GJÁLP 2003-2005:

DEPRESSION DEVELOPMENT, ICE FLUX AND HEAT OUTPUT

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ÁGRIP

Í skýrslunni er gerð grein fyrir niðurstöðum mælinga á sigdældum og ísskriði inn til Gjálpar á árunum 2003-2005. Gögnin eru tengd fyrri mælingum sem hófust í júní 1997, 8 mánuðum eftir Gjálpargosið. Mælingarnar hafa verið gerðar á sumrin en veturinn 2002-2003 stóð járnstika í tæplega 1750 m hæð norðan Gjálpar. Færsla þessarar stiku frá hausti 2002 til hausts 2003 bendir til þess að ekki sé munur á ísskriði að sumri eða vetri og því dugi sumarmælingarnar til að meta ísskrið á hverjum tíma á Gjálparsvæðinu. Niðurstöður um yfirborðshraða og rúmmálsbreytingar dælda (ΔV) eru notaðar til að meta ísflæði inn til Gjálpar (ΔQ) á tveimur fjögurra ára tímabilum, 1998-2001 og 2002-2005. Einnig er stuðst við fáanlegar upplýsingar um afkomu svæðisins (B). Afkoma við botn (B’) er síðan fundin út frá massavarðveislu, þar sem $B' = \Delta V - B - \Delta Q$. Niðurstaðan er sú að á fyrra tímabilinu (1998-2001) hafi bráðnun við botn samsvarað um 3 m^3s^{-1} en verið óveruleg á því seinna (2002-2005). Afl jarðhitans í fjallinu fyrir sömu tímabil er 880±140 MW 1998-2001 en 30±140 MW 2002-2005. Það er því bráðabirgðaniðurstaða að varmastraumur frá Gjálp hafi verið mikill fyrstu 4-5 árin en óverulegur og jafnvel nánast enginn eftir það. Tilvist lítils sigketils þar sem megingígurinn var í gosinu bendir þó til þess að a.m.k. þar sé einhver hiti eftir í fjallinu, þó fáir tugir megawatta ættu að duga til að skýra ketilinn. Engar vísbendingar hafa fundist um að vatn hafi safnast fyrir við Gjálp frá því skömmu eftir gosið

CONTENTS

1. INTRODUCTION

In this report the measurement series of surface ice flow at the site of the Gjálp eruption in Vatnajökull is presented. Measurements of ice flow velocity into the Gjálp depression began in 1997 and have been carried out every year since. The preliminary results for the first 5 years were given in a report in 2003 (Guðmundsson and Högnadóttir, 2003). Surveys were also carried out in the summers of 2003, 2004 and 2005. The main focus of this fieldwork was to continue ice velocity measurements on a network of stakes in the Gjálp area, and through GPS profiles accross the area to create detailed maps of the glacier surface, in order to monitor changes. A 6 km long and up to 550 m high subglacial ridge was created in the Gjálp eruption (Guðmundsson et al., 2002). Here the series of ice flow, ice surface maps, and the estimated thermal heat flux from the ridge are presented.

The surveys form a part of the PhD project of the first author at the Insitute of Earth Sciences, University of Iceland. The project is supported by an FS grant from the Student Research Fund and Vegagerðin and field assistance has been provided by the Iceland Glaciological Society. Surveying has been carried out in the spring expeditions of the Glaciological Society and the autumn expeditions of Landsvirkjun and Jarðvísindastofnun.

2. MEASUREMENTS

In 2004 it was decided to extend the number of stakes in the inner region of the Gjálp depression to get a more detailed picture of the surface flow field.

All measurement stakes for the surface velocities were put down in early June each year. Holes were drilled with a steam drill to place the 3 to 4 meter long stakes into the glacier surface. The positions of the stakes were measured with a sub-meter accuracy DGPS in 2003 and with a kinematic Trimble® R7 GPS in 2004 and 2005. The accuracy of the R7 is within the cm range and can be as good as half a centimeter. Thus the accuracy of the measured data series was improved in 2004 and thereafter. The positions of the stakes were re-measured in autumn (September or October) the same year and thus the displacement over the summer was used to calculate the summer mean surface velocity.

In June each year surface profiles were surveyed on snow-scooters with continuous logging GPS to provide sufficient input data to create the annual surface maps of the Gjálp region. DGPS was used in 2003 and the R7 in 2004 and 2005. The location of the profiles are shown in Appendix A.

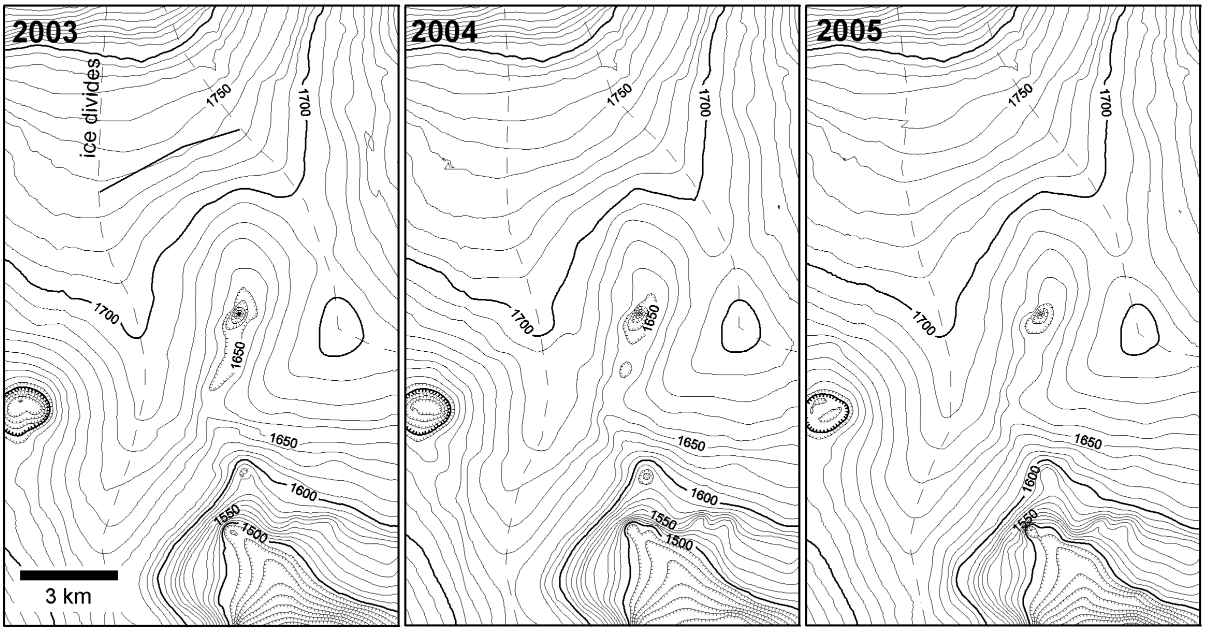

Figure 1. The surface maps for the Gjálp area in 2003, 2004 and 2005. The location of the cross-section used for ice inflow estimate is shown with the solid line on the 2003 map at about 1740 m elevation.

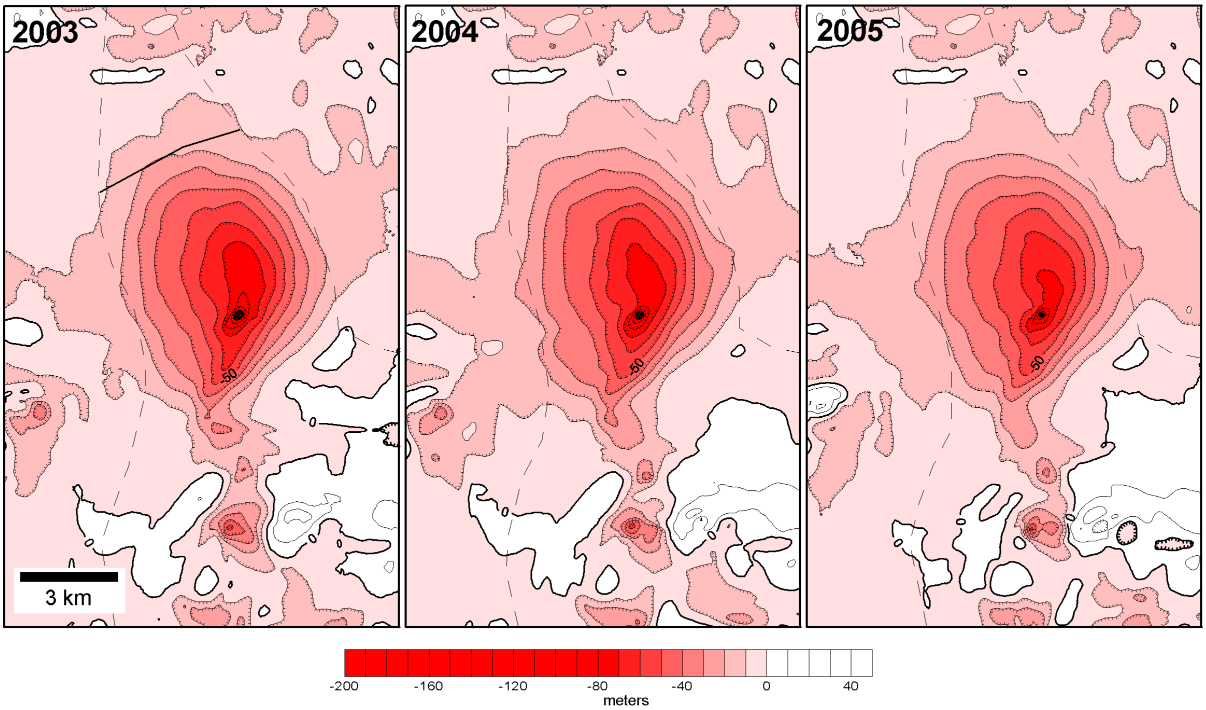

Figure 2. The surface elevation change between the years 2003, 2004 and 2005 and the reference year of 1996.

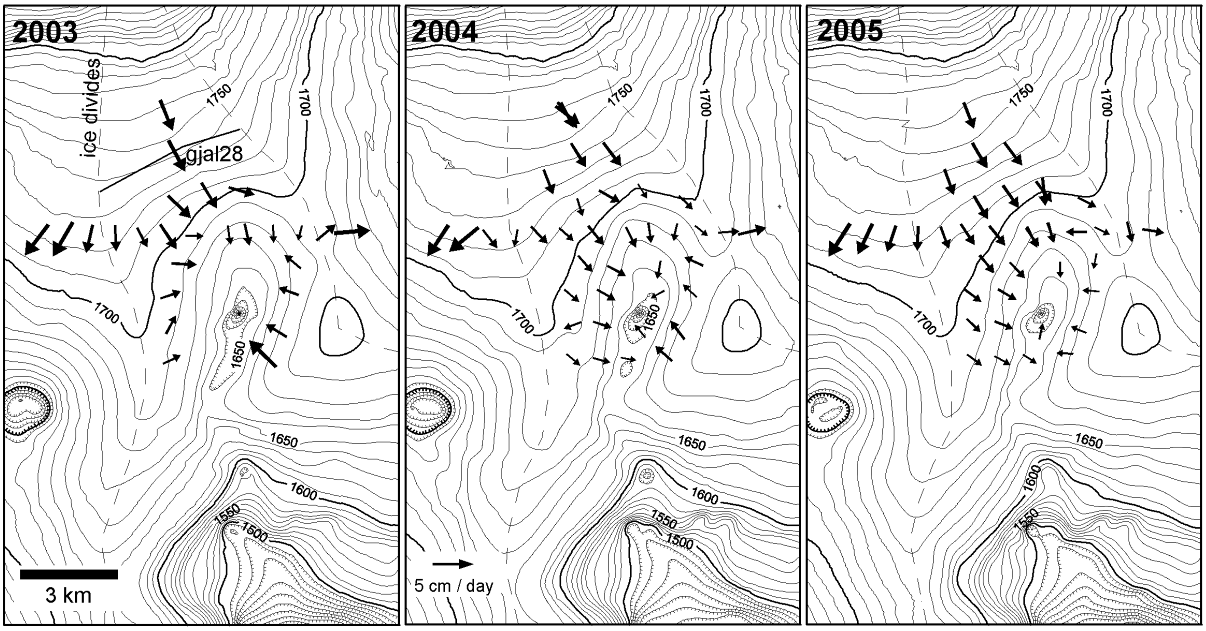

Figure 3. The surface velocities at all stakes in the Gjálp area in 2003, 2004 and 2005. The black line in the 2003 map marks the position of the inflow profile used for estimation of basal heat output.

3. RESULTS

The annual surface maps are shown in Figure 1. The change in surface elevation relative to the pre-eruption surface (1996) for 2003-2005 is shown in Figure 2.

To investigate the difference between summer mean surface velocity and annual mean surface velocity a metal pole was put down in autumn of 2002 at the position of gjal28 (see Figure 3 and Appendix B). After 377 days the pole was measured again (in 2003) and a mean annual surface velocity of 3.33 cm/day obtained. This compares to the summer mean surface velocities of gjal28 in 2002, 2004 and 2005, which are 2.76 cm/day in 2002, 2.74 cm/day in 2004 and 2.82 cm/day in 2005. This indicates that the summer mean velocities represent the annual mean velocities fairly well and can be used as an estimation for the annual mean velocity.

The surface elevation changes between the reference year 1996, before the eruption and the years 2003, 2004 and 2005 (Figure 3) are used to estimate the total volume change in the Gjálp depression.

The volume change of the Gjálp depression is shown in Figure 4. The graph was updated with the 2003 to 2005 data and the volume data without melting at the bedrock was recalculated and extended until 2005 as well.

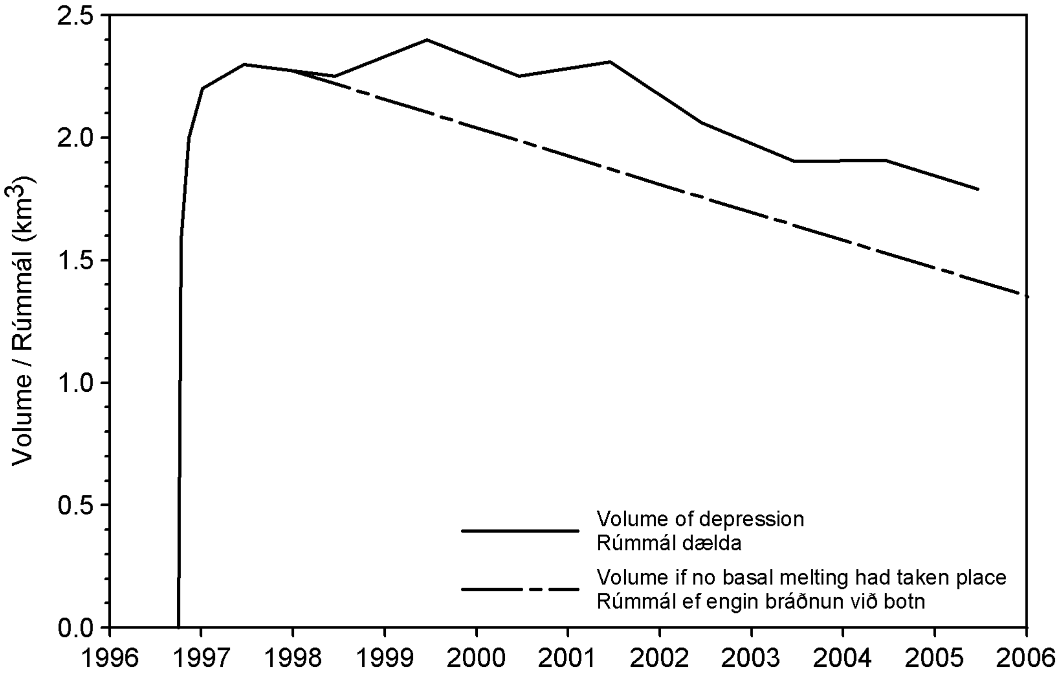

Figure 4. The volume change of the Gjálp depression.

3.1. Basal melting

To estimate the melting at the bedrock in the Gjálp area and to produce the curves displayed in Figure 4 the approach of 'conservation of mass' was chosen. Therefore the formula

$$B' = \Delta V - B - \Delta Q \qquad (1)$$

describes the conservation of mass within the system with ΔV the volume change in the Gjálp depression during the period, B the surface mass balance over the same period as B = S*b*t (S: the area of the depression, b the net mass balance rate and t the time of the period), ΔQ the ice inflow from the north and B' the mass balance at the bottom (negative values indicate melting at the base).

A data series extends from late 1996 until the middle of 2005. Here the heat output of Gjálp between 1998 and 2005 was re-estimated. The heat output estimation for 1996 and 1997 is taken from Gudmundsson et al. (1997) and Guðmundsson and Högnadóttir (2003). The values for the 8 year period from 1998 to 2005 were split into two 4 year periods and an average heat output for each of those two 4 year periods calculated. Between the beginning of 1998 and the end of 2001, B was estimated with S = 65 km, b = 1.35 m/year and t = 4 years, as B = 0.35 km^3. ΔV is 0.1 km^3 (Figure 4). ΔQ was estimated as 0.11 km^3, using the averaged surface velocities for each year and an inflow cross section of 3 km^2. The mean inflow velocity through the cross section was assumed to be 80% of the surface velocity (Paterson, 2001). The velocity at the stakes gjal06, gjal09, gjal10 and gjal11 was used to average the annual mean velocity. For the period 1998 to 2001 these results lead to B' = 0.37 km^3 which would be melting rate at the bedrock of 0.1 km^3/year or 3 m^3 s^{-1} of ice. This yields a heat flux of 880

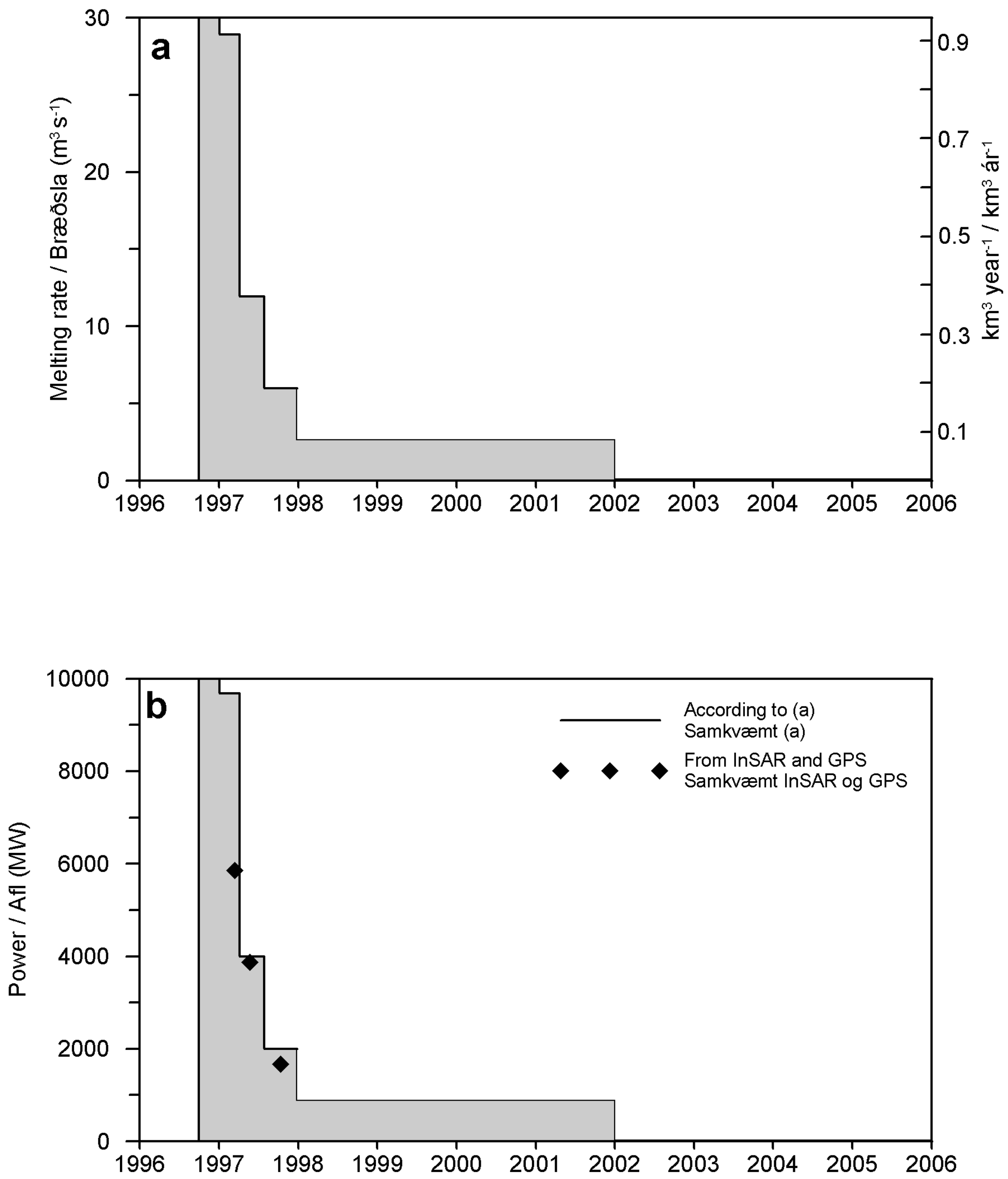

Figure 5. (a) the graph of the meltwater production rate at Gjálp. (b) the heat output of Gjálp. The combined InSAR and GPS results are from S. Guðmundsson et. al., (2002).

MW. The water runoff rate for that period was estimated to be 2.7 $m^3 s^{-1}$. A preliminary error estimation gives a heat flux of 880±140 MW, a relative error of 16 %. These results are displayed in Figure 5.

The second period extended from beginning of 2002 to end of 2005. The data measured in mid 2005 were extrapolated to the end of the year to make another 4 years period analysis possible. The net mass balance rate was the same for those years (F. Pálsson et. al. 2004a, 2004b) so B = 0.35 km^3. The velocities at the stakes gjal28, gjal38 and gjal37 were used in

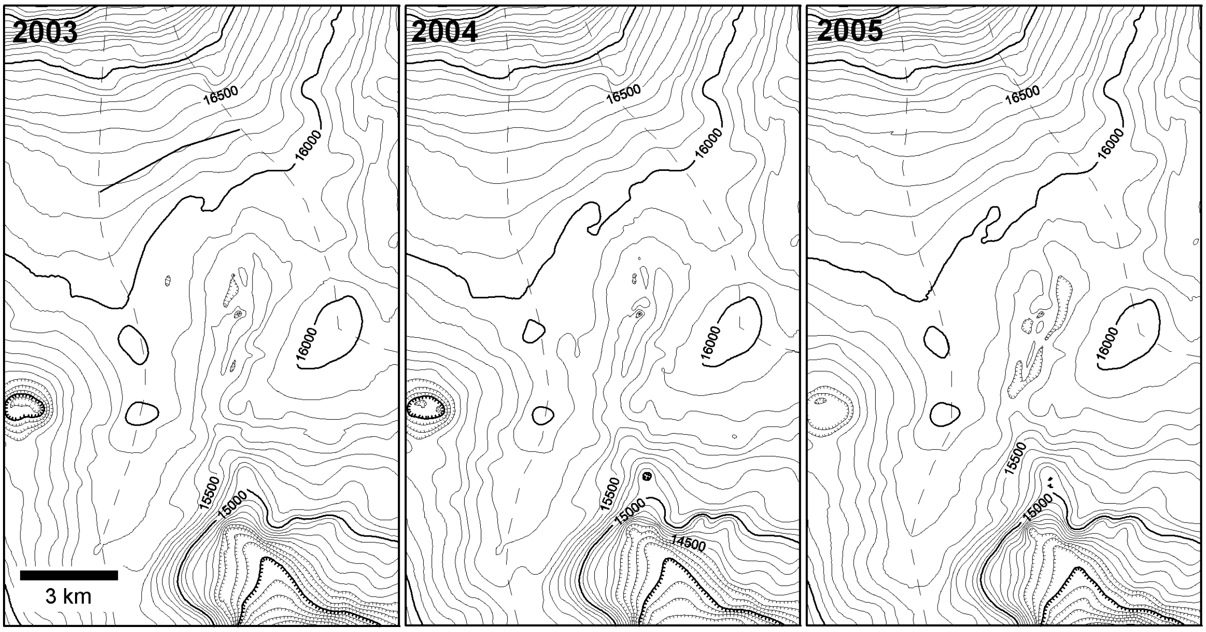

Figure 6. The water potential maps for the Gjálp area (F in kPa).

2004 and 2005 and the stakes mentioned above for the year 2002. 2003 was estimated with gjal28 and G01. The inflow cross section was along the black line shown in Figure 3. This leads to $\Delta Q = 0.11$ km^3. With $\Delta V = 0.45$ km^3 B' was calculated as B' = 0.01 km^3. This is a melting rate at the bottom of 0.1 m^3 s^{-1} of ice or 0.09 m^3 s^{-1} of water runoff. Considering the likely error margins it turns out that this value is not significantly different from zero; the estimated heat flux for the four years 2002-2005 is 30±140 MW. The preliminary conclusion is therefore that no significant melting occurred at the base in Gjálp after 2001. However, a small ice cauldron with steep walls exists at the site of the subaerial crater of Gjálp, suggesting that some basal melting is still sustaining it. But a heat flux of only a few tens of megawatts would probably be sufficient to explain this small ice cauldron.

3.2. Water potential and possible water storage

The water potential maps of the Gjálp area are displayed in Figure 6. The water potential was calculated according to the formula

$$\Phi = r_i g \left[z_s + \frac{r_w - r_i}{r_w} z_b \right] \qquad (2)$$

The maps suggest that minor closed depressions in the potential exist along the slopes of the subglacial Gjálp ridge. However, these potential lows are in all likelyhood to shallow to generate conditions for water storage. No evidence for such water storage has ever been observed at Gjálp since shortly after the eruption. Thus, a preliminary conclusion is that the changes of the formation of such subglacial lakes that may generate jökulhlaups is small in the aftermath of subglacial fissure eruptions.

Figure 7 shows the normalized velocities at the stakes gjal06, gjal09, gjal10 and gjal11 as well as the mean velocity derived from those stakes with respect to the 1998 velocity.

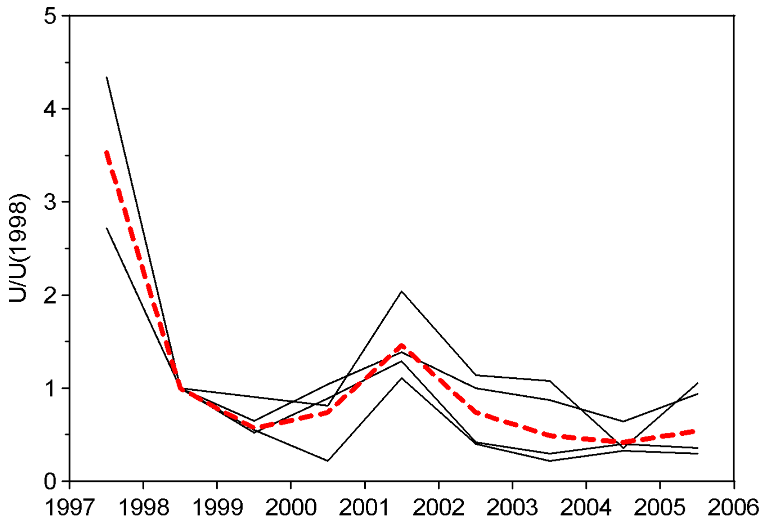

Figure 7. The velocities at the stakes gjal06, gjal09, gjal10 and gjal11, normalized to the 1998 velocity. Red marks the mean velocity.

4. CONCLUSION

The heat output of the Gjálp edifice was re-estimated for the period between 1998 and 2005. The heat output was calculated for two 4 year periods, one from 1998 to 2001, which yields a heat flux of 880±140 MW, and the second period from 2002 to 2005 results in a heat flux of 30±140 MW, which is not significantly different from zero. Field evidence demonstrates that there is heat output in a small ice cauldron at the eruption site, but apart from that no detectable heat output at the bottom of Gjálp with in this period is observed. A more detailed study of the inner ice flow field around the Gjálp edifice, in combination with numerical models of ice flow, will make a better estimation of the heat output between 2002 to 2005 possible. Such an estimate is scheduled to be carried out at the Institute of Earth Sciences in 2006.

5. REFERENCES

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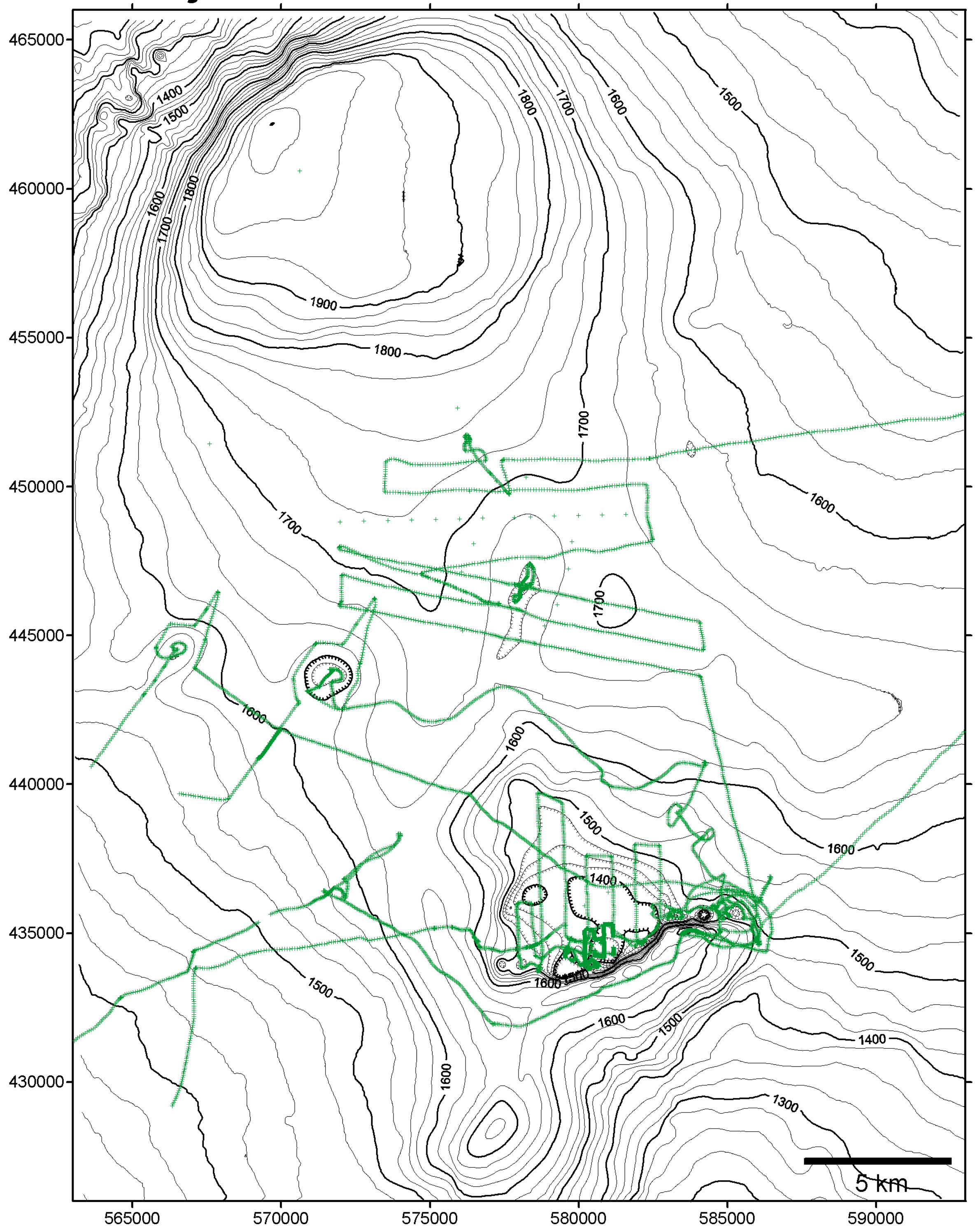
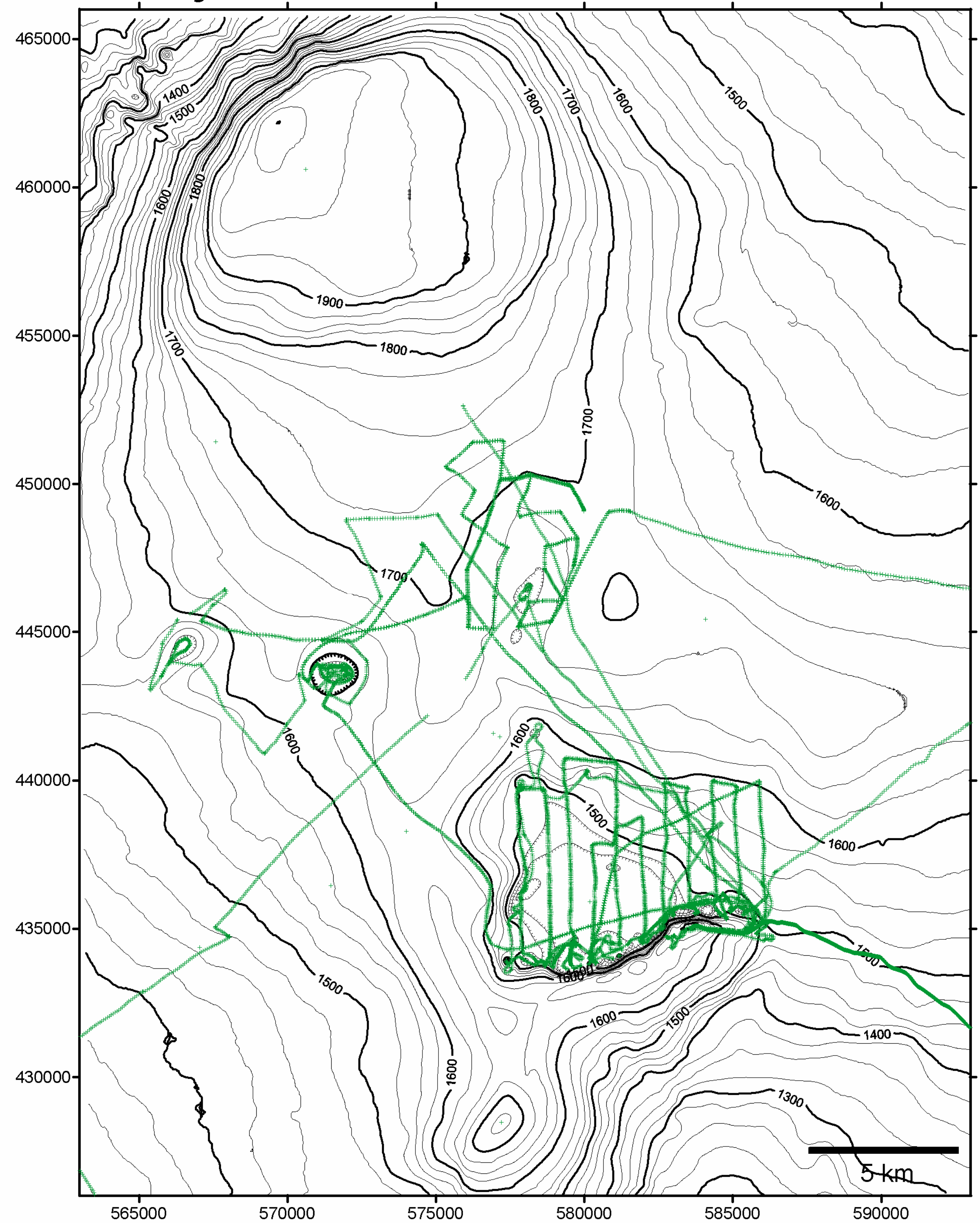
Viðauki A: DGPS mælingar 2003-2005

2003 júní



2004 júní



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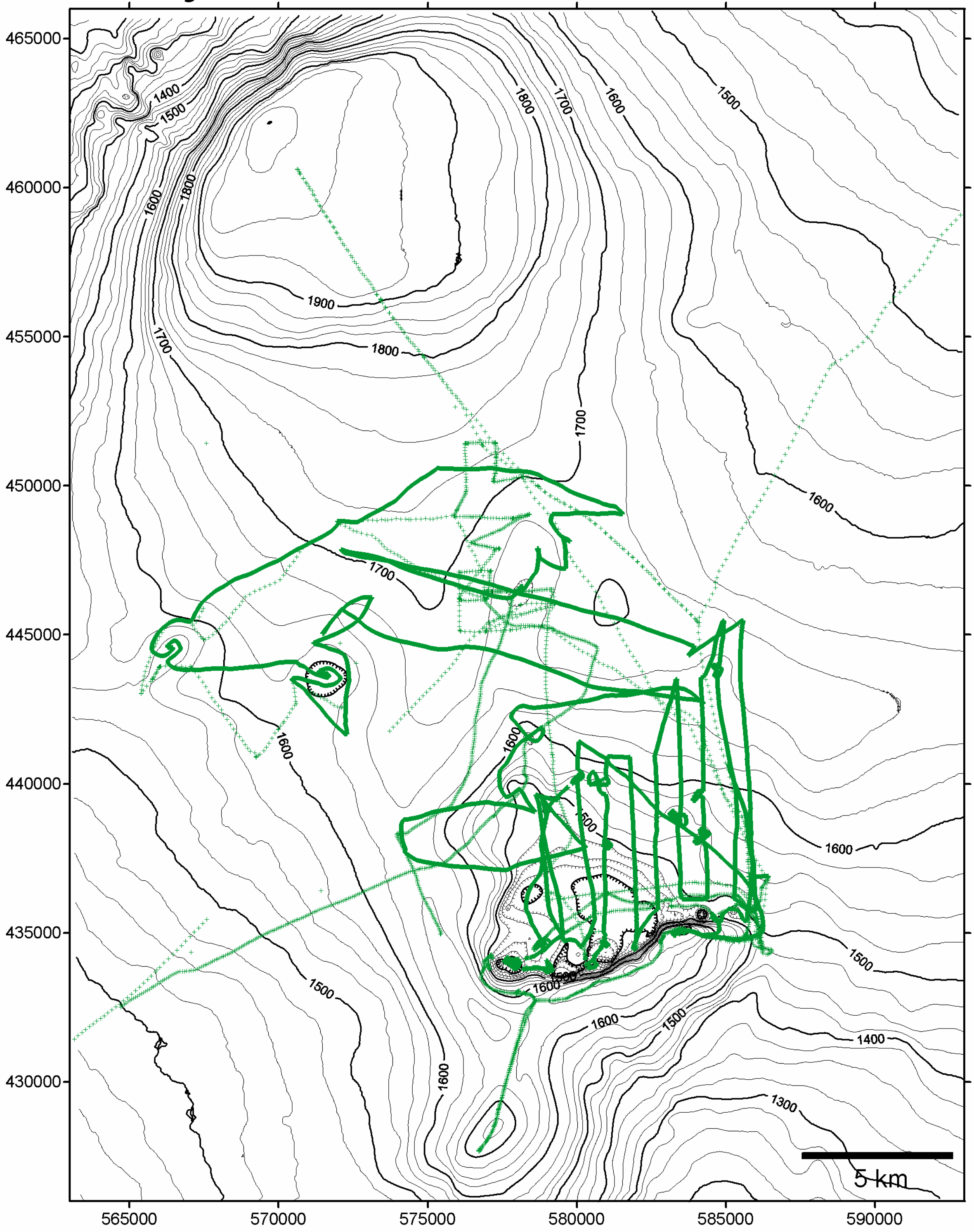
1800
1900
5 km

2005 júní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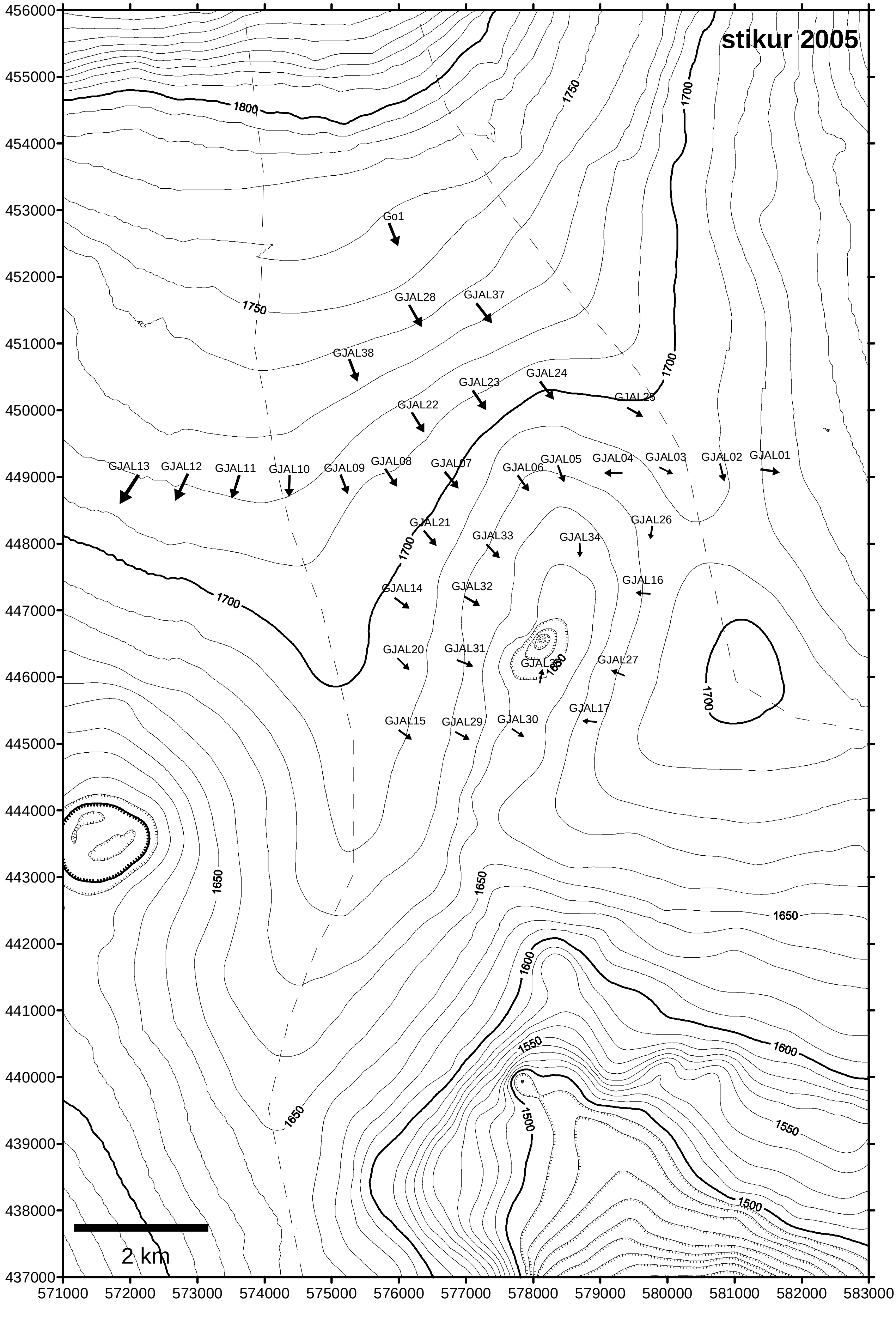
5 km

Viðauki B: Mælingar á ísskriði 2003 - 2005.



punktur	x-i93	y-i93	hys	dags1	dags2	daga fjöldi	færsla (m)	horn	cm/dag	m/ári	stefna (gráður)
2003											
G01g	575924,6	452643,1	1756,2	030601	030926	117	3,52	158	3	10,97	-158
G04h	584087,2	445425,8	1686,1	030606	030926	112	0,73	56	0,65	2,39	-56
Gjal01c	581578,5	449072,8	1678,1	030602	030926	116	4,01	85	3,45	12,6	-85
Gjal02c	580781,7	449044,1	1692,4	030602	030926	116	2,16	50	1,86	6,8	-50
Gjal03c	579986,9	449031,2	1690,9	030602	030926	116	0,63	195	0,55	1,99	-195
Gjal04c	579175,5	449010,4	1680	030602	030926	116	1,04	178	0,89	3,27	-178
Gjal05c	578374,8	448987,1	1671,9	030602	030926	116	1,71	168	1,47	5,37	-168
Gjal06c	577833,1	448967,8	1675,5	030602	030926	116	1,27	172	1,1	4	-172
Gjal07c	576775,0	448943,3	1694	030602	030926	116	1	91	0,86	3,15	-91
Gjal08c	575983,4	448920,4	1702,9	030602	030926	116	2,89	147	2,49	9,08	-147
Gjal09c	575186,6	448901,9	1710,3	030602	030926	116	1,66	153	1,44	5,24	-153
Gjal10c	574378,4	448879,7	1720,6	030602	030926	116	2,37	178	2,04	7,46	-178
Gjal11c	573582,1	448858,6	1721,8	030602	030926	116	2,76	193	2,38	8,68	-193
Gjal12c	572777,2	448838,6	1720,6	030602	030926	116	4,53	210	3,91	14,26	-210
Gjal13c	571980,0	448818,0	1717,2	030602	030926	116	4,43	217	3,82	13,93	-217
Gjal14c	576050,3	447130,4	1694,3	030602	030926	116	1,56	71	1,35	4,91	-71
Gjal15c	576092,4	445148,2	1686,6	030602	030926	116	1,3	64	1,12	4,07	-64
Gjal16c	579649,6	447238,4	1677,1	030601	030926	117	1,54	291	1,31	4,79	-291
Gjal17c	578853,0	445323,4	1670,8	030601	030926	117	4,26	315	3,64	13,29	-315
Gjal20c	576057,3	446210,4	1690,6	030602	030926	116	1,52	28	1,31	4,8	-28
Gjal21c	576460,1	448081,1	1690,6	030602	030926	116	2,2	93	1,89	6,91	-93
Gjal22c	576327,4	449838,0	1707,8	030602	030926	116	3,28	134	2,83	10,31	-134
Gjal23c	577224,3	450189,0	1702,4	030602	030926	116	2,92	149	2,52	9,2	-149
Gjal24c	578219,4	450319,9	1697,2	030602	030926	116	2,46	106	2,12	7,73	-106
Gjal26c	579766,0	448152,2	1680,8	030601	030926	117	1,54	309	1,31	4,8	-309
Gjal27c	579267,1	446033,4	1676,3	030601	030926	117	2,05	301	1,75	6,4	-301
Gjal28b	576246,3	451401,2	1737,7	020914	030926	377	12,54	152	3,33	12,14	-152
Gke15c	584225,8	440746,7	1624,8	030603	030926	115	4,12	194	3,58	13,08	-194
2004											
G01h	575914,1	452651,1	1756,5	040609	040718	39	1,39	143	3,57	13,03	-143
G01h	575915,4	452649,9	1755,6	040718	040928	72	2,24	127	3,11	11,34	-127
G01hx	575911,7	452651,8	1755,7	040606	040928	114	3,13	154	2,75	10,03	-154
G04i	584083,3	445432,3	1685,9	040609	040718	39	0,44	45	1,14	4,15	-45
G04i	584083,5	445432,8	1685,5	040718	040928	72	0,56	38	0,78	2,85	-38
GJAL01d	581530,2	449088,5	1677,8	040610	040928	110	3,09	76	2,81	10,26	-76
GJAL02d	580820,1	449063,4	1691	040610	040928	110	1,44	86	1,31	4,79	-86
GJAL03d	579985,2	449098,5	1691,9	040606	040928	114	0,51	128	0,45	1,63	-128
GJAL04d	579193,5	449056,4	1681,6	040610	040928	110	0,75	191	0,69	2,5	-191
GJAL05d	578418,6	449030,3	1675,3	040610	040928	110	1,37	172	1,24	4,53	-172
GJAL06d	577846,9	448899,0	1673,3	040610	040928	110	1,84	153	1,67	6,1	-153
GJAL07d	576783,4	448953,5	1696,7	040606	040928	114	2,38	141	2,08	7,61	-141
GJAL08d	575878,5	448989,0	1706,3	040610	040928	110	1,07	133	0,97	3,54	-133
GJAL09d	575059,3	448967,7	1713	040608	040928	112	2,12	136	1,89	6,91	-136
GJAL10d	574346,5	448873,9	1720,5	040608	040928	112	0,75	190	0,67	2,45	-190
GJAL11d	573560,2	448851,6	1720,4	040608	040928	112	2	142	1,79	6,53	-142
GJAL12d	572767,9	448834,7	1721,6	040608	040928	112	5,2	230	4,64	16,94	-230
GJAL13d	571981,9	448794,4	1716,6	040608	040928	112	5,2	213	4,64	16,93	-213
GJAL14d	576039,4	447107,5	1695	040606	040928	114	1,12	130	0,98	3,59	-130
GJAL15d	576088,4	445142,2	1687,1	040610	040928	110	0,74	130	0,68	2,47	-130
GJAL16d	579636,9	447253,6	1679,1	040606	040928	114	1,04	313	0,91	3,32	-313
GJAL17d	578840,7	445327,9	1672,8	040610	040928	110	1,85	313	1,68	6,13	-313

punktur	x-i93	y-i93	hys	dags1	dags2	daga fjöldi	færsla (m)	horn	cm/dag	m/ári	stefna (gráður)
GJAL20d	576064,2	446195,7	1692,7	040610	040928	110	0,84	249	0,76	2,78	-249
GJAL21d	576457,2	448087,9	1694,7	040606	040928	114	1,73	138	1,52	5,55	-138
GJAL22d	576287,7	449820,9	1709,9	040610	040928	110	1,03	163	0,93	3,4	-163
GJAL23d	577193,2	450157,7	1704,5	040610	040928	110	2,06	120	1,87	6,82	-120
GJAL24d	578194,8	450316,1	1699,2	040610	040928	110	0,65	149	0,59	2,15	-149
GJAL25d	579513,3	449966,9	1696,6	040606	040928	114	1,18	134	1,04	3,78	-134
GJAL26d	579758,4	448160,7	1681,9	040610	040928	110	1,37	295	1,24	4,53	-295
GJAL27d	579263,8	446048,1	1677,6	040610	040928	110	1,96	323	1,78	6,5	-323
GJAL28d	576250,8	451419,6	1740	040610	040928	110	3,02	148	2,74	10,02	-148
GJAL29d	576947,3	445127,8	1673,2	040610	040928	110	0,76	104	0,69	2,52	-104
GJAL30d	577771,3	445165,5	1651,7	040610	040928	110	0,31	100	0,28	1,03	-100
GJAL31d	576971,5	446216,0	1676,9	040610	040928	110	1,15	108	1,05	3,82	-108
GJAL32d	577092,5	447133,3	1673,3	040610	040928	110	1,49	120	1,36	4,95	-120
GJAL33d	577410,2	447871,2	1674	040610	040928	110	1,46	119	1,33	4,85	-119
GJAL34d	578696,9	447902,7	1662,8	040610	040928	110	0,9	190	0,82	2,99	-190
GJAL35d	578653,4	447148,9	1651,1	040610	040928	110	0,3	241	0,28	1	-241
GJAL36d	578123,0	446013,0	1644,4	040610	040928	110	0,47	321	0,43	1,57	-321
GJAL37d	577277,4	451445,5	1729,3	040610	040928	110	3,3	143	3	10,94	-143
GJAL38d	575338,1	450596,3	1733,6	040610	040928	110	2,72	159	2,48	9,04	-159
2005											
G01i	575920,5	452636,9	1756,1	050501	051001	153	4,03	158	2,63	9,61	-158
G04j	584094,6	445406,7	1685	050605	050811	67	0,6	11	0,9	3,29	-11
G04j	584094,9	445407,0	1683,5	050811	051002	52	0,42	72	0,81	2,95	-72
GJAL01e	581528,7	449091,7	1676,1	050610	051001	113	1,64	100	1,45	5,3	-100
GJAL02e	580812,6	449069,4	1689,3	050610	051001	113	1,41	167	1,25	4,55	-167
GJAL03e	579978,2	449095,3	1691,5	050610	051001	113	0,55	116	0,49	1,78	-116
GJAL04e	579191,3	449060,3	1682,9	050610	051001	113	1,38	270	1,22	4,44	-270
GJAL05e	578413,2	449046,5	1678,8	050608	051002	116	1,37	161	1,18	4,32	-161
GJAL05ne	578417,1	449044,3	1678,8	050608	051002	116	1,28	167	1,1	4,01	-167
GJAL06e	577850,9	448904,9	1677,9	050608	051002	116	1,74	145	1,5	5,48	-145
GJAL06ne	577847,2	448907,2	1677,9	050608	051002	116	1,86	155	1,61	5,86	-155
GJAL07e	576784,8	448951,9	1698,6	050608	051002	116	2,33	141	2,01	7,32	-141
GJAL07ne	576783,2	448956,7	1698,7	050608	051002	116	2,35	141	2,02	7,38	-141
GJAL08e	575885,0	448987,8	1707,8	050608	051003	117	2,3	147	1,97	7,19	-147
GJAL08ne	575884,0	448992,2	1707,8	050608	051003	117	2,07	147	1,77	6,44	-147
GJAL09e	575185,8	448891,8	1712,9	050608	051003	117	2,02	159	1,73	6,32	-159
GJAL10e	574367,8	448864,9	1720,1	050608	051003	117	2,32	182	1,98	7,23	-182
GJAL11e	573568,8	448855,0	1720,1	050608	051003	117	3,03	198	2,59	9,47	-198
GJAL12e	572764,6	448847,2	1718,2	050610	051003	115	4,29	205	3,73	13,6	-205
GJAL13e	571980,1	448814,6	1715,4	050610	051003	115	5,56	213	4,83	17,65	-213
GJAL14e	576047,2	447107,0	1695,5	050608	051002	116	1,41	127	1,21	4,43	-127
GJAL15e	576093,2	445134,6	1687,8	050608	051002	116	0,84	127	0,72	2,64	-127
GJAL16e	579635,8	447254,8	1678,8	050610	051002	114	0,49	274	0,43	1,57	-274
GJAL17e	578841,5	445333,9	1673,8	050608	051002	116	0,51	274	0,44	1,62	-274
GJAL20e	576066,7	446196,6	1692,2	050608	051002	116	1,02	135	0,88	3,21	-135
GJAL21e	576465,9	448082,0	1696,6	050608	051002	116	1,79	140	1,54	5,62	-140
GJAL21ne	576462,3	448083,1	1696,5	050608	051002	116	1,73	144	1,49	5,43	-144
GJAL22e	576284,7	449816,9	1711,4	050608	051001	115	2,76	149	2,4	8,78	-149
GJAL22ne	576287,6	449820,5	1711,5	050608	051001	115	2,6	149	2,26	8,27	-149
GJAL23e	577198,6	450153,1	1706,6	050608	051001	115	2,78	146	2,42	8,84	-146
GJAL23ne	577193,6	450151,6	1706,7	050608	051001	115	2,84	144	2,47	9,03	-144
GJAL24e	578202,3	450299,0	1698,4	050608	051001	115	2,53	143	2,2	8,02	-143

punktur	x-i93	y-i93	hys	dags1	dags2	daga fjöldi	færsla (m)	horn	cm/dag	m/ári	stefna (gráður)
GJAL24ne	578206,4	450297,4	1698	050608	051001	115	3,09	174	2,69	9,81	-174
GJAL25e	579515,9	449973,1	1696,6	050610	051002	114	1,33	119	1,16	4,25	-119
GJAL26e	579758,0	448166,4	1682,6	050610	051002	114	0,23	190	0,2	0,72	-190
GJAL27e	579264,2	446059,5	1678,8	050608	051002	116	0,44	292	0,38	1,39	-292
GJAL28e	576245,2	451415,1	1740,5	050608	051001	115	3,17	151	2,76	10,06	-151
GJAL28ne	576250,0	451415,2	1740,5	050608	051001	115	3,25	149	2,82	10,3	-149
GJAL29e	576944,0	445119,8	1675	050608	051002	116	0,83	119	0,71	2,6	-119
GJAL30e	577771,0	445165,6	1654,2	050608	051002	116	0,43	124	0,37	1,36	-124
GJAL31e	576985,0	446207,8	1678,1	050608	051002	116	1,17	111	1,01	3,68	-111
GJAL32e	577090,3	447138,3	1675,3	050608	051002	116	1,42	121	1,23	4,47	-121
GJAL33e	577400,1	447887,8	1676,8	050608	051002	116	1,64	137	1,41	5,16	-137
GJAL34e	578695,4	447906,2	1664,2	050610	051002	114	0,35	179	0,31	1,13	-179
GJAL36e	578118,0	446011,2	1646,7	050608	051002	116	0,4	12	0,34	1,25	-12
GJAL37e	577269,8	451456,4	1730,1	050608	051001	115	3,15	142	2,74	9,98	-142
GJAL38e	575322,8	450598,5	1734,3	050610	051001	113	2,75	160	2,44	8,89	-160