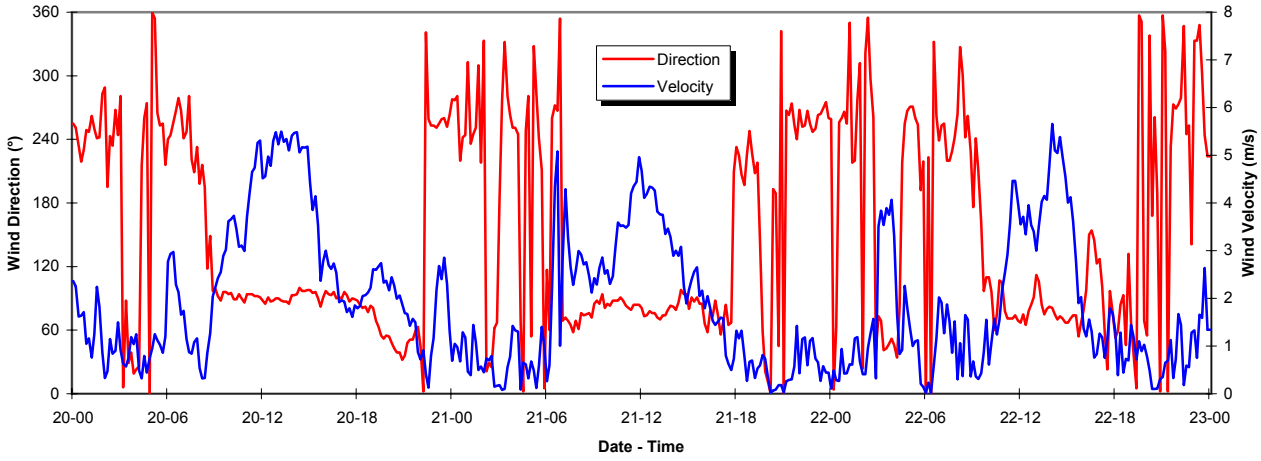
Sómastaðagerði 23 - 25 July 2000



Sómastaðagerði 7 - 9 August 2000

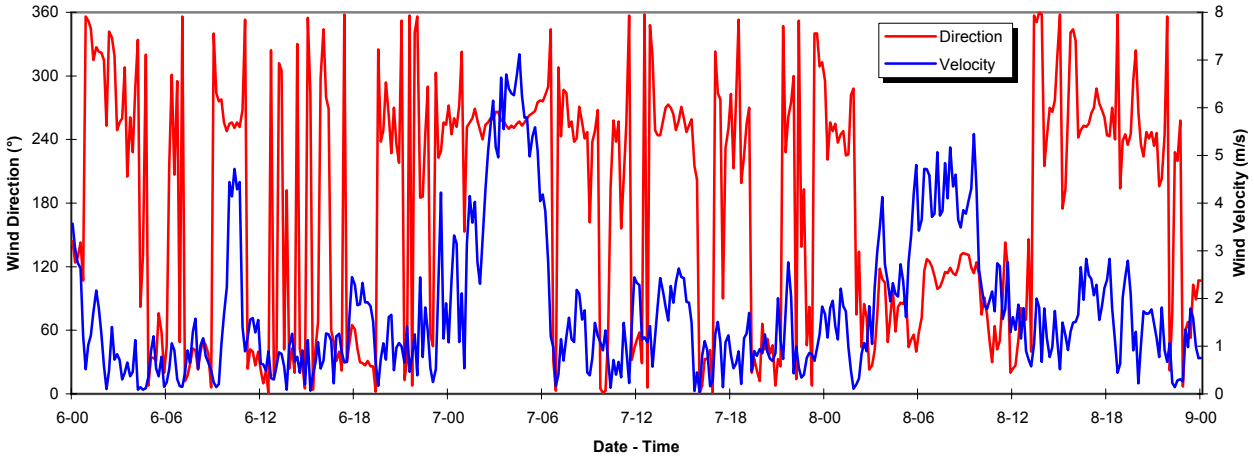


Sómastaðagerði 20 - 22 August 2000

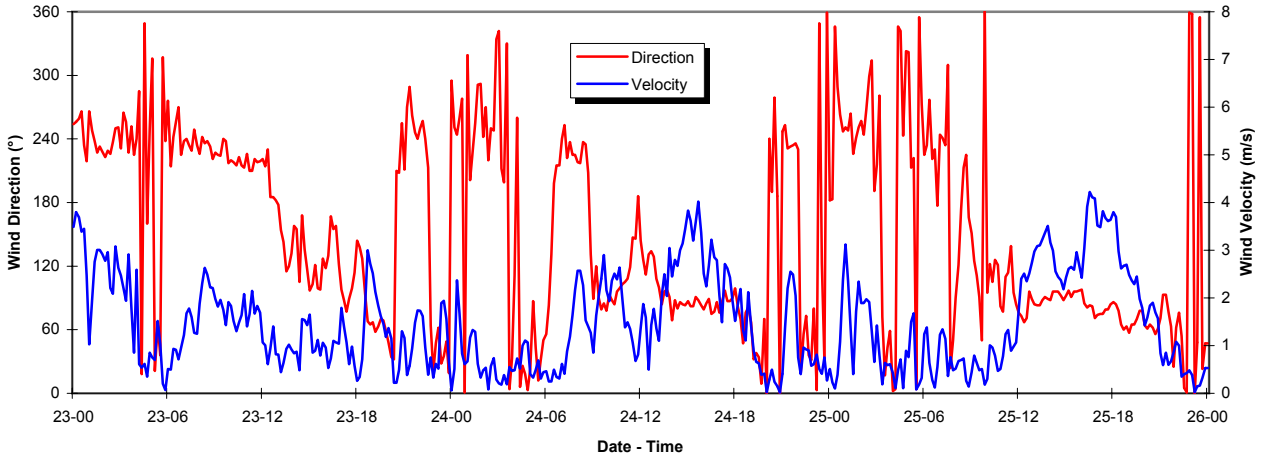


Wind Direction and Wind Velocity

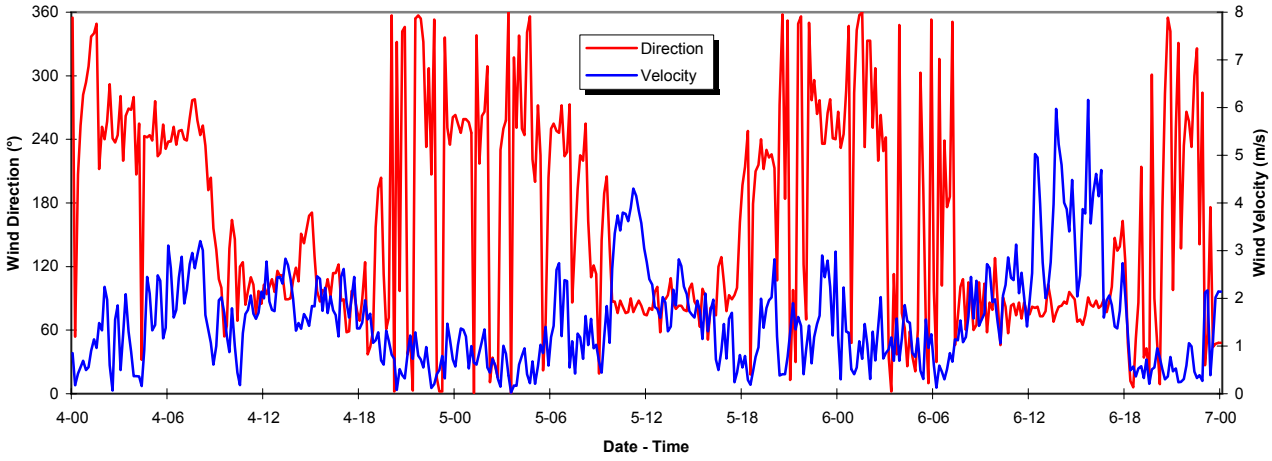
Sómastaðageröi 6 - 8 December 2000



Sómastaðageröi 23 - 25 April 2001



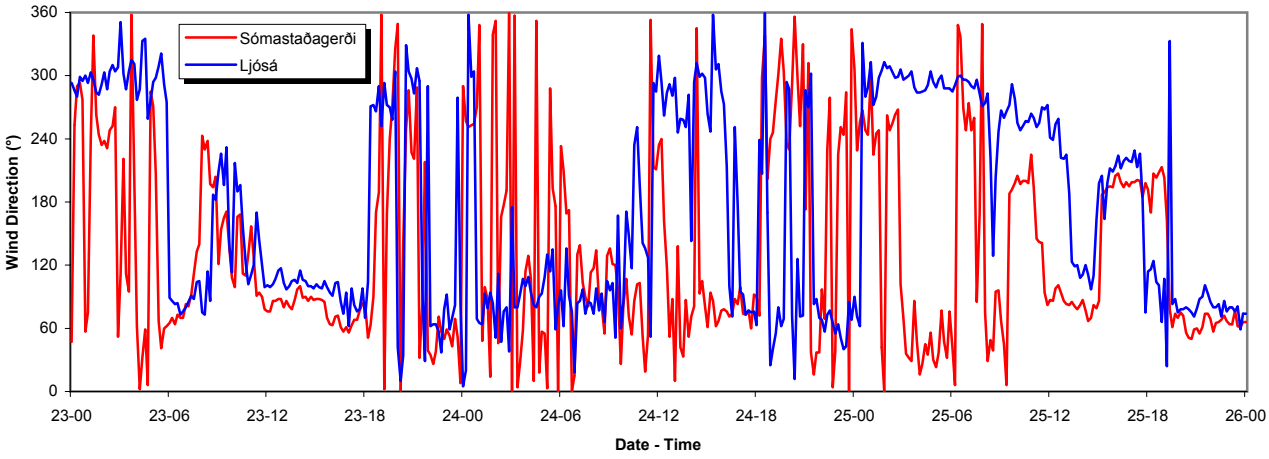
Sómastaðageröi 4 - 6 May 2001



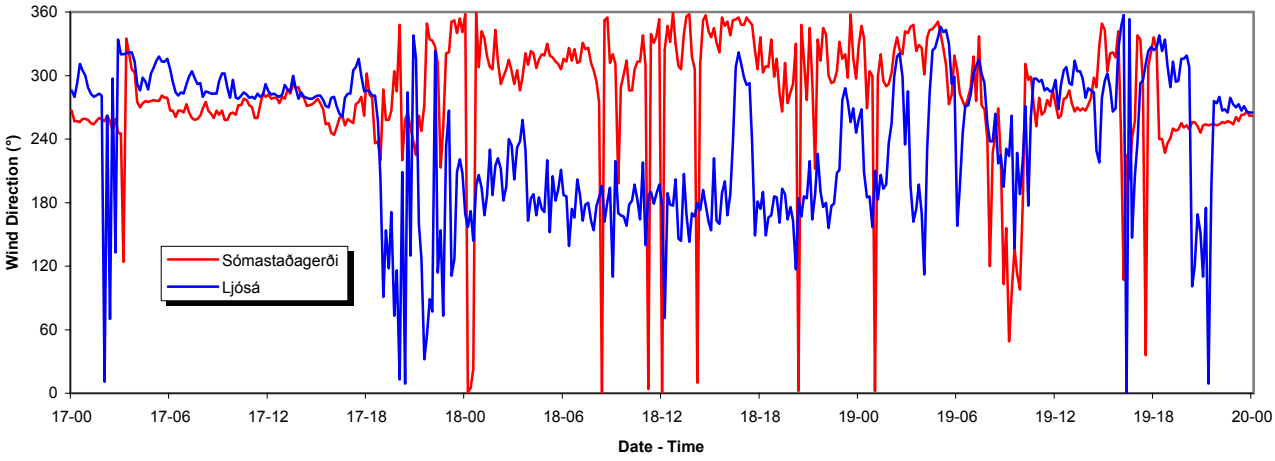
Annex 38

Wind Direction at Sómastaðagerði and Ljósá

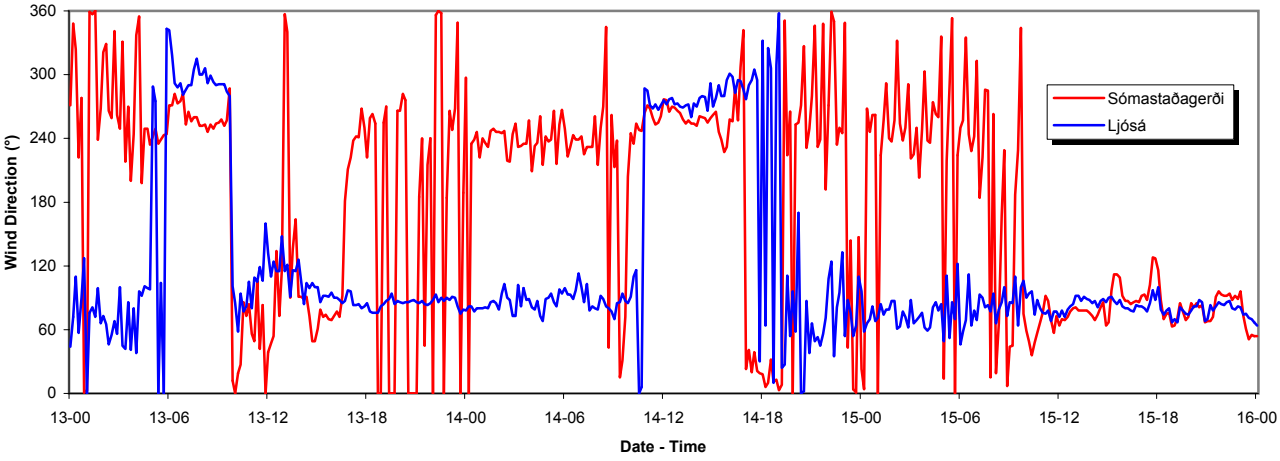
23 - 25 August 2000



17 - 19 September 2000



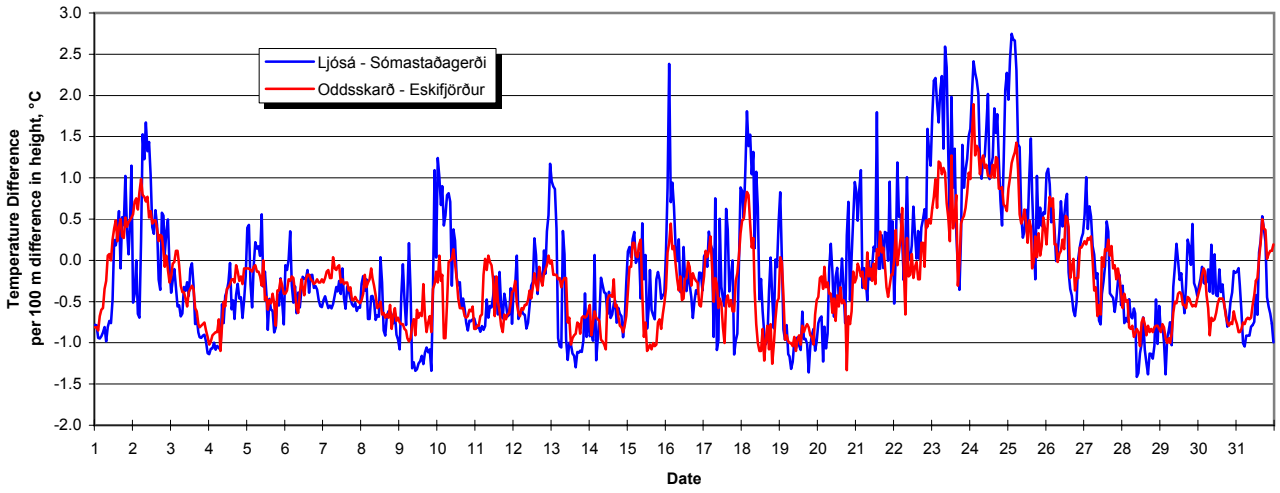
13 - 15 October 2000



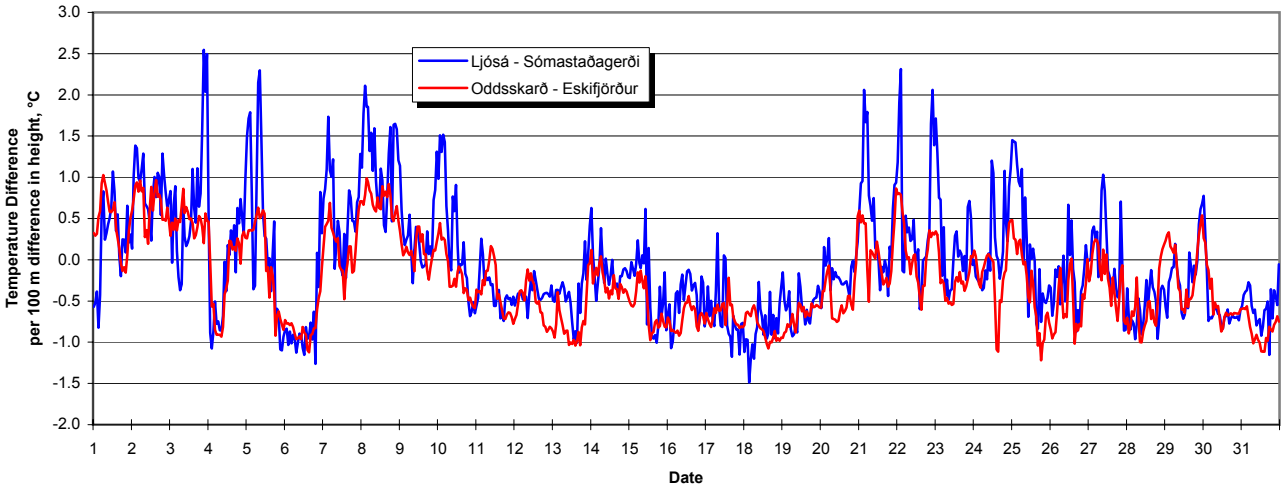
Annex 39

Vertical temperature difference per 100 m difference in height
Ljósá - Sómastaðagerði and Oddsskarð - Eskifjörður

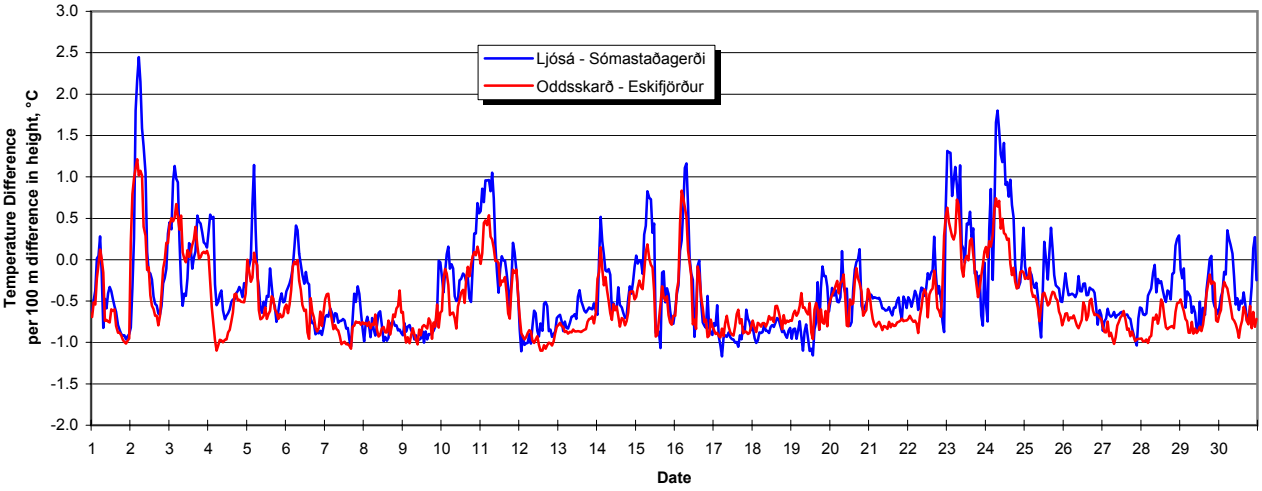
July 2000



August 2000



September 2000



Annex 40