Geodetic Activities During the 1995 Juneau Icefield Research Program Field Season

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Appendices

1. Introduction

The surveying program of the summer Institute of the Juneau Icefield Research Program (JIRP) serves three aims: First to keep the long term movement records on the main profiles running. Second to gather data on movement, Strain rates, height changes and so forth to help to develop a better understanding of the system "glacier" in combination with adjacent sciences and to depict a more precise picture of the complex interaction of glacial response to long and short term variations of the climate. And last to teach the students participating in the summer Institute surveying techniques, evaluation procedures and critical interpretation of the results by involving them in projects connected with first two aims.

2. Survey projects

The 1995 survey campaign was mainly focussed on two projects: Integrating the local JIRP networks (Taku network around Camp 10 and Gilkey network in the Camp 8/18 area) in a worldwide reference frame (here: Network of the International GPS Service for Geodynamics (IGS network)) and to demarcate the névé areas of the Matthes, Llewellyn and Vaughan Lewis glacier on the high plateau. Different profiles in that area should help to determine the borders of the areas supplying those glaciers.

Furthermore the double line Profile IV and the other main movement profiles in the Camp 10 and Camp 8/18 area and about a forth of the 1991 flags in the Trench were observed. A time series of some 40 hours of positions for a point close to flag 15 of Profile IV on the Taku glacier was measured to have a better look on short term movement variations.

For the first time Real-Time-GPS (RT-GPS) was brought to the Icefield. Practical tests revealed a higher effectiveness and a better reliability of the survey results. A major set back for that type of GPS measurements is the limitation of the necessary radio link. Due to the general rule for the circumstances on the Icefield found out during the survey campaign, that if there is a line of sight between the reference station and the rover, there will be a stable radio link, only two profiles (Profile IV and SW Branch Profile) where observed using RT-GPS. In principle RT-GPS provides the possibility to reestablish positions of flags from former years even in white out conditions. Setting up the profiles year after year exact in the same location will lead to height and movement comparison without hypothesis and can help to detect kinematic waves traveling down glaciers on the Icefield (*Van de Wal and Oerlemans 1995*).

With one exception all measurements were carried out using GPS, mostly in rapid static mode. Theory, principles and evaluation of GPS observations are not described in this report; they are well known and can be reviewed in a lot of publications (*Wells et al. 1986, Seeber 1989 e.g.*).

Figure 1 shows the locations of all survey projects on the Juneau Icefield in 1995, a timetable of the surveys carried out is given in table 1.

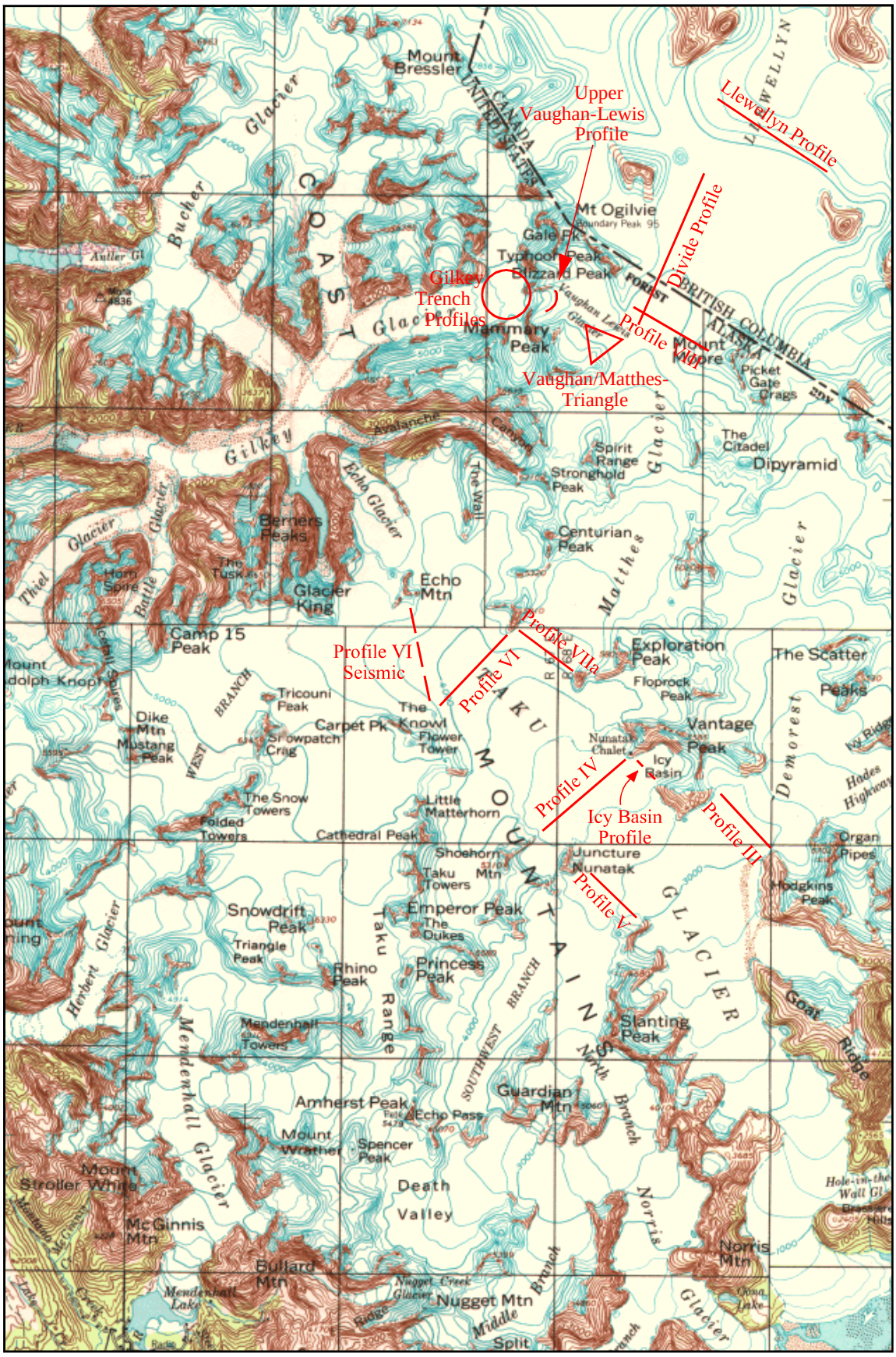

Figure 1: Locations of the 1995 survey projects on the Juneau Icefield

Profile	Location	Survey Dates	Purpose of survey	Type of measure-ment	No. of points
Profile III	Demorest glacier	July 17, 1995 July 25, 1995	AB MV	GPS GPS	10 10
Profile IV	Taku glacier	July 20 - 22, 1995 July 28, 1995	AB, HC MB, MV SR	RT-GPS GPS	31 31
Profile IVa	Icy Basin	July 24, 1995 August 1, 1995	AB MV	GPS GPS	9 9
Profile V	Taku glacier SW Branch	July 23, 1995 July 29, 1995	AB, HC MV	RT-GPS RT-GPS	12 12
Profile VI	Taku glacier NW Branch	July 18, 1995 July 28, 1995	AB MV	GPS GPS	10 10
Profile VIIa	Matthes glacier	July 18 - 19, 1995 July 26, 1995	AB MV	GPS GPS	13 13
Profile VIII	Matthes glacier	August 6, 1995 August 10, 1995	AB MV	GPS GPS	12 12
Upper Vaughan Lewis	Vaughan Lewis glacier	August 7, 1995 August 12, 1995	AB MV	T2/EDM GPS	8 8
Vaughan / Matthes triangle	Matthes / Vaughan Lewis glacier	August 5, 1995 August 11, 1995	AB, MV SR	GPS GPS	9 9
Divide profile	Matthes / Llewellyn glacier	August 5 - 7, 1995 August 14, 1995	AB, MV SR	GPS GPS	16 15
Llewellyn profile	Llewellyn glacier	August 7, 1995 August 13, 1995	AB MV	GPS GPS	11 11
Profile D	Gilkey Trench	August 12, 1995	MV	GPS	7
Profile E	Gilkey Trench	August 12, 1995	MV	GPS	2
Taku tracking	Taku glacier	July 30, 1995 - August 1, 1995	MV	GPS	1
IGS Connection	Scott (C 10) N1 (C 18)	July 15 - 17, 1995 August 2, 1995	POS	GPS	1 1
JIRP network	C 19 area C 18 area	August 13, 1995 August 14, 1995	POS POS	GPS GPS	3 3
Profile VI Seismic	Taku glacier NW Branch	August 8, 1995	POS	GPS	16
Icy Basin Seismic	Icy Basin	July 29, 1995	POS	GPS	5
Lower Demorest Seismic	Demorest glacier	July 31, 1995	POS	GPS	3

Profile	Location	Survey Dates	Purpose of survey	Type of measure-ment	No. of points
Met Locations	Taku glacier Camp 10 hill	July 23, 1995 July 24, 1995	POS	GPS	4

Explanation: Purpose of survey: AB = Ablation; HC = Height comparison; MB = Mass balance; MV = Movement; POS = Position; SR = Strain rates

Type of measurement: GPS = Rapid Static GPS survey; RT-GPS = Real-Time GPS survey; T2/EDM = Theodolite and Electronic Distance measurement

Table 1: Timetable of the survey work carried out in the 1995 JIRP campaign

2.1. Connecting the Icefield to the IGS network

In 1994 the International Association of Geodesy established the International GPS Service for Geodynamics (IGS) to provide the scientific community with GPS observations from an increasing number of permanently tracking GPS stations around the world, very precise orbits for all GPS satellites and other GPS derived products like earth rotation parameters (*Beutler et al. 1994*). The positions of those stations are derived using observations of space measurement techniques such as GPS, VLBI (Very Long Baseline Interferometry) and SLR (Satellite Laser Ranging) to obtain a highly accurate representation of a worldwide reference coordinate system. This realization is called **I**nternational **T**errestrial **R**eference **F**rame (ITRF). The coordinates of the IGS stations are updated yearly and named after the year, ITRF93 e.g. All IGS products (GPS data gathered at permanently tracking stations and their positions e.g.) are open to the public and can be downloaded from data center managed by the IGS.

Up to nowadays there were two main local networks on the Icefield with different datum definitions what often caused some confusion. For a long time it had been a wish to unify the networks and to connect them with the official USGS network. In former years some attempts were made using terrestrial survey techniques but no satisfying results were achieved.

For the derivation of the positions of two Icefield points (Scott at Camp 10 and N1 at Camp 18) in the ITRF93 coordinate system, the most current system at this time, simultaneous GPS observations from those stations and the four closest IGS stations (Alberthead in British Columbia, Fairbanks in Alaska, Pendicton in British Columbia and Yellowknife in Northwest Territories) were used. The point configuration is shown in figure 2.

All baseline computations were performed with the Geotracer GPS Software Version 2.0. This software includes an easy and effective data screening tool, that allows to exclude bad observations from every satellite from the baseline computation (*Geotronics 1995*). The atmospheric influence on the observations was taken into account using standard models for the

ionosphere and troposphere resp. The baseline length ranged from some 970 km to 1420 km what made it necessary to use precise ephemerises for the computation. 47 baselines, representing 106 hours of observation from station Scott and 41 hours from station N1, connecting the six points were computed. No satisfying result could be achieved for 11 baselines. The final coordinates were determined using a 3d adjustment with 36 baselines and the IGS stations as fixed point and transformed to conformal coordinates using the JIRP projection (parameters see table 2). The final coordinates can be found in Appendix A3 and a printed log of the 3d adjustment in Appendix A1.

Figure 2: Locations of the IGS stations

Parameter	Value
Projection type	Transverse Mercator
False Easting	500 000 m
False Northing	0 m
Central meridian	134° 00′ 00″ West

Parameter	Value
Latitude of origin	0° 00′ 00″ North
Scale on central meridian	1.000000
Zone width	3° 00′ 00″

Table 2: Parameters of the projection set “JIRP”

The standard deviations of the coordinate components shown in Appendix A1 are too optimistic due to the very high degree of freedom involved in GPS measurement analysis. A more realistic measure of the accuracy achieved can be calculated from the residuals of the 3d-

adjustment. The so called repeatability for each coordinate component is displayed in table 3.

Latitude [mm]	Longitude [mm]	Height [mm]
36,5	46,4	68,4

Table 3: Repeatability of the "IGS-baseline" measurements

2.2. Embedding of the JIRP networks into the IGS frame

All baselines between benchmarks observed with GPS in the last four years were recomputed and their final ITRF93 coordinates derived by a 3d adjustment with the points N1 and Scott as fixed points. A log of that adjustment is given in Appendix A2. In a second step two sets of transformation parameters for the transition from the local coordinate systems (Taku and Gilkey network) to the ITRF93 coordinate system were derived using a 7 parameter (3 translations, 3 rotations, 1 scale factor) transformation.

In a first step a transformation with all identical points of the Taku network was performed. Points "Taku D Lower" and "SW Taku Lower" revealed residuals in position of about 2m in the local network. Using the old reports describing the layout, measuring and adjustment of that network (*Welsch 1984, Heister 1985, Blachnitzky 1987*) no reason could be found for those discrepancies. The final set of transformation parameters for the Taku network was derived without the two doubtable points. The remaining residuals in the identical points show a mean point error of about 18 cm in position and about 6 cm in height. Compared with the accuracies achieved in the adjustment performed in 1984 (*Welsch 1984*), this is a better result than it could be expected. The scale factor of -188 ppm (= 18,8 cm per km) confirms the fact of a gross scale error in the local Taku network (*Blachnitzky 1987*), but not the order of magnitude (- 325 ppm) stated by *Blachnitzky*.

In 1986 a part of the local Gilkey network was readjusted using additional measurements made in 1985 and 1986 (*Kersting 1986*). The new adjusted coordinates changed from some centimeters up to some meters, so the local Gilkey network from that time on consisted actually of two different coordinate sets. In a the first step of transformation parameter determination all identical points with local coordinates derived in the 1986 adjustment were used. Point "FFGR 39" showed a residual of about 1,5 m in height, that could result from a wrong target height introduced in the adjustment. Point "FFGR 12" revealed residuals in position of about 1,5 m in the local network. Again no explanation for that disagreement could be found. Only the position of point "FFGR 39" and the height of point "FFGR 12" in combination with all three components of the points "FFGR24", "FFGR 31", "FFGR 43" and "N1" were used for the determination of the final set of transformation parameters. The remaining residuals in the identical points show a mean point error of about 4 cm in position and about 3 cm in height. That is in combination with the scale factor of -12 ppm (= -1,2 cm per km) an indicator for the very good accor-

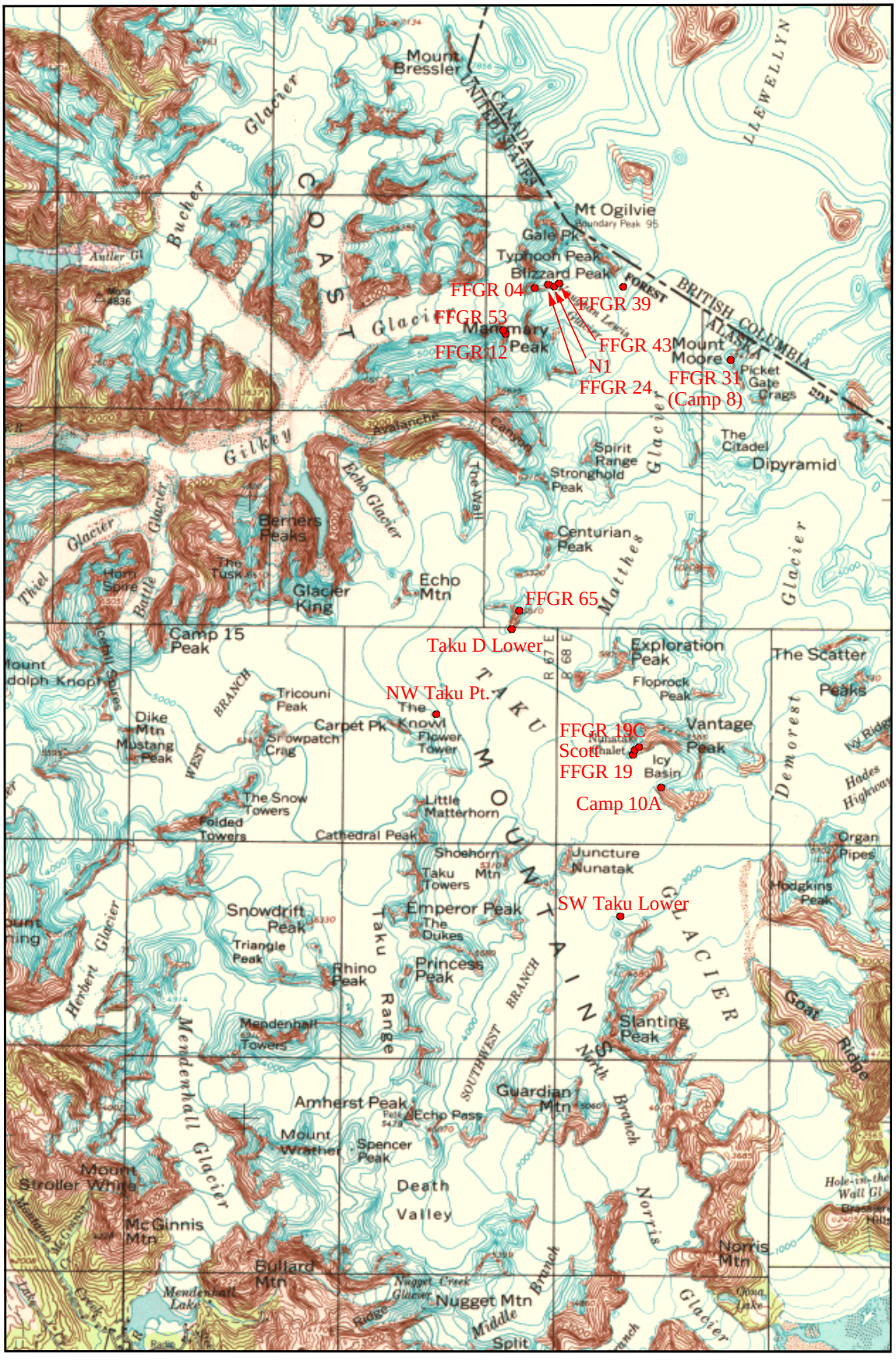

Figure 3: Locations of the GPS survey points on the Juneau Icefield

dance of both coordinate systems and the high quality of the local Gilkey network determined in 1986.

It must be emphasized that all coordinates from the Gilkey network derived in 1984 and transformed to ITRF93 coordinates can be "wrong" in the meter level. If those points have to be used as reference points for GPS surveying in the future a proper point determination has to be done.

Figure 3 shows the benchmarks on the Icefield determined with GPS and a listing of conformal ITRF93 coordinates of all benchmarks is given in Appendix A3.

Comparing GPS derived movement vectors with those determined by means of classical surveying techniques a rotation of both networks is to consider (*Lang 1993*). The rotation angles of both local networks versus the ITRF93 network were determined in the process described above. The local Taku network has to be rotated 6.76 gon anticlockwise, the local Gilkey network 25.17 gon anticlockwise to have the same orientation as the ITRF93 network. Using the equation

$t_{ITRF} = t_{local} + \alpha$ with t_{ITRF} = direction of a movement vector in the ITRF system
t_{local} = direction of movement vector in a local system
α = rotation angle mentioned above

direction of movement vectors derived in different coordinate systems can be compared.

2.3. Movement surveys

2.3.1. Movement profiles Camp 10 area

On Profile IV and Profile V (SW Branch) the 1994 positions were reestablished using RT-GPS. All other movement profiles around Camp 10, except the Icy Basin Profile, were established as close as possible to the 1994 positions using the general description of the specific locations given in *McGee* (*McGee 1994, Appendix 1*). They only vary in the number of flags. The resulting movement vectors show a high degree of accordance with those determined in 1994 so that all statements made on the general mode of flow for each profile in *McGee* are still valid without any restrictions.

The Icy Basin Profile traverses Icy Basin in a line in between the points FFGR 19 at Camp 10 and Camp 10A on the western slope of Taku A. That profile was established to give positions for geophysical research. Despite the fact that the movement is very slow in Icy Basin and therefore a long time span between survey and resurvey is recommended that profile was resurveyed after one week only. Assuming a position accuracy of 5 cm (the internal accuracy of GPS is much higher, but the definition of the point - a 1 x 2 inch flagpole - is as accurate as 5 cm or so only), the accuracy in distance between two points or one point in two epochs is about 7 cm. Under those assumptions a distance of about 20 cm is needed to have - in the sense of statistics - a significant movement. Out of 9 points only three fulfill that requirement and one of

them is obviously an outlier. Therefore neither movement vectors are shown in Appendix C2 nor movement data are listed in Appendix C3 for the Icy Basin Profile.

2.3.2. Movement profiles Camp 18 area

Even if ProfileVIII is shifted on the line Blizzard Point - Camp 8 further towards Camp 8 and the Upper Vaughan Lewis Profile is located approximately 300 m further up glacier than in 1994, again the degree of accordance comparing both years results allow to refer to the statements concerning the general mode of flow for those profiles given in *McGee*.

The movement pattern 1995 on Profile VIII looks somewhat inhomogeneous compared to 1994, the magnitude of the velocity found in 1995 is more realistic than those from 1994 and matches well the numbers of former years.

Three new profiles were set in the Camp 18 area. First to find a better demarcation of the névé areas of the Llewellyn, Matthes and Vaughan Lewis glacier and second to have a first impression on the velocity the Llewellyn glacier is moving. The attempt to demarcate the névé areas of the Llewellyn, Matthes and Vaughan-Lewis Glacier showed no satisfying results, mainly because the triangle shaped Matthes/Vaughan Lewis Divide Profile was set under white out conditions and placed about 700 m too far down glacier (see Appendix C2, page 3).

The movement pattern at the Matthes/Vaughan Lewis Divide Profile is as expected and shows no peculiarities. Points 1, 9, 8 and 7 form a 800 m straight line which is located about 500 m west of the center line of the Matthes glacier following the glaciers gradient. The glacier movement rate increases from 9 cm/day at point 1 to 18 cm/day at point 7, producing long perpendicular crevasses in that area. Except point 4, which is basically moving downwards the slopes of the backside of the Mammary Peak range all other movement vectors have a similar orientation slightly rotate towards the centerline of the Matthes glacier. The velocity show the expected decline as further from the center the points are located. The whole profiles extent covers less than a third of the cross section of the Matthes glacier allowing no statement on the mode of flow even if there is evidence for a parabolic kind of flow.

The Divide profile was established to find out where the crest between Matthes and Llewllyn glacier is located. It is some 5 km long starting on the center line of the Matthes glacier about 1 km south of Profile VIII and ending about 2.5 km across the border on the canadian side of the Icefield. For two points no movement data could be derived due to faulty results (point 1) and disappearance of the flag before the resurvey (point 9). It seems that the divide is located in the area around flag 15 and 16; between both flags the direction of movement changes about 70 gon and reaches for the first time an north west orientation, comparable to the movement direction at the Llewellyn profile located approximately 6 km further down glacier. South of flag 15 the movement vectors turn more and more to the south and the velocity is slowly picking up what indicates that a part of the ice flowing from the small plateau on the backside of Mount Ogivile feeds the Matthes glacier.

The Llewellyn glacier profile is located on the canadian side of the Icefield, about 8 km beyond the border and some 3 km before the Llewellyn glacier enters the narrow channel

between F10 Peak and Sloko ridge. With a length of about 4 km it covers half of the cross section of the glacier in that place. The eastern flags (point 1 to 5) show an erratic pattern of movement, mainly directed towards the center of the Llewellyn glacier. Most distances those flags moved in total are close or below the level of significance (see page 8). Therefore these vectors have to be seen as a good estimate for the real movement. Further to the west the movement picks up speed and changes the direction to north west. The maximal velocity is reached at the western end of the profile (flag 11) with 15 cm/day. Judging from the local situation the plateau around Mount Nesselrode and Mount Bressler contributes a substantial part to the Llewellyn glacier in the area of the profile. It can be assumed that beyond the western end of the profile the velocity will be higher, what would indicate an asymmetrical channel flow. On the other hand the movement vectors determined in 1995 could explain a parabolic flow, too. Further investigations have to be done to clarify exactly the mode of flow.

The results of the movement analysis for all profiles are given in appendices C2 (plots) and C3 (tables).

2.3.3. Movement profiles in the Trench

Due to the limited time at the end of the season 12 flags set up in 1990 were found only. The search was concentrated on Profile D and E, because almost every flag of those profiles was found in 1994 and the years before. Three of the flags (D3, D4 and E1) were located in crevasses and are lost forever. In table 4 the movement data from 1994 to 1995 are displayed. They fit well in the known pattern (*Welsch et al. 1997*).

Point	Total movement [m]	Daily movement [m]	Bearing of movement [gon]
D1 1990	135.98	0.37	221.82
D2 1990	166.69	0.46	214.78
D5 1990	176.36	0.48	244.54
D6 1990	171.57	0.47	223.38
D7 1990	177.13	0.49	252.00
D8 1990	171.65	0.47	235.78
D9 1990	161.60	0.44	253.73
E2 1990	18.30	0.02	224.29
E3 1990	22.97	0.06	215.44

Table 4: Movement in the Trench 1994 - 1995

Even if only a short time could be used to search it can be assumed that more than a third of the original flags from 1990 are lost. The information gathered the last five years is sufficient to explain the general mode of movement in the area of the Trench were the Gilkey Glacier turns 90 degrees (*Welsch et al. 1997*). In the future more detailed studies on specific problems in the

Trench should be carried out and the areas of investigation should move further up and down the Gilkey glacier.

2.3.4. Continuous movement monitoring

Patterson (*Patterson, 1981*) states that the movement of glaciers are subjected to variations of different time intervals (day/night, summer/winter e.g.). Those variations in velocity can be bigger as 100% within a few hours (*Patterson, 1981, p. 66*). To verify that theory a 48 hour survey of the Taku glacier was initiated. One permanently tracking GPS receiver was set on a platform near flag 15 on Profile IV, another was simultaneously observing on station Scott in Camp 10. The resulting baseline length is approximately 1.5 km. Due to technical problems (a broken cable blocked the communication between the sensor and the controller for about two hours before that was discovered) 43 hours of observations were used for analysis. A position of the moving receiver was derived using 15 minutes of observations each. In the vicinity of flag 15 of Profile IV the Taku glacier reaches a depth of about 1300m (*Sprenke et al. 1995; Sprenke et al. 1996*), so that despite Pattersons statement a steady movement was assumed. Therefore the "quarter hour" positions were analyzed using linear regression. The result of that analysis shows a more or less steady movement. The irregular jumps in figure 4a are in the range of error and therefore not significant.

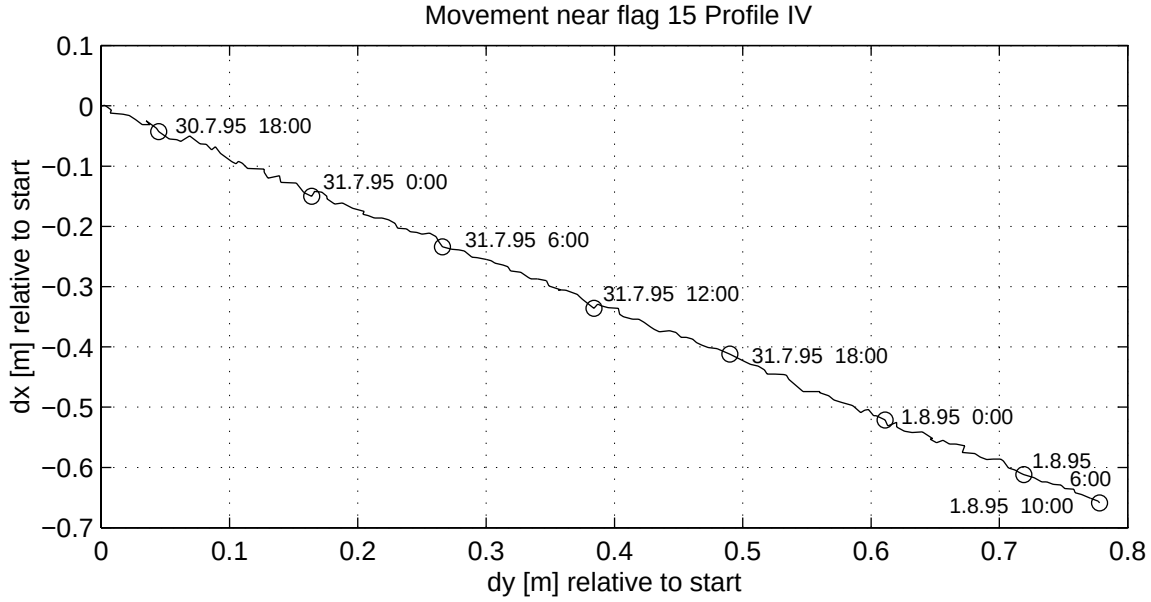

Figure 4a: Movement near flag 15 of Profile IV

The accuracy of the height component determined with GPS is two to three times worse than for the position. But a trend can be identified in very noisy data too, if there are enough observations for analysis. Figure 4b shows the differences in height relative to the first measurement and a best fit line to the data. The platform the moving receiver was placed on had three

feet with a length of about half a meter and kept the platform stable in all components, so the change in height (= -1.8 cm/day) can be used as a measure for the glaciers gradient in that area.

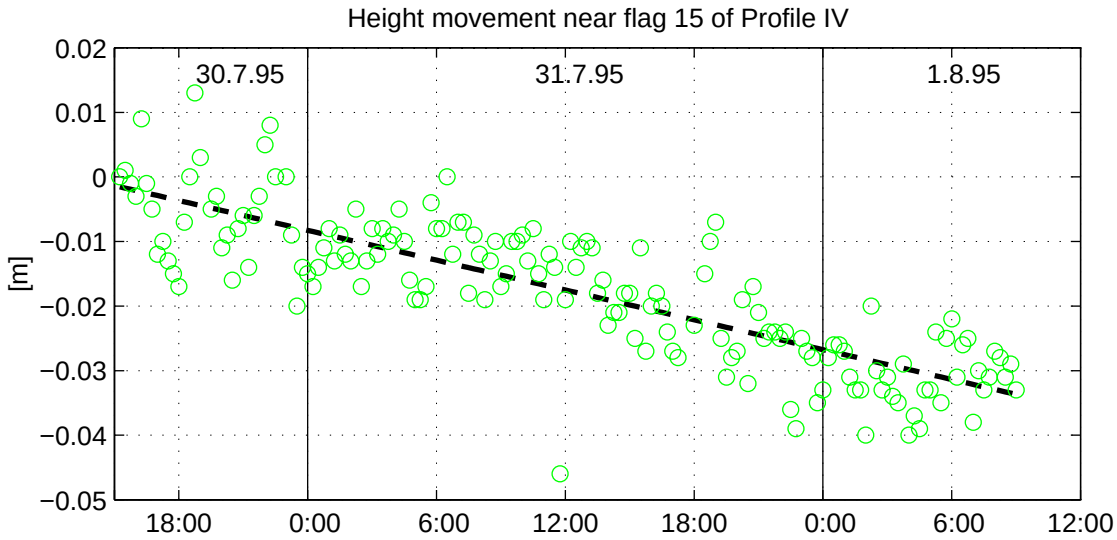

Figure 4b: Height movement of Taku glacier near flag 15

The residuals of the regression analysis of the total distance moved show a not very well defined pattern which seems to have a cycle length of about 24 hours (see figure 5) what would indicate a day/night variation of velocity of the Taku glacier. On the one hand it seems implausible that a glacier with a length of about 60 km, a width varying from 3 to 6 km (*Miller 1963*) and an estimated average center line depth of 900 m (*Nolan et al. 1995, fig. 7*) will show short term response to a daily change in air temperature and on the other hand the length of the time serve - less than twice of the anticipated cycle duration of 24 hours - is too short to allow a secured statement on that topic.

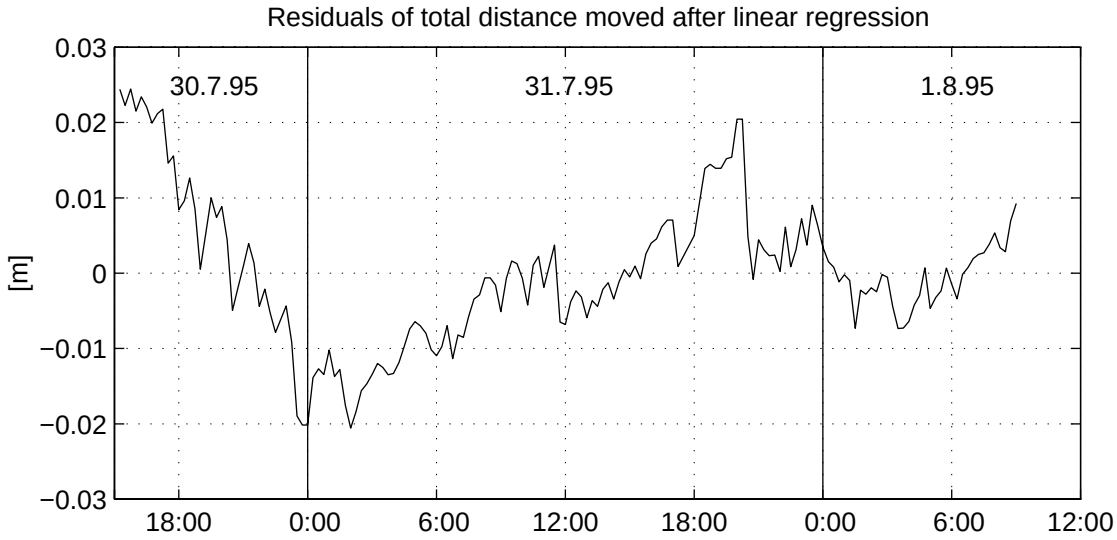

Figure 5: Residuals of regression analysis

2.4. Height comparison

Using the same positions and carrying out the survey the same date every year an exact comparison of the glacier surface heights can be done. In practice it is not always possible to take the observations every year on the same date nor to have accurately the same position for all flags. The demand for the same date can be fulfilled by interpolation, if the desired date is in between the zero and the resurvey of a profile. Assuming a glacier gradient of 1° a position error of 3.5 m will lead to an error in height of 5 cm. That is the level of accuracy which can be achieved using GPS for height determination (again, the height determination using GPS can be much more accurate, but the definition of the reference plane for the instrumental height of the GPS sensor over a snowcovered uneven surface will be possible within 5 cm or so only). Therefore a position error up to about 5 m can count as the same position in the flat part of the glacier.

In 1995 the 1994 positions on Profile IV (Taku Glacier) and Profile V (SW Branch Taku Glacier) were reestablished using RT-GPS. The comparison revealed a loss of elevation of about 1.5 meters on Profile IV and about 1.25 m on Profile V. Graphs are given in figures 6; the exact numbers can be found in Appendix D.

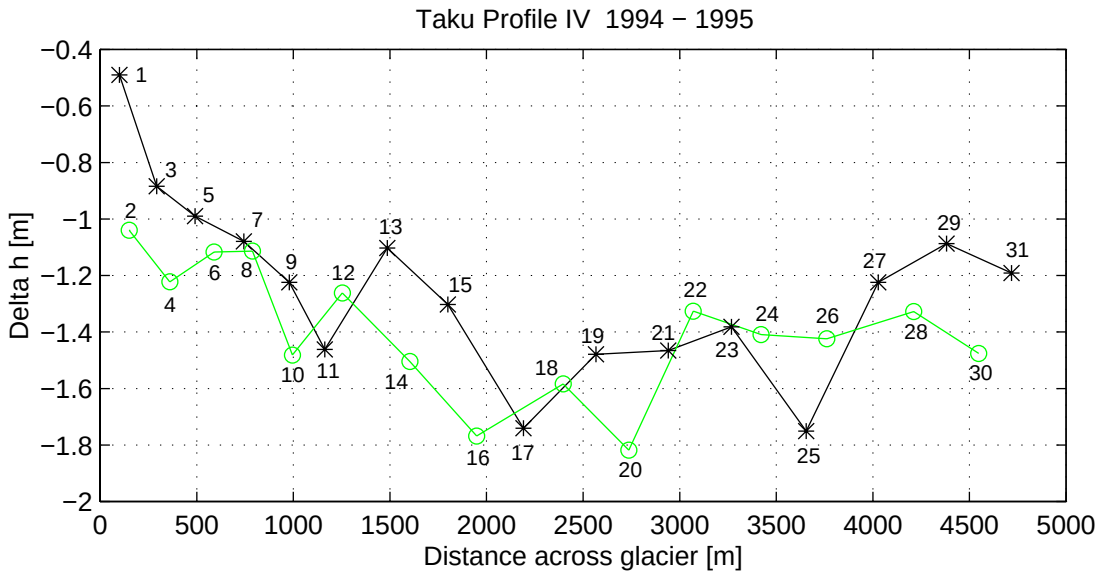

Figure 6a: Height change 1994 - 1995 on Taku glacier Profile IV
(Upper line points are marked with "✳" and shown in black, lower line points are marked with "○" and shown in grey)

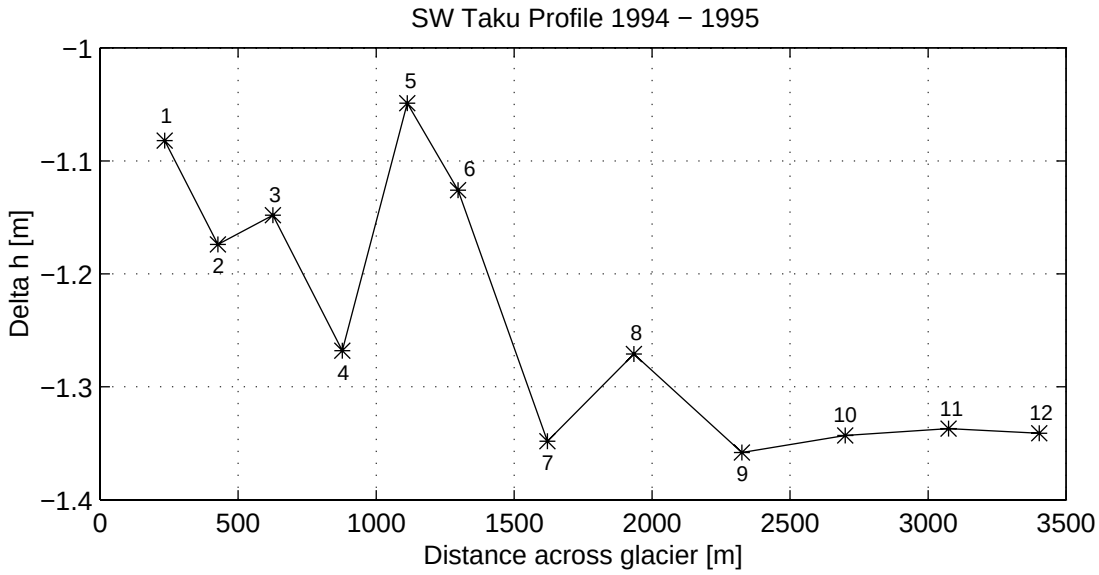

Figure 6b: Height change 1994 - 1995 on Taku glacier Profile V (SW Branch)

2.5. Ablation

The results on all profiles in the Camp 10 area are comparable to former years. For all profiles on the high plateau it is better to speak of height change rather than ablation. Between survey and resurvey of those profiles snow fall of regional different intensity occurred on the high plateau. Plots of the “ablation” can be found in Appendix C1, numerical results in Appendix C3.

2.6. Volume change on Profile IV

There is a significant loss of volume on Profile IV from 1994 to 1995 (see chapter 2.4. Height comparison). That supports the observation that the snowline on the Taku glacier was about 1 km further up glacier in 1995 than in an average summer season. Numbers for volume change 1994 to 1995 and for a short period this summer (July, 22nd - July, 28) are listed in Appendix E.

2.7. Strain rates

By reestablishing year after year the flags of Profile IV in the same positions at the same time (more or less), Strain rates derived from the triangles formed by the double line can be compared without hypothesis. All strain elements show a good agreement for all three years that type of profile layout is done. As an example therefore the maximal principle strain (E1) is

shown in figure 7. The numbers for each triangle are given in Appendix F.

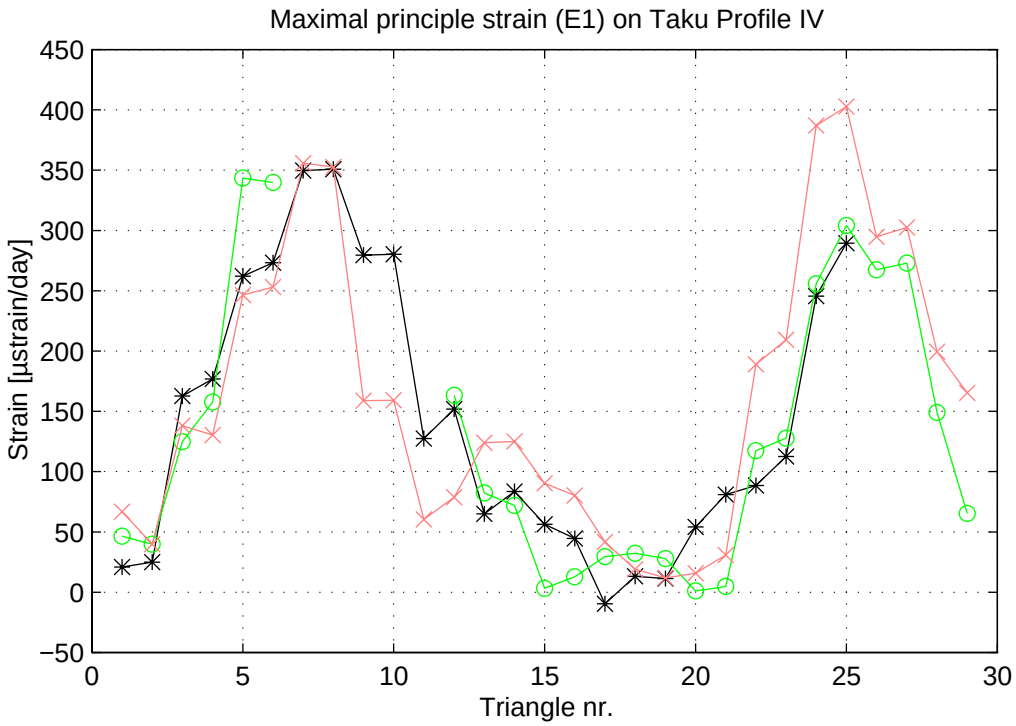

Figure 7: Maximal principle strain (E1) on Taku Profile IV
(Data referring to 1993 are marked "✳" and shown in black, data referring to 1994 are marked "○" and shown in grey, data referring to 1995 are marked "✕" and shown in grey. Triangle 1 is formed by points 1,2,3; triangle 2 by the points 2,3,4 and so on.)

3. Prospect

Using RT-GPS in combination with fast mode of transportation where possible (thiokol e.g.) surveying projects with large amounts of points can be done in a feasible timespan. That will allow in future to get all "classical" profiles surveyed every year and to open more remote areas of the Icefield for investigations. In all areas glaciers are merging a more or less dense grid of points can be layed out and surveyed in one day. That provides the user with more information by nearly the same effort in fieldwork. From those grids movement and strain rates in the convergence areas or contour lines in the divergence areas (see Divide profile) can be derived.

That means in detail that a grid consisting of about 50 flags each (spacing approximately 500 m) is sufficient to demarcate clearly the névé areas of the Matthes and Vaughan Lewis glacier and Matthes and Llewellyn glacier resp. If that is not feasible the elongation of the Divide profile can with much less effort give clarity to the position of the rim between the Matthes and the Llewellyn glacier.

In general every survey project on the Llewellyn glacier will add useful information to the understanding of the entire Icefield. In a first step a profile at the entry of the channel mentioned

in chapter 2.3.2. and a better placed Llewellyn profile is suggested. A mapping project of ice boundaries around Camp 26 can help to quantify the obvious loss of ice in that area. Accurate height information gathered on the same points over years is required to figure out whether the dramatic trend of glacial retreat and loss of volume in lower elevations continues in the higher elevations.

A grid type layout in the convergence area of the Matthes and the Taku glacier could point out how far the Matthes glacier is pushing into the Taku glacier. Even a profile from NW Taku point to Taku C can give some information on that topic.

As mentioned in chapter 2.3.3. the mode of flow in and around the convergence area of the Gilkey, Vaughan Lewis and Unnamed glacier is nowadays well known. The areas of interest in the Trench should move further up and down the Gilkey glacier, as far the efforts justify the results.

The continuous movement monitoring should be repeated on a much smaller glacier, there a glacial response to short term changes in environmental conditions is more likely. A good place for an setup is on the Vaughan Lewis glacier right above the Icefall, there a discontinuous movement can be assumed too.

4. Acknowledgment

Without the strong support and excellent logistics provided by Prof. Dr. M. M. Miller that ambiguous surveying program could not have been even partially completed. Dr. Peter Angus-Leppan substantially contributed to the success of the surveying program with his professional help. Last but not least the authors want to thank Joan Miller and her team with Rebecca Dayton in Juneau who managed to get all the supplies at the right time to the right place and all participants of the 1995 summer Institute who always liked to help out when help was needed.

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Appendix A1

Adjustment log
“IGS connection”

3D adjustment log
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Project: IGS-Coordinates for SCOTT and N1 (Camp 18)

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Approximate coordinates (geocentric)

Station	X [m]	Y [m]	Z [m]
ALBH____	-2341332.869	-3539049.487	4745791.402
DRAO____	-2059164.641	-3621108.378	4814432.426
FAIR____	-2281621.365	-1453595.756	5756961.965
N1_C18__	-2310587.245	-2369749.863	5435869.710
SCOTT___	-2320015.434	-2385115.501	5424599.444
YELL____	-1224452.429	-2689216.071	5633638.288

****

Residuals after adjustment [mm]

Baseline from	to	X	Y	Z	N	E	h
ALBH____	SCOTT___	-41.5	-141.9	88.7	-57.0	56.7	152.5
DRAO____	SCOTT___	23.8	-101.6	20.6	-42.1	80.0	56.0
FAIR____	SCOTT___	-78.6	37.4	108.2	18.2	-78.6	113.0
YELL____	SCOTT___	40.3	19.0	-0.6	33.2	22.6	-19.4
ALBH____	SCOTT___	16.2	-19.3	-71.1	-46.2	24.7	-54.3
DRAO____	SCOTT___	19.5	-27.7	-72.8	-51.3	32.2	-52.8
YELL____	SCOTT___	53.4	38.9	19.3	63.7	22.2	-13.7
ALBH____	SCOTT___	20.0	-71.1	-14.4	-43.0	60.2	13.9
DRAO____	SCOTT___	10.8	-61.2	-18.5	-45.2	45.4	10.0
FAIR____	SCOTT___	-14.5	83.9	-20.8	26.9	-74.2	-38.1
YELL____	SCOTT___	51.5	18.4	26.0	51.3	32.2	0.9
ALBH____	SCOTT___	-4.8	-67.9	-13.9	-53.2	38.9	22.1
DRAO____	SCOTT___	-12.0	-75.2	-13.0	-62.1	35.6	29.1
FAIR____	SCOTT___	-14.8	55.8	-19.9	11.5	-52.6	-28.8
FAIR____	SCOTT___	-72.8	48.5	37.3	-5.2	-83.6	45.1
YELL____	SCOTT___	-22.2	-0.3	21.3	-0.6	-18.2	24.9
FAIR____	SCOTT___	-43.6	53.1	64.1	30.0	-68.7	56.6
YELL____	SCOTT___	-4.7	51.1	54.6	61.3	-32.7	28.2
FAIR____	N1_C18__	3.7	76.3	-122.2	-12.6	-56.9	-131.8
FAIR____	SCOTT___	-25.2	64.7	-60.5	-9.8	-66.1	-63.4
YELL____	SCOTT___	50.9	67.0	-54.3	46.5	4.2	-88.5
YELL____	N1_C18__	29.1	77.9	-76.0	33.1	-20.0	-105.8
SCOTT___	N1_C18__	34.9	29.7	-62.6	6.5	4.3	-77.1
ALBH____	N1_C18__	-44.7	-114.8	98.1	-36.3	37.2	148.6
ALBH____	N1_C18__	-60.6	-9.6	34.5	-16.2	-41.2	54.7
DRAO____	N1_C18__	-43.3	-75.7	84.1	-20.7	10.9	118.8
DRAO____	N1_C18__	-30.5	-102.7	63.8	-43.8	37.4	110.5
YELL____	N1_C18__	-8.7	63.2	-14.7	34.0	-42.9	-36.0
YELL____	N1_C18__	39.1	-9.0	11.1	18.2	37.3	2.5
ALBH____	N1_C18__	2.3	-61.3	31.3	-18.7	40.2	52.6
DRAO____	N1_C18__	37.3	-24.8	-32.9	-17.1	44.7	-28.2
FAIR____	N1_C18__	4.0	66.0	-67.5	7.7	-48.7	-80.6
ALBH____	N1_C18__	-33.9	-72.0	55.4	-29.4	18.8	90.4
DRAO____	N1_C18__	-14.2	-52.5	32.1	-22.0	20.2	55.6

```
FAIR____N1_C18__  -15.6    38.2    10.2       15.4  -39.5     3.4
YELL____N1_C18__    3.2    28.8    51.3       47.4  -13.7    32.2

*******************************************************************************

               Adjusted coordinates (geocentric)
               ---------------------------------

Station            X               Y               Z         sX     sY     sZ
                 [m]             [m]             [m]       [mm]   [mm]   [mm]

ALBH____    -2341332.8691   -3539049.4871    4745791.4019    0.0    0.0    0.0
DRAO____    -2059164.6409   -3621108.3780    4814432.4260    0.0    0.0    0.0
FAIR____    -2281621.3650   -1453595.7560    5756961.9650    0.0    0.0    0.0
N1_C18__    -2310587.3760   -2369750.0505    5435869.8659   10.9   14.5    9.9
SCOTT___    -2320015.4753   -2385115.6434    5424599.5323   12.8   12.3   11.3
YELL____    -1224452.4290   -2689216.0709    5633638.2881    0.0    0.0    0.0


               Adjusted coordinates (ellipsoidal)
               ----------------------------------

Station        Phi             Lambda              h        sP     sL     sh
               [°]              [°]               [m]      [mm]   [mm]   [mm]

ALBH____    48.3897821417  -123.4874696556     31.7579    0.0    0.0    0.0
DRAO____    49.3226201889  -119.6249804444    541.8849    0.0    0.0    0.0
FAIR____    64.9780020389  -147.4992383944    319.0068    0.0    0.0    0.0
N1_C18__    58.8344689107  -134.2757806303   1698.4568    7.8   14.3   12.7
SCOTT___    58.6470523222  -134.2073064920   1189.7398    8.7   13.3   13.8
YELL____    62.4808951667  -114.4806979500    180.8372    0.0    0.0    0.0


               Adjusted coordinates (conformal)
               --------------------------------

Station        Easting         Northing            h        sE     sN     sh
                 [m]             [m]               [m]      [mm]   [mm]   [mm]

N1_C18__     484073.4444     6524262.7638      1698.4568    7.8   14.3   12.7
SCOTT___     487963.3030     6503372.1110      1189.7398    8.7   13.3   13.8
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Appendix A2

Adjustment log
“JIRP benchmarks”

3D adjustment log
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Project: Readjustment JIRP-network (GPS obs. 1992-1995)

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Approximate coordinates (geocentric)

Station	X [m]	Y [m]	Z [m]
FFGR04__	-2311110.270	-2369193.014	5435528.308
FFGR12__	-2312746.852	-2369321.669	5434669.036
FFGR19C_	-2319981.349	-2385109.578	5424626.360
FFGR19__	-2320032.909	-2385189.177	5424549.571
FFGR24__	-2310451.635	-2369776.668	5435956.505
FFGR31__	-2306770.223	-2377407.092	5434571.660
FFGR39__	-2308210.280	-2372139.825	5436171.792
FFGR43__	-2310595.693	-2369638.625	5435920.803
FFGR53__	-2312731.307	-2369267.241	5434681.532
N1_C18__	-2310587.376	-2369750.050	5435869.866
NW_TAKU_	-2325345.370	-2377997.338	5425685.462
SCOTT___	-2320015.475	-2385115.643	5424599.532
SW_TAKU_	-2324848.000	-2389194.639	5420694.163
TAKU_A__	-2319993.508	-2386846.869	5423754.082
TAKU_D_L	-2320517.155	-2377951.209	5427657.750
TAKU_D__	-2320549.500	-2377947.848	5427742.816

****

Residuals after adjustment [mm]

Baseline from	to	X	Y	Z	N	E	h
SCOTT___	SW_TAKU_	0.0	0.0	0.0	0.0	0.0	0.0
SCOTT___	SW_TAKU_	0.0	0.0	0.0	0.0	0.0	0.0
SCOTT___	TAKU_A__	0.0	0.0	0.0	0.0	0.0	0.0
SCOTT___	FFGR19C_	3.5	2.8	-6.9	0.2	0.5	-8.3
SCOTT___	FFGR19__	-4.4	-5.2	7.1	-2.2	0.5	9.6
SCOTT___	NW_TAKU_	9.2	22.4	-25.9	5.7	-9.1	-33.8
SCOTT___	FFGR19C_	2.8	-4.7	13.9	6.0	5.3	12.5
SCOTT___	FFGR19__	4.5	-1.5	-4.8	-0.8	4.3	-5.1
FFGR19C_	FFGR19__	3.3	3.5	-14.9	-3.6	-0.1	-15.2
SCOTT___	NW_TAKU_	2.8	10.0	-21.4	-3.3	-5.0	-23.0
NW_TAKU_	TAKU_D_L	-8.7	-10.9	15.5	-3.8	1.4	20.5
SCOTT___	TAKU_D_L	0.2	1.0	-0.2	0.6	-0.6	-0.6
TAKU_D_L	TAKU_D__	0.0	0.0	0.0	0.0	0.0	0.0
N1_C18__	FFGR31__	0.0	0.0	0.0	0.0	0.0	0.0
N1_C18__	FFGR39__	0.0	0.0	0.0	0.0	0.0	0.0
N1_C18__	FFGR24__	0.0	0.0	0.0	0.0	0.0	0.0
N1_C18__	FFGR12__	0.0	0.0	0.0	0.0	0.0	0.0
N1_C18__	FFGR53__	-1.0	-1.9	2.8	-0.3	0.6	3.5
N1_C18__	FFGR04__	0.0	0.0	0.0	0.0	0.0	0.0
N1_C18__	FFGR53__	8.3	9.7	-26.3	-2.7	-0.9	-29.1
N1_C18__	NW_TAKU_	-22.5	-42.6	51.5	-12.8	13.7	68.0
SCOTT___	FFGR19__	-2.4	0.7	1.9	-0.1	-2.2	2.3
SCOTT___	TAKU_D_L	14.3	-1.2	-10.3	2.4	11.1	-13.5
SCOTT___	N1_C18__	20.4	24.6	-59.5	-3.6	-2.5	-67.4

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N1_C18__FFGR43__    2.4   -6.8   -1.7         -3.5    6.5    0.2
N1_C18__FFGR43__    6.8   11.8  -13.3          4.5   -3.4  -18.2
N1_C18__FFGR43__    1.5    8.3    6.3          9.3   -4.7    1.8
N1_C18__FFGR43__  -12.3   -3.0   -1.0         -9.6   -6.7    4.7
N1_C18__FFGR43__   -3.7    2.1    3.9          1.2   -4.1    3.9
N1_C18__FFGR43__   -2.9   -3.9    5.7         -1.1    0.6    7.4
N1_C18__FFGR43__    0.3   -1.6    2.4          0.5    1.3    2.5

*******************************************************************************


               Adjusted coordinates (geocentric)
               ---------------------------------

Station            X               Y               Z         sX     sY     sZ
                  [m]             [m]             [m]       [mm]   [mm]   [mm]

FFGR04__    -2311110.2696   -2369193.0139    5435528.3081   24.0   24.7   19.0
FFGR12__    -2312746.8521   -2369321.6689    5434669.0356   11.5   10.1   29.6
FFGR19C_    -2319981.3452   -2385109.5749    5424626.3532    6.2    7.2   11.1
FFGR19__    -2320032.9139   -2385189.1825    5424549.5783    4.5    4.1    7.6
FFGR24__    -2310451.6347   -2369776.6679    5435956.5052    9.9   12.9   25.5
FFGR31__    -2306770.2231   -2377407.0923    5434571.6606    7.8   11.4   20.3
FFGR39__    -2308210.2804   -2372139.8253    5436171.7921   10.3   11.7   17.4
FFGR43__    -2310595.6900   -2369638.6321    5435920.8011    2.1    2.1    3.8
FFGR53__    -2312731.3082   -2369267.2433    5434681.5345    5.7    7.4   20.6
N1_C18__    -2310587.3760   -2369750.0500    5435869.8660    0.0    0.0    0.0
NW_TAKU_    -2325345.3609   -2377997.3150    5425685.4362    5.3    5.9   11.2
SCOTT___    -2320015.4750   -2385115.6429    5424599.5320    0.0    0.0    0.0
SW_TAKU_    -2324847.9997   -2389194.6392    5420694.1635   13.6   15.1   37.8
TAKU_A__    -2319993.5079   -2386846.8692    5423754.0824   23.2    9.1   23.9
TAKU_D_L    -2320549.4856   -2377947.8490    5427742.8055    2.8    3.0    5.2
TAKU_D__    -2320032.8069   -2377901.6926    5428421.0182    6.8    7.2   16.7


               Adjusted coordinates (ellipsoidal)
               ----------------------------------

Station        Phi             Lambda              h        sP      sL     sh
               [°]              [°]               [m]      [mm]    [mm]   [mm]

FFGR04__    58.8331412795  -134.2889936653    1388.7532   22.7     7.1   31.3
FFGR12__    58.8196646194  -134.3077118655    1292.8650   13.0     8.4   29.5
FFGR19C_    58.6473933369  -134.2069580688    1197.9990    6.4     4.7   12.3
FFGR19__    58.6463217543  -134.2066388091    1180.8351    4.5     2.9    8.1
FFGR24__    58.8354526804  -134.2737764545    1733.4157   14.5     9.0   25.0
FFGR31__    58.8067274326  -134.1360515477    2051.5752   10.1     7.2   21.2
FFGR39__    58.8354619896  -134.2174377446    1984.3844   10.6     8.7   18.9
FFGR43__    58.8352735365  -134.2772302167    1703.7615    1.9     1.5    4.2
FFGR53__    58.8201051445  -134.3081772650    1277.7731    9.2     5.3   20.0
N1_C18__    58.8344689139  -134.2757806361    1698.4567    0.0     0.0    0.0
NW_TAKU_    58.6626603664  -134.3586245029    1402.0597    5.4     4.1   11.9
SCOTT___    58.6470523250  -134.2073064944    1189.7393    0.0     0.0    0.0
SW_TAKU_    58.5805716332  -134.2179616941    1133.4871   17.3     7.1   38.6
TAKU_A__    58.6337070127  -134.1862571079    1105.7570   12.6    14.6   28.6
TAKU_D_L    58.6982268068  -134.3000910390    1399.2120    2.8     2.0    5.7
TAKU_D__    58.7044097108  -134.2942695914    1774.1079   11.7     4.9   14.7
```

Adjusted coordinates (conformal)

Station	Easting [m]	Northing [m]	h [m]	sE [mm]	sN [mm]	sh [mm]
FFGR04__	483309.7456	6524118.0949	1388.7532	22.7	7.1	31.3
FFGR12__	482221.8197	6522621.7279	1292.8650	13.0	8.4	29.5
FFGR19C_	487983.6504	6503410.0337	1197.9990	6.4	4.7	12.3
FFGR19__	488001.8195	6503290.6144	1180.8351	4.5	2.9	8.1
FFGR24__	484189.6349	6524371.8725	1733.4157	14.5	9.0	25.0
FFGR31__	492136.6241	6521147.7732	2051.5752	10.1	7.2	21.2
FFGR39__	487443.1443	6524360.9755	1984.3844	10.6	8.7	18.9
FFGR43__	483990.1011	6524352.7380	1703.7615	1.9	1.5	4.2
FFGR53__	482195.1570	6522670.9222	1277.7731	9.2	5.3	20.0
N1_C18__	484073.4441	6524262.7641	1698.4567	0.0	0.0	0.0
NW_TAKU_	479186.7626	6505147.7166	1402.0597	5.4	4.1	11.9
SCOTT___	487963.3028	6503372.1113	1189.7398	0.0	0.0	0.0
SW_TAKU_	487320.5900	6495968.9177	1133.4871	17.3	7.1	38.6
TAKU_A__	489181.3506	6501882.0109	1105.7570	12.6	14.6	28.6
TAKU_D_L	482601.5386	6509092.7433	1399.2120	2.8	2.0	5.7
TAKU_D__	482942.0714	6509779.9566	1774.1079	11.7	4.9	14.7

Appendix A3

Coordinate Listing
JIRP benchmarks
(ITRF93)

Date of last revision:
October 10, 1995

Camp10 area (Date of last revision: October 10, 1995)					
Point name	Point number	GPS	Easting [m]	Northing [m]	Height [m]
FFGR 19	1	**	488001.819	6503290.614	1180.835
FFGR 19B	1.1	-	488383.812	6503660.530	1241.878
FFGR 19D	1.2	-	488260.073	6503696.171	1254.276
FFGR 19C	1.3	**	487983.650	6503410.034	1197.999
Taku B Lower	1.4	-	488291.558	6503745.867	-
Camp 10 North	1.5	-	487953.269	6503398.640	-
SW-Taku	2	-	487333.573	6495903.939	1143.427
SW-Taku East	2.1	-	487312.654	6495908.411	-
SW Taku Lower	2.2	**	487320.590	6495968.918	1133.487
Taku A	3	-	490529.131	6501653.626	1512.058
Taku B	4	-	488584.436	6504541.021	1590.049
Taku B Cairn	4.1	-	488583.698	6504540.867	-
Taku C	5	-	485696.043	6506827.041	1545.433
Taku C Lower	5.1	-	485645.149	6506713.779	1528.352
Sunday Point	6	-	490254.368	6500611.310	-
Sunday Point Cairn	6.1	-	490235.660	6500682.262	-
Taku D	7	-	482941.368	6509777.053	-
Taku D Cairn (FFGR65)	7.1	**	482942.071	6509779.957	1774.108
Taku D Lower	8	**	482601.539	6509092.743	1399.212
Camp 9	9	-	489442.403	6510665.078	1556.245
Camp 9 Cairn	9.1	-	489443.111	6510663.358	-
NW Taku	10	**	479186.763	6505147.717	1402.060
NW Taku Cairn	10.1	-	479186.085	6505145.695	-
Shoehorn Peak	11	-	482657.922	6500295.568	1326.323
Juncture Peak	12	-	485056.993	6498619.047	1339.302
Juncture Peak Lower	12.1	-	485424.654	6498221.908	-
Bavaria Point	13	-	489420.618	6501375.001	-
Glacier King	14	-	474734.290	6509446.898	1481.190

Camp10 area (Date of last revision: October 10, 1995)					
Point name	Point number	GPS	Easting [m]	Northing [m]	Height [m]
Glacier King Cairn	14.1	-	474735.937	6509445.704	-
Camp 10 A	15	**	489181.351	6501882.011	1105.757
Vantage Peak	16	-	490390.613	6504291.678	1709.758
Twin Peak Geodetic	17	-	500176.970	6499821.680	-
Mt. Moore	18	-	492458.686	6521225.683	2176.999
Mt. Moore Cairn	18.1	-	492460.379	6521228.953	-
Scott	19.1	**	487963.303	6503372.111	1189.739
Exploration Peak	-	-	487450.691	6507809.499	-

Camp18 area (Date of last revision: October 10,1995)					
Point name	Point number	GPS	Easting [m]	Northing [m]	Height [m]
FFGR 45	1	- (1)	484309.190	6524412.397	1746.234
C-8	2	- (2)	492140.925	6521150.738	-
FFGR 31 (C-8)	2.1	**	492136.624	6521147.773	2051.576
FFGR 39	4	**	487443.145	6524360.975	1984.385
FFGR 68	5	- (1)	484425.561	6524412.371	1751.700
FFGR 24 (C-18)	6	**	484189.635	6524371.872	1733.416
FFGR 43 (C-18)	7	**	483990.101	6524352.738	1703.762
FFGR 44	8	- (1)	483834.616	6524280.393	1669.456
FFGR 31 (C-18)	9	- (2)	483705.703	6524279.108	-
FFGR 49	11	- (2)	483243.884	6524040.864	-
FFGR 48	12	- (2)	483375.321	6524008.245	-
C-19	14	- (2)	482226.727	6522614.329	-
FFGR 18 (C-19)	15	- (2)	482294.622	6522477.640	-
FFGR 12 (C-19)	16	**	482221.820	6522621.728	1292.865
Mammary Peak	18	- (1)	484896.398	6522670.739	1929.308
FFGR 63	22	- (2)	484315.328	6524310.038	-

Camp18 area (Date of last revision: October 10,1995)					
Point name	Point number	GPS	Easting [m]	Northing [m]	Height [m]
FFGR 64	23	- (2)	484219.277	6524334.386	-
Ruby Pt.	24	- (2)	484123.294	6524192.347	-
C-19TL	25	- (2)	482224.809	6522611.759	-
FFGR 04 (Cleaver)	26	**	483309.746	6524118.094	1388.753
FFGR 53 (C-19)	27	**	482195.157	6522670.922	1277.773
FFGR 42	28	- (2)	483435.226	6524133.709	1425.756
N1 (C-18)	29	**	484073.444	6524262.764	1698.457
N2 (C-18)	30	- (1)	483956.266	6524239.536	1682.202
FFGR 34	31	- (1)	484553.696	6524404.104	-

** = Coordinates derived using GPS measurements
(1) = Local coordinates from 1986 adjustment
(2) = Local coordinates from 1984 adjustment

Appendix B1

Coordinate Listing
Movement Profile Flags

Profile III (Demorest Glacier)

Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
DEM 01	491649.711	6501295.788	1021.378	17.07.95	14:08
DEM 02	491985.889	6501039.631	1026.474	17.07.95	14:49
DEM 03	492269.853	6500824.957	1031.643	17.07.95	15:26
DEM 04	492528.264	6500632.692	1032.526	17.07.95	14:58
DEM 05	492817.762	6500395.914	1030.020	17.07.95	16:02
DEM 06	493236.348	6500094.995	1046.018	17.07.95	16:36
DEM 07	493541.451	6499876.643	1052.024	17.07.95	17:31
DEM 08	493800.015	6499652.178	1052.185	17.07.95	16:52
DEM 09	494056.860	6499454.334	1052.928	17.07.95	16:27
DEM 10	494291.460	6499316.241	1052.276	17.07.95	15:58
Epoch 1					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
DEM 01	491649.533	6501295.797	1021.133	25.07.95	16:45
DEM 02	491985.089	6501039.172	1026.144	25.07.95	17:17
DEM 03	492268.472	6500824.150	1031.266	25.07.95	17:52
DEM 04	492526.437	6500631.694	1032.135	25.07.95	18:24
DEM 05	492815.980	6500395.032	1029.575	25.07.95	19:00
DEM 06	493234.535	6500094.198	1045.494	25.07.95	19:26
DEM 07	493539.655	6499875.883	1051.531	25.07.95	18:59
DEM 08	493798.628	6499651.477	1051.718	25.07.95	18:28
DEM 09	494055.824	6499453.745	1052.492	25.07.95	17:52
DEM 10	494290.528	6499315.729	1051.666	29.07.95	20:58

Profile IV (Taku Glacier)

Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
TAKU IV 01	487743.545	6503056.139	1119.424	20.07.95	15:02
TAKU IV 02	487528.410	6503206.257	1126.172	20.07.95	14:32
TAKU IV 03	487602.073	6502925.201	1122.331	20.07.95	15:30
TAKU IV 04	487379.731	6503057.231	1125.173	20.07.95	15:58
TAKU IV 05	487453.688	6502792.801	1122.254	20.07.95	16:28
TAKU IV 06	487221.996	6502890.742	1122.713	20.07.95	16:54
TAKU IV 07	487267.134	6502623.699	1120.009	21.07.95	13:44
TAKU IV 08	487085.967	6502746.552	1121.976	20.07.95	18:20
TAKU IV 09	487091.299	6502466.818	1120.532	22.07.95	16:08
TAKU IV 10	486936.638	6502602.233	1121.516	20.07.95	19:29
TAKU IV 11	486957.200	6502341.183	1121.022	21.07.95	14:30
TAKU IV 12	486756.726	6502417.719	1120.816	21.07.95	14:53
TAKU IV 13	486716.328	6502123.843	1120.737	21.07.95	15:17
TAKU IV 14	486484.475	6502197.607	1122.397	21.07.95	15:38
TAKU IV 15	486483.743	6501913.898	1116.888	21.07.95	16:03
TAKU IV 16	486223.460	6501969.995	1121.276	21.07.95	16:24
TAKU IV 17	486195.813	6501649.160	1120.711	21.07.95	16:46
TAKU IV 18	485892.972	6501668.947	1127.012	21.07.95	17:10
TAKU IV 19	485918.786	6501396.568	1127.176	21.07.95	17:32
TAKU IV 20	485641.421	6501439.734	1133.093	21.07.95	17:52
TAKU IV 21	485640.910	6501145.929	1133.592	22.07.95	16:47
TAKU IV 22	485392.602	6501217.948	1137.527	21.07.95	18:35
TAKU IV 23	485397.041	6500926.534	1135.427	22.07.95	21:03
TAKU IV 24	485125.776	6500988.688	1138.308	21.07.95	19:26
TAKU IV 25	485111.782	6500666.605	1137.434	22.07.95	20:48
TAKU IV 26	484860.761	6500776.902	1140.193	22.07.95	18:45
TAKU IV 27	484836.495	6500415.009	1138.314	22.07.95	20:31
TAKU IV 28	484511.799	6500494.136	1139.926	22.07.95	19:12

TAKU IV 29	484572.945	6500178.523	1141.954	22.07.95	20:14
TAKU IV 30	484251.322	6500281.146	1141.274	22.07.95	19:37
TAKU IV 31	484324.050	6499953.280	1146.174	22.07.95	19:58
Epoch 1					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
TAKU IV 01	487743.779	6503056.147	1119.105	28.07.95	19:21
TAKU IV 02	487528.433	6503206.165	1125.856	28.07.95	19:19
TAKU IV 03	487602.312	6502925.076	1121.942	28.07.95	19:04
TAKU IV 04	487380.006	6503056.981	1124.777	28.07.95	19:01
TAKU IV 05	487454.103	6502792.354	1121.812	28.07.95	18:48
TAKU IV 06	487222.728	6502890.142	1122.369	28.07.95	18:39
TAKU IV 07	487268.211	6502622.757	1119.655	28.07.95	18:29
TAKU IV 08	487087.210	6502745.401	1121.630	28.07.95	18:20
TAKU IV 09	487092.986	6502465.360	1120.224	28.07.95	18:11
TAKU IV 10	486938.771	6502600.126	1121.126	28.07.95	18:02
TAKU IV 11	486959.702	6502339.038	1120.640	28.07.95	17:53
TAKU IV 12	486759.435	6502415.346	1120.510	28.07.95	17:39
TAKU IV 13	486719.281	6502121.309	1120.427	28.07.95	17:28
TAKU IV 14	486487.673	6502195.073	1121.955	28.07.95	17:13
TAKU IV 15	486486.985	6501911.116	1116.451	28.07.95	17:08
TAKU IV 16	486226.570	6501967.250	1120.894	28.07.95	16:51
TAKU IV 17	486199.165	6501646.463	1120.330	28.07.95	16:46
TAKU IV 18	485896.240	6501666.305	1126.554	28.07.95	16:27
TAKU IV 19	485922.059	6501394.093	1126.735	28.07.95	16:22
TAKU IV 20	485644.665	6501437.313	1132.714	28.07.95	16:02
TAKU IV 21	485643.701	6501143.937	1133.211	28.07.95	15:58
TAKU IV 22	485395.832	6501215.494	1137.229	28.07.95	15:39
TAKU IV 23	485399.666	6500924.652	1135.050	28.07.95	15:32
TAKU IV 24	485128.555	6500986.474	1137.960	28.07.95	15:16
TAKU IV 25	485113.868	6500665.191	1137.099	28.07.95	15:08
TAKU IV 26	484862.387	6500775.560	1139.941	28.07.95	14:52
TAKU IV 27	484837.655	6500414.316	1138.044	28.07.95	14:42

Point	Easting [m]	Northing [m]	Height [m]	Date	Time
TAKU IV 28	484512.498	6500493.623	1139.725	28.07.95	14:17
TAKU IV 29	484573.344	6500178.429	1141.657	28.07.95	14:13
TAKU IV 30	484251.492	6500281.015	1141.056	28.07.95	13:44
TAKU IV 31	484324.081	6499953.382	1145.822	28.07.95	13:44

Profile V (Taku Glacier SW Branch)

Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
SW TAKU 01	485734.862	6498030.013	1060.211	23.07.95	14:14
SW TAKU 02	485859.279	6497874.656	1062.902	23.07.95	15:08
SW TAKU 03	485960.973	6497734.648	1066.030	23.07.95	15:37
SW TAKU 04	486104.910	6497545.452	1068.365	23.07.95	16:06
SW TAKU 05	486272.932	6497352.036	1068.288	23.07.95	16:34
SW TAKU 06	486450.129	6497147.013	1067.882	23.07.95	17:02
SW TAKU 07	486577.595	6496992.743	1070.859	23.07.95	17:28
SW TAKU 08	486689.735	6496863.595	1075.300	23.07.95	17:56
SW TAKU 09	486805.654	6496732.153	1078.786	23.07.95	17:43
SW TAKU 10	486904.407	6496621.479	1080.164	23.07.95	17:28
SW TAKU 11	487011.856	6496489.179	1081.228	23.07.95	17:13
SW TAKU 12	487116.982	6496357.218	1084.296	23.07.95	16:56
Epoch 1					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
SW TAKU 01	485734.999	6498030.180	1059.919	29.07.95	14:21
SW TAKU 02	485859.484	6497874.864	1062.566	29.07.95	14:52
SW TAKU 03	485961.342	6497735.099	1065.825	29.07.95	15:23
SW TAKU 04	486105.267	6497545.768	1068.090	29.07.95	15:33
SW TAKU 05	486273.312	6497352.522	1067.975	29.07.95	15:39
SW TAKU 06	486450.415	6497147.613	1067.526	29.07.95	15:46
SW TAKU 07	486577.993	6496993.234	1070.509	29.07.95	15:54
SW TAKU 08	486690.229	6496864.016	1074.955	29.07.95	15:59
SW TAKU 09	486806.229	6496732.640	1078.353	29.07.95	16:07
SW TAKU 10	486904.687	6496621.634	1079.762	29.07.95	16:13
SW TAKU 11	487012.047	6496489.420	1080.805	29.07.95	16:17
SW TAKU 12	487117.219	6496357.319	1083.998	29.07.95	16:22

Profile VI (Taku Glacier NW Branch)

Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
NW TAKU 01	481867.887	6508186.273	1271.587	18.07.95	20:23
NW TAKU 02	481627.510	6507877.248	1271.604	18.07.95	19:53
NW TAKU 03	481351.534	6507507.059	1273.405	18.07.95	19:19
NW TAKU 04	481133.171	6507214.254	1276.281	18.07.95	18:48
NW TAKU 05	480924.503	6506937.036	1278.583	18.07.95	18:17
NW TAKU 06	480669.836	6506599.497	1281.652	18.07.95	17:49
NW TAKU 07	480468.750	6506336.553	1283.769	18.07.95	17:20
NW TAKU 08	480252.521	6506055.152	1280.991	18.07.95	16:53
NW TAKU 09	480047.174	6505785.212	1278.228	18.07.95	16:22
NW TAKU 10	479852.390	6505506.435	1278.073	18.07.95	15:45
Epoch 1					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
NW TAKU 01	481868.490	6508185.716	271.053	28.07.95	18:21
NW TAKU 02	481628.936	6507876.387	1271.067	28.07.95	17:52
NW TAKU 03	481353.785	6507505.770	1272.798	28.07.95	17:20
NW TAKU 04	481135.880	6507212.897	1275.734	28.07.95	16:50
NW TAKU 05	480927.334	6506935.734	1278.026	28.07.95	16:21
NW TAKU 06	480672.480	6506598.323	1281.056	28.07.95	15:51
NW TAKU 07	480471.238	6506335.536	1283.161	28.07.95	15:24
NW TAKU 08	480254.896	6506054.236	1280.358	28.07.95	14:56
NW TAKU 09	480049.185	6505784.491	1277.692	28.07.95	14:28
NW TAKU 10	479853.522	6505506.055	1277.548	28.07.95	13:58

Profile VIIa (Lower Matthes Glacier)

Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
LOW MAT 01	483287.375	6509301.188	1291.704	19.07.95	18:54
LOW MAT 02	483509.539	6509054.256	1291.172	19.07.95	18:28
LOW MAT 03	483671.874	6508864.703	1288.945	19.07.95	18:04
LOW MAT 04	483850.601	6508649.308	1285.619	19.07.95	17:38
LOW MAT 05	484002.014	6508474.943	1285.556	19.07.95	17:14
LOW MAT 06	484175.736	6508279.467	1286.804	19.07.95	16:48
LOW MAT 07	484325.776	6508116.188	1287.379	19.07.95	16:18
LOW MAT 08	484469.246	6507972.895	1294.280	18.07.95	19:36
LOW MAT 09	484657.460	6507803.604	1301.858	18.07.95	19:10
LOW MAT 10	484906.829	6507637.560	1304.396	18.07.95	18:40
LOW MAT 11	485130.858	6507500.167	1304.405	18.07.95	18:03
LOW MAT 12	485324.443	6507300.281	1296.669	18.07.95	17:30
LOW MAT 13	485640.682	6507221.739	1303.923	18.07.95	15:36
Epoch 1					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
LOW MAT 01	483287.441	6509301.103	1291.340	26.07.95	15:30
LOW MAT 02	483508.972	6509053.419	1290.790	26.07.95	15:59
LOW MAT 03	483670.769	6508863.250	1288.499	26.07.95	16:27
LOW MAT 04	483849.030	6508647.391	1285.184	26.07.95	16:54
LOW MAT 05	484000.203	6508472.898	1285.159	26.07.95	17:18
LOW MAT 06	484173.616	6508277.273	1286.343	26.07.95	17:42
LOW MAT 07	484323.688	6508113.923	1286.964	26.07.95	17:35
LOW MAT 08	484466.764	6507970.354	1293.734	26.07.95	17:10
LOW MAT 09	484655.091	6507801.381	1301.216	26.07.95	16:45
LOW MAT 10	484904.697	6507635.256	1303.828	26.07.95	15:08
LOW MAT 11	485129.152	6507498.197	1303.879	26.07.95	15:36
LOW MAT 12	485323.307	6507298.571	1296.190	26.07.95	16:04
LOW MAT 13	-	-	-	-	-

Profile VIII (Upper Matthes Glacier)

Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
MATTHES 01	490903.021	6522004.866	1832.377	06.08.95	13:27
MATTHES 02	490613.420	6522169.266	1820.932	06.08.95	13:54
MATTHES 03	490366.204	6522305.920	1796.907	06.08.95	14:19
MATTHES 04	490119.216	6522443.514	1791.481	06.08.95	14:43
MATTHES 05	489885.040	6522574.352	1792.549	06.08.95	15:07
MATTHES 06	489636.881	6522711.678	1796.142	06.08.95	15:33
MATTHES 07	489366.448	6522858.938	1801.369	06.08.95	15:56
MATTHES 08	489089.149	6523015.443	1804.681	06.08.95	17:06
MATTHES 09	488765.920	6523197.618	1809.296	06.08.95	17:32
MATTHES 10	488415.469	6523396.533	1814.875	06.08.95	17:58
MATTHES 11	488105.722	6523570.894	1828.967	06.08.95	18:23
MATTHES 12	487864.179	6523706.811	1851.038	06.08.95	18:45
Epoch 1					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
MATTHES 01	490902.738	6522004.689	1832.136	10.08.95	14:02
MATTHES 02	490613.030	6522168.942	1820.748	10.08.95	13:41
MATTHES 03	490365.825	6522305.700	1796.657	10.08.95	13:21
MATTHES 04	490118.940	6522443.123	1791.241	10.08.95	13:02
MATTHES 05	489884.742	6522573.799	1792.338	10.08.95	12:42
MATTHES 06	489636.678	6522711.190	1795.977	10.08.95	12:16
MATTHES 07	489366.459	6522858.472	1801.251	10.08.95	16:29
MATTHES 08	489088.924	6523014.861	1804.509	10.08.95	16:09
MATTHES 09	488765.777	6523197.176	1809.143	10.08.95	15:53
MATTHES 10	488415.590	6523396.237	1814.696	10.08.95	15:35
MATTHES 11	488105.670	6523570.727	1828.819	10.08.95	15:14
MATTHES 12	487864.251	6523706.681	1850.860	10.08.95	14:54

Matthes/Vaughan-Lewis Glacier Divide Profile

Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
MATVL 01	488065.530	6521713.608	1771.785	05.08.95	19:02
MATVL 02	487837.500	6521529.754	1771.592	05.08.95	18:40
MATVL 03	487630.589	6521359.718	1774.931	05.08.95	18:20
MATVL 04	487441.498	6521227.073	1782.585	05.08.95	17:59
MATVL 05	487782.609	6521108.736	1757.348	05.08.95	17:30
MATVL 06	488016.931	6521018.129	1751.020	05.08.95	19:43
MATVL 07	488205.098	6520935.506	1748.243	05.08.95	20:01
MATVL 08	488149.090	6521193.007	1759.499	05.08.95	20:20
MATVL 09	488106.877	6521466.950	1767.833	05.08.95	20:40
Epoch 1					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
MATVL 01	488065.527	6521713.083	1771.493	11.08.95	18:24
MATVL 02	-	-	-	-	-
MATVL 03	487630.724	6521359.427	1774.631	11.08.95	19:11
MATVL 04	487441.738	6521227.009	1782.289	11.08.95	15:47
MATVL 05	487782.721	6521108.165	1757.030	11.08.95	16:20
MATVL 06	488017.075	6521017.149	1750.771	11.08.95	16:47
MATVL 07	488204.966	6520934.211	1747.928	11.08.95	17:14
MATVL 08	488148.883	6521191.948	1759.177	11.08.95	17:37
MATVL 09	488106.814	6521466.121	1767.536	11.08.95	18:01

Upper Vaughan-Lewis Glacier Profile

Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
VAUGHAN 01	485620.483	6524358.071	1733.58	07.08.95	15:15
VAUGHAN 02	485747.180	6524153.872	1734.81	07.08.95	15:15
VAUGHAN 03	485830.159	6523948.108	1738.06	07.08.95	15:15
VAUGHAN 04	485874.313	6523693.866	1743.15	07.08.95	15:15
VAUGHAN 05	485877.331	6523472.567	1748.11	07.08.95	15:15
VAUGHAN 06	485794.830	6523293.130	1752.09	07.08.95	15:15
VAUGHAN 07	485670.263	6523112.673	1756.70	07.08.95	15:15
VAUGHAN 08	485441.790	6523028.187	1767.82	07.08.95	15:15
Epoch 1					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
VAUGHAN 01	485620.122	6524357.618	1733.418	12.08.95	15:55
VAUGHAN 02	485746.678	6524153.583	1734.617	12.08.95	16:22
VAUGHAN 03	485828.732	6523948.124	1737.906	12.08.95	16:44
VAUGHAN 04	485872.961	6523694.124	1742.976	12.08.95	17:09
VAUGHAN 05	485875.574	6523473.138	1747.913	12.08.95	17:34
VAUGHAN 06	485793.193	6523293.938	1751.920	12.08.95	17:56
VAUGHAN 07	485668.821	6523113.586	1756.383	12.08.95	18:17
VAUGHAN 08	-	-	-	-	-

Coordinates in Epoch 0 were derived using theodolite and EDM. Due to incertainties of trigonometric height determination heights are rounded to the nearest centimeter.

Divide Profile (Matthes/Llewellyn Glacier)

Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
CREST 01	488866.765	6522402.662	1783.265	05.08.95	16:10
CREST 02	489015.804	6522671.637	1794.541	05.08.95	16:35
CREST 03	489156.398	6522957.106	1803.443	05.08.95	16:55
CREST 04	489275.232	6523242.862	1810.294	05.08.95	17:15
CREST 05	489425.420	6523573.553	1816.731	05.08.95	17:33
CREST 06	489520.207	6523919.657	1823.715	05.08.95	18:08
CREST 07	489699.298	6524260.169	1832.951	05.08.95	18:35
CREST 08	489879.630	6524544.849	1839.776	05.08.95	18:59
CREST 09	490022.373	6524858.055	1845.493	05.08.95	19:27
CREST 10	490138.876	6525189.659	1851.980	05.08.95	19:51
CREST 11	490324.058	6525607.582	1860.813	05.08.95	20:14
CREST 12	490588.401	6526177.434	1872.526	05.08.95	20:41
CREST 13	489448.084	6523134.842	1808.132	06.08.95	16:18
CREST 14	489107.760	6523347.296	1812.217	06.08.95	16:42
CREST 15	490746.217	6526519.924	1876.440	07.08.95	18:10
CREST 16	490913.452	6526854.310	1879.113	07.08.95	18:33
Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
CREST 01	488858.771	6522410.846	1783.334	14.08.95	17:39
CREST 02	489015.481	6522670.433	1794.283	14.08.95	17:16
CREST 03	489156.003	6522955.808	1803.191	14.08.95	16:44
CREST 04	489274.931	6523241.753	1810.071	14.08.95	15:32
CREST 05	489424.978	6523572.546	1816.459	14.08.95	15:08
CREST 06	489519.954	6523918.803	1823.494	14.08.95	14:47
CREST 07	489699.191	6524259.431	1832.731	14.08.95	14:26
CREST 08	489879.448	6524544.086	1839.538	14.08.95	14:04
CREST 09	-	-	-	-	-

Point	Easting [m]	Northing [m]	Height [m]	Date	Time
CREST 10	490138.848	6525188.973	1851.772	14.08.95	13:41
CREST 11	490324.163	6525607.106	1860.617	14.08.95	13:19
CREST 12	490588.572	6526177.132	1872.344	14.08.95	12:55
CREST 13	489447.898	6523133.794	1807.903	14.08.95	15:54
CREST 14	489107.584	6523346.482	1812.024	14.08.95	16:20
CREST 15	490746.454	6526519.695	1876.304	14.08.95	12:32
CREST 16	490913.886	6526854.432	1878.932	14.08.95	12:07

Trench Profiles

Point	Easting [m]	Northing [m]	Height [m]	Date	Time
D1 1990	482609.782	6524214.721	1097.905	12.08.95	14:34
D2 1990	482598.631	6524318.084	1104.775	12.08.95	14:13
D5 1990	482180.283	6524157.490	1097.565	12.08.95	17:11
D6 1990	482134.770	6524373.560	1100.472	12.08.95	17:37
D7 1990	481881.396	6524226.470	1079.321	12.08.95	15:57
D8 1990	481955.716	6524371.418	1094.566	12.08.95	16:39
D9 1990	481772.240	6524314.892	1077.083	12.08.95	16:07
E2 1990	482993.542	6524326.650	1106.680	12.08.95	13:24
E3 1990	482914.735	6524267.174	1105.832	12.08.95	12:28

Llewellyn Glacier Profile

Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
LLEW 01	496272.230	6531070.167	1822.485	07.08.95	13:06
LLEW 02	496044.060	6531210.161	1818.882	07.08.95	13:32
LLEW 03	495796.073	6531324.582	1814.928	07.08.95	13:56
LLEW 04	495545.088	6531448.143	1811.243	07.08.95	14:19
LLEW 05	495172.308	6531627.656	1806.897	07.08.95	14:42
LLEW 06	494800.409	6531824.010	1802.800	07.08.95	15:03
LLEW 07	494414.400	6532013.268	1800.098	07.08.95	15:28
LLEW 08	493959.896	6532233.939	1800.791	07.08.95	15:51
LLEW 09	493507.568	6532456.889	1801.174	07.08.95	16:15
LLEW 10	493150.832	6532663.336	1799.850	07.08.95	16:40
LLEW 11	492856.106	6532855.979	1800.456	07.08.95	17:05
Epoch 1					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
LLEW 01	496272.172	6531070.273	1822.182	13.08.95	18:31
LLEW 02	496044.099	6531210.292	1818.688	13.08.95	18:05
LLEW 03	495796.204	6531324.753	1814.672	13.08.95	17:42
LLEW 04	495545.085	6531448.343	1811.051	13.08.95	17:19
LLEW 05	495172.350	6531627.863	1806.741	13.08.95	16:44
LLEW 06	494800.458	6531824.322	1802.731	13.08.95	16:14
LLEW 07	494414.642	6532013.644	1799.899	13.08.95	15:44
LLEW 08	493960.244	6532234.551	1800.526	13.08.95	15:15
LLEW 09	493507.954	6532457.611	1800.939	13.08.95	14:46
LLEW 10	493151.278	6532663.931	1799.612	13.08.95	14:19
LLEW 11	492856.734	6532856.613	1800.136	13.08.95	13:50

Icy Basin Profile

Epoch 0					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
ICY BASIN 01	488164.897	6503116.702	1099.805	24.07.95	14:27
ICY BASIN 02	488292.156	6502991.340	1096.488	24.07.95	14:44
ICY BASIN 03	488410.455	6502874.900	1096.236	24.07.95	15:00
ICY BASIN 04	488531.775	6502755.513	1096.625	24.07.95	15:14
ICY BASIN 05	488653.038	6502635.780	1097.654	24.07.95	15:29
ICY BASIN 06	488765.252	6502526.369	1098.294	24.07.95	15:27
ICY BASIN 07	488883.944	6502408.419	1098.668	24.07.95	15:08
ICY BASIN 08	488995.433	6502298.559	1098.940	24.07.95	14:54
ICY BASIN 09	489105.694	6502189.626	1100.659	24.07.95	14:37
Epoch 1					
Point	Easting [m]	Northing [m]	Height [m]	Date	Time
ICY BASIN 01	488164.819	6503116.553	1099.544	01.08.95	14:50
ICY BASIN 02	488292.092	6502991.349	1096.128	01.08.95	15:08
ICY BASIN 03	488410.463	6502875.025	1095.919	01.08.95	15:26
ICY BASIN 04	488531.768	6502755.433	1096.433	01.08.95	15:41
ICY BASIN 05	488653.062	6502635.815	1097.283	01.08.95	15:58
ICY BASIN 06	488765.070	6502525.410	1098.012	01.08.95	16:16
ICY BASIN 07	488883.835	6502408.131	1098.356	01.08.95	16:33
ICY BASIN 08	488995.375	6502298.348	1098.555	01.08.95	16:54
ICY BASIN 09	489105.792	6502189.666	1100.367	01.08.95	17:12

Appendix B2

Coordinate Listing
Met Pack
and
Seismic Locations

Met Pack Locations

Point	Easting [m]	Northing [m]	Height [m]	Date	Time
MPACK TAKU	487208.398	6501692.502	1109.623	23.07.95	19:46
MP C10-HILL	487927.049	6503285.364	1154.656	24.07.95	14:50
MPACK DREAMLAND	487962.076	6503417.854	1192.375	24.07.95	15:14
MET SHELTER C10	487998.644	6503327.903	1185.995	24.07.95	14:28

Seismic Locations

Point	Easting [m]	Northing [m]	Height [m]	Date	Time
ICY BASIN P 01	488735.700	6502552.600	1098.400	29.07.95	17:30
ICY BASIN P 02	489001.699	6502763.518	1102.079	01.08.95	18:13
ICY BASIN P 03	489187.268	6502898.463	1104.793	01.08.95	18:27
ICY BASIN Q 01	488434.292	6502196.969	1094.400	01.08.95	18:43
ICY BASIN Q 02	488067.263	6501832.620	1092.353	01.08.95	18:57
ICY BASIN ROCK/ICE	488097.234	6503183.745	1107.235	01.08.95	19:19
LOW DEM S01	491560.320	6501391.926	1018.604	31.07.95	14:10
LOW DEM S02	494678.211	6499094.059	1057.937	31.07.95	15:48
LOW DEM S03	494525.453	6499048.797	1052.821	31.07.95	16:16
NW SEISMIC 01	478980.615	6505811.793	1326.076	08.08.95	14:46
NW SEISMIC 02	478921.534	6506034.753	1327.516	08.08.95	15:00
NW SEISMIC 03	478861.504	6506256.899	1327.275	08.08.95	15:11
NW SEISMIC 04	478798.216	6506470.477	1326.894	08.08.95	15:26
NW SEISMIC 04A	478770.800	6506588.044	1326.367	08.08.95	18:12
NW SEISMIC 04B	478742.863	6506717.599	1325.256	08.08.95	18:02
NW SEISMIC 05	478690.409	6506936.364	1323.436	08.08.95	15:39
NW SEISMIC 06	478636.384	6507159.088	1324.130	08.08.95	15:50
NW SEISMIC 07	478581.668	6507384.098	1327.450	08.08.95	16:04
NW SEISMIC 08	478526.139	6507610.211	1331.017	08.08.95	16:15
NW SEISMIC 09	478471.931	6507835.217	1334.316	08.08.95	16:27

Point	Easting [m]	Northing [m]	Height [m]	Date	Time
NW SEISMIC 10	478415.984	6508059.046	1336.099	08.08.95	16:41
NW SEISMIC 11	478358.097	6508285.778	1337.049	08.08.95	16:54
NW SEISMIC 12	478306.994	6508512.305	1337.659	08.08.95	17:10
NW SEISMIC 13	478255.147	6508738.809	1337.566	08.08.95	17:23
NW SEISMIC 14	478204.684	6508976.305	1336.288	08.08.95	17:38

Appendix C1

Plots of Movement Vectors

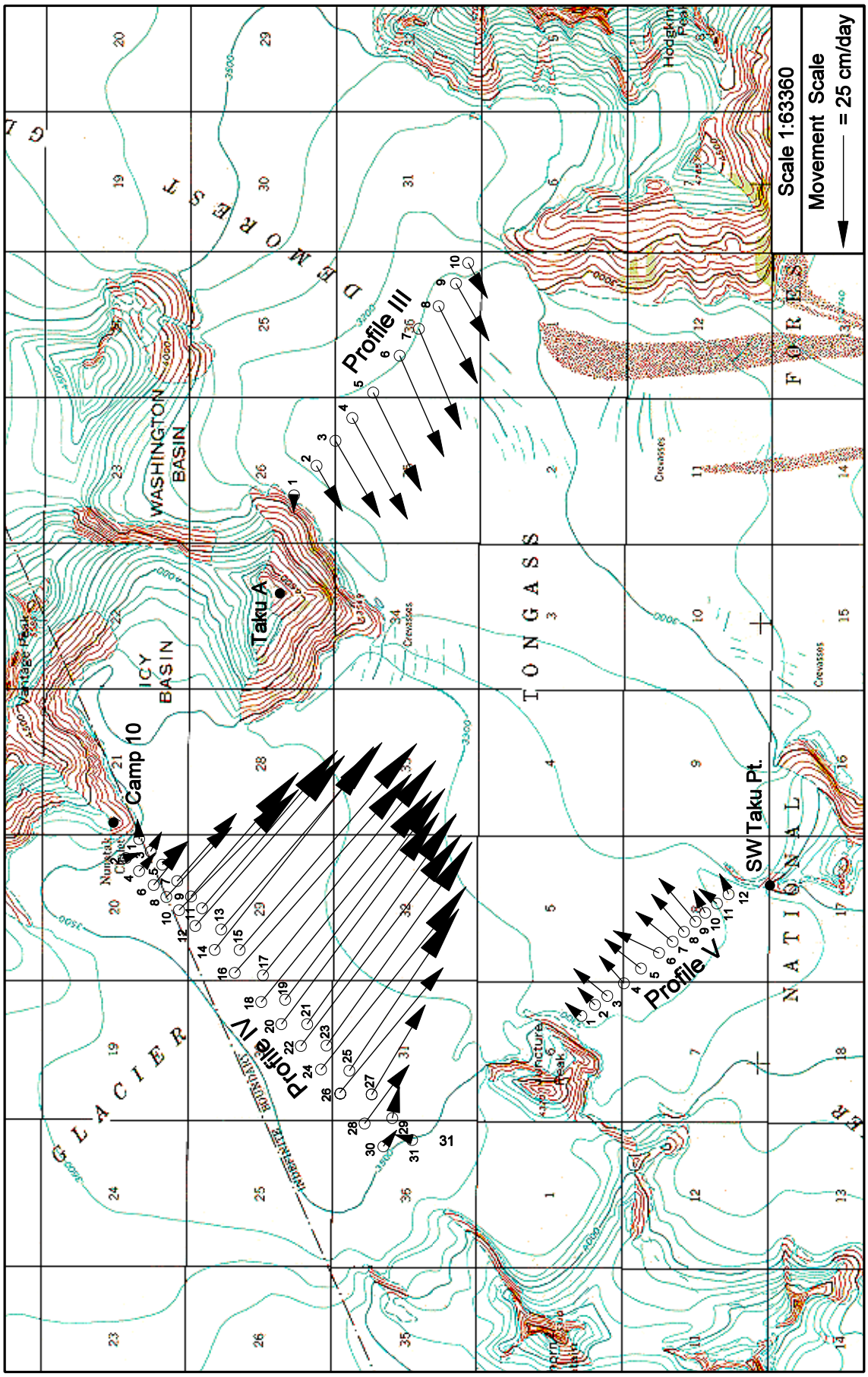


Figure C1: Movement profiles on the Taku Glacier

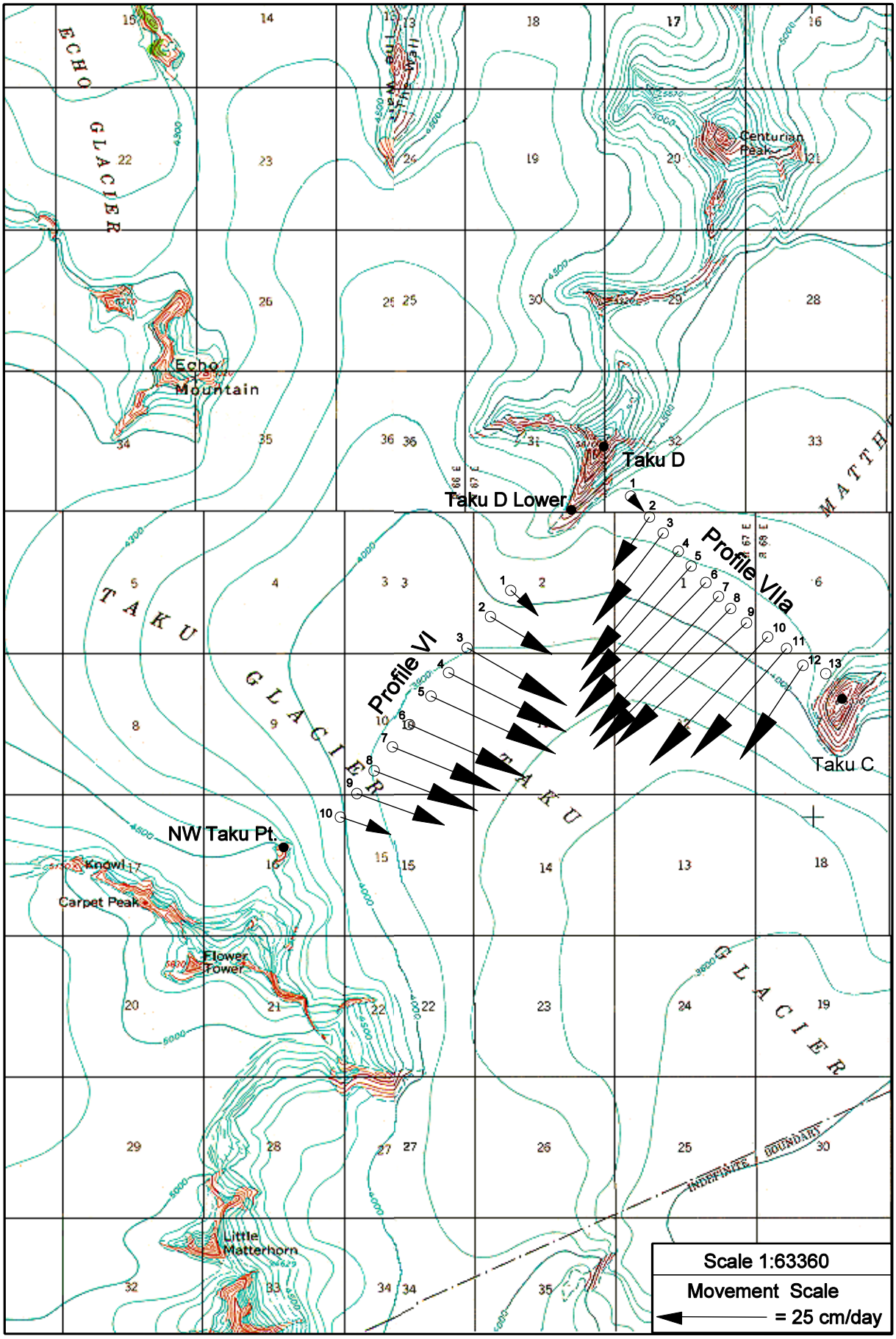


Figure C2: Movement profiles on the Taku and Lower Matthes Glacier

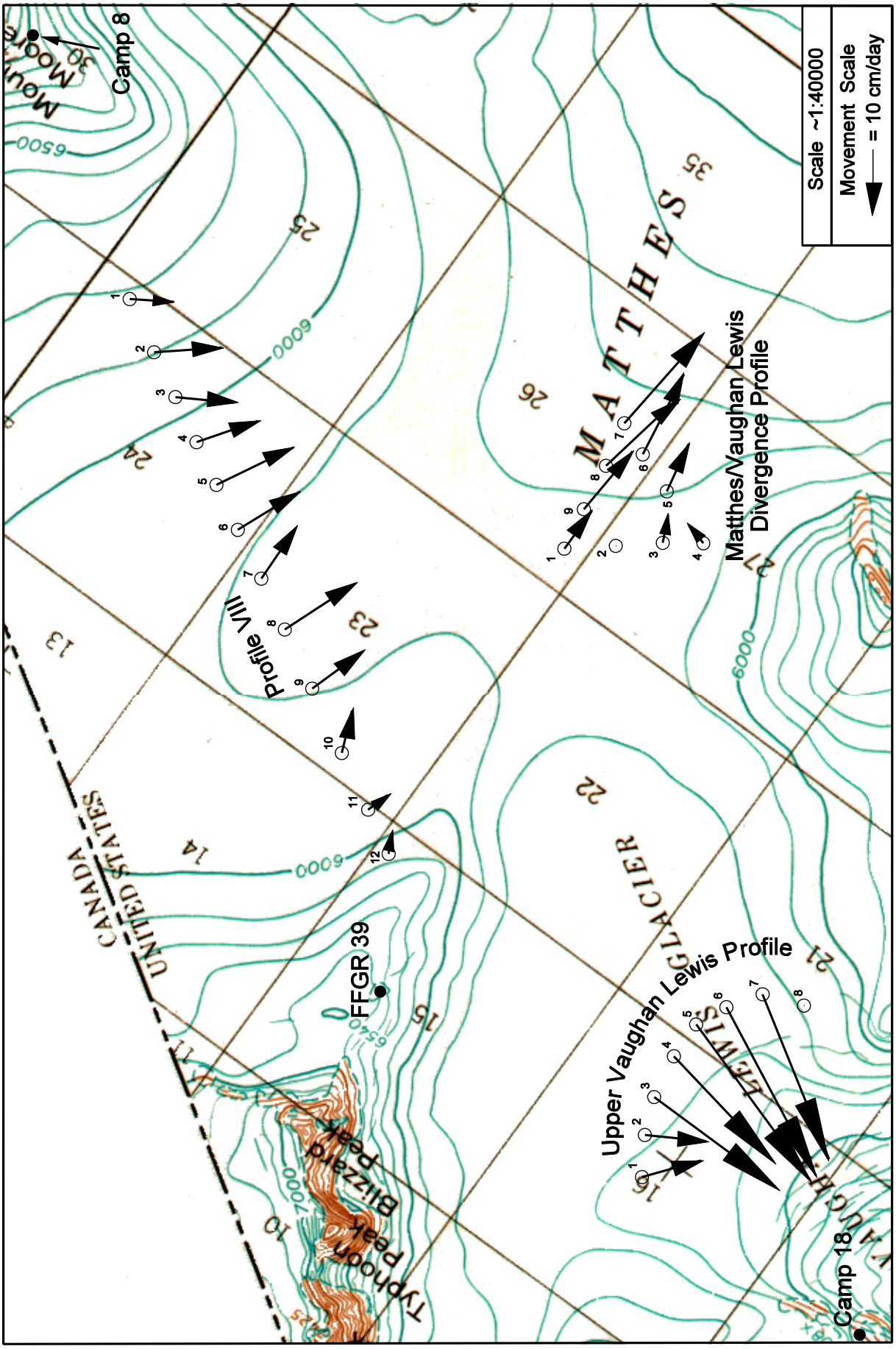


Figure C3: Movement profiles on the high plateau

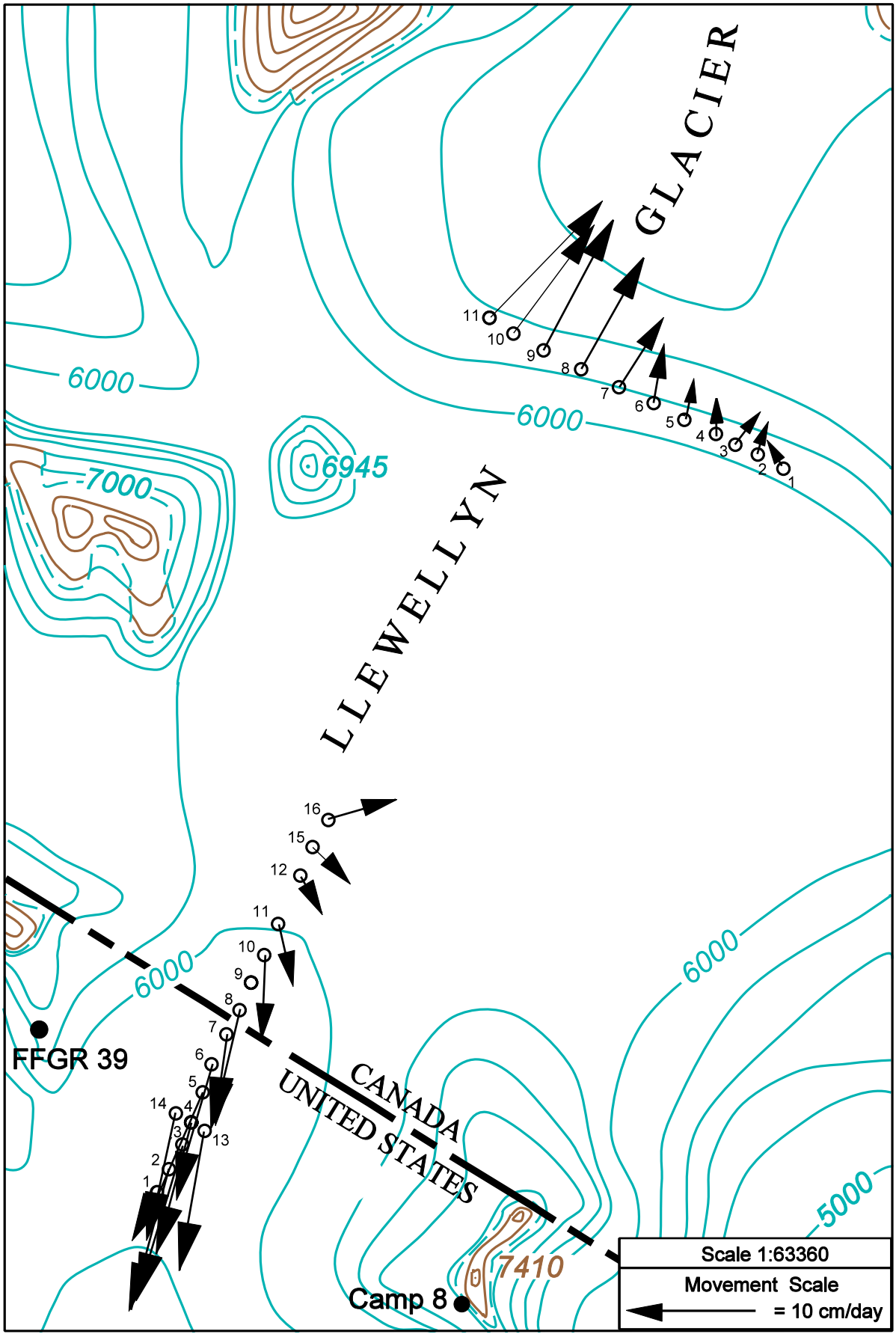
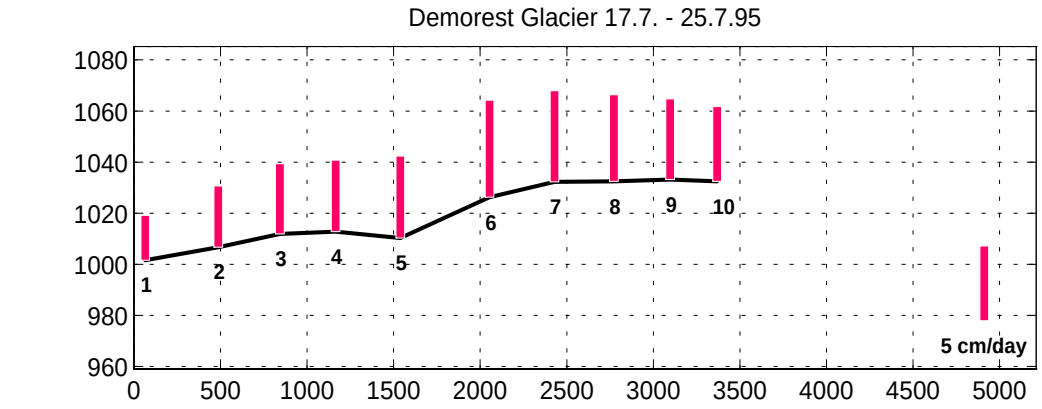
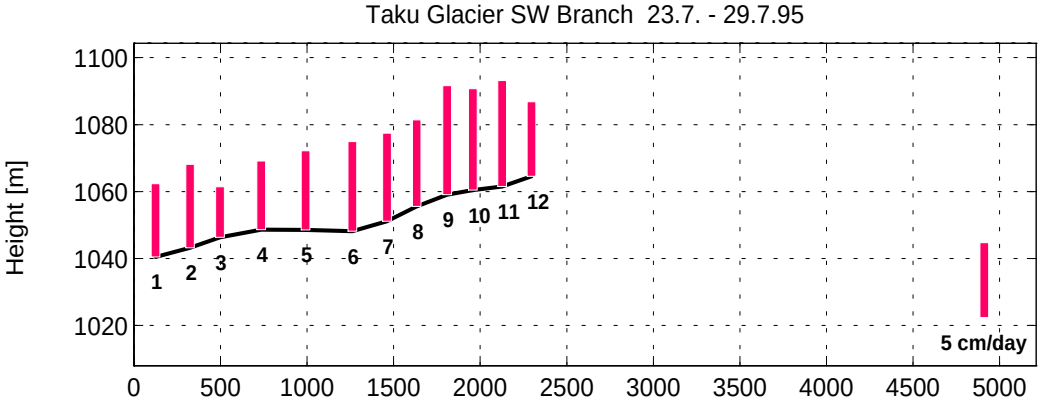


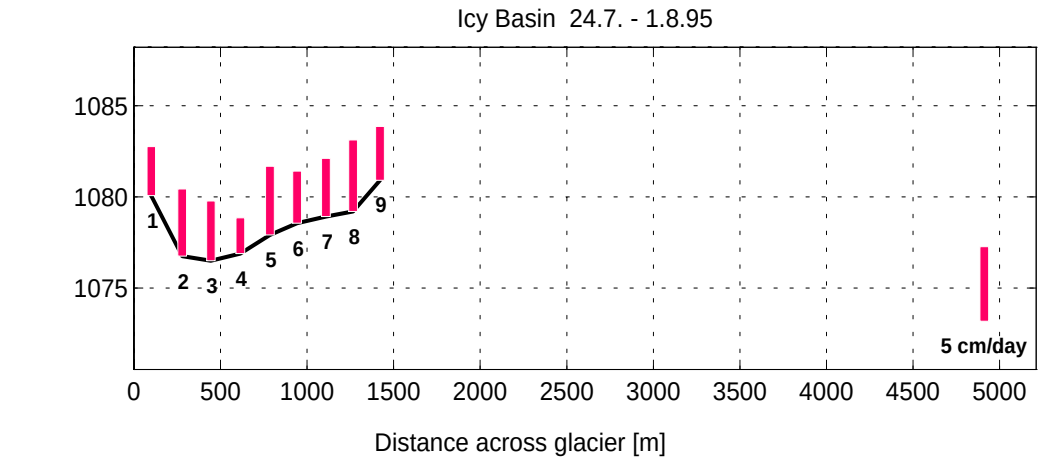
Figure C4: Movement profiles on the Llewellyn Glacier

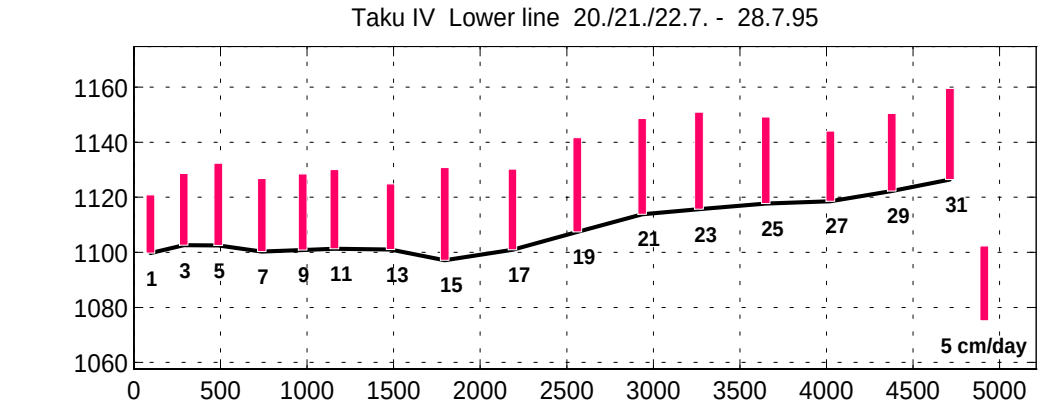
Appendix C2

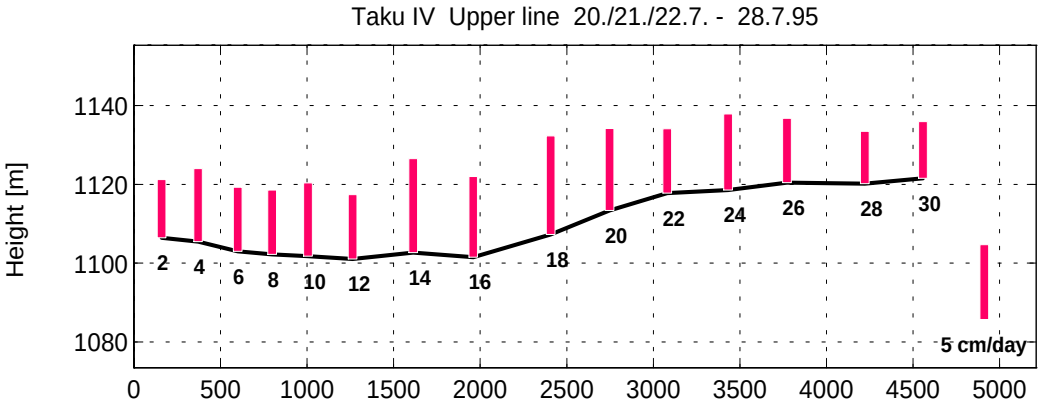
Ablation Plots

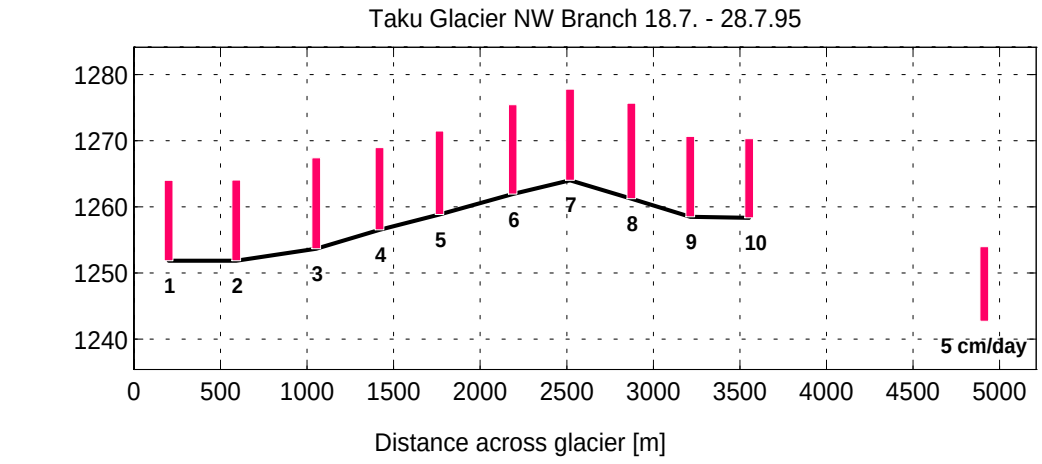

Demorest Glacier 17.7. - 25.7.95
1080
1060
1040
1020
1000
980
960
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
1
2
3
4
5
6
7
8
9
10
5 cm/day

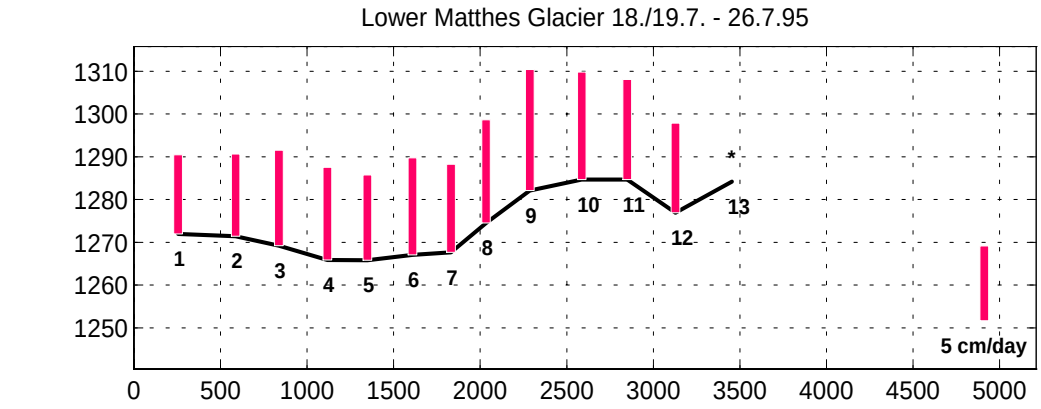

Taku Glacier SW Branch 23.7. - 29.7.95
Height [m]
1100
1080
1060
1040
1020
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
1
2
3
4
5
6
7
8
9
10
11
12
5 cm/day

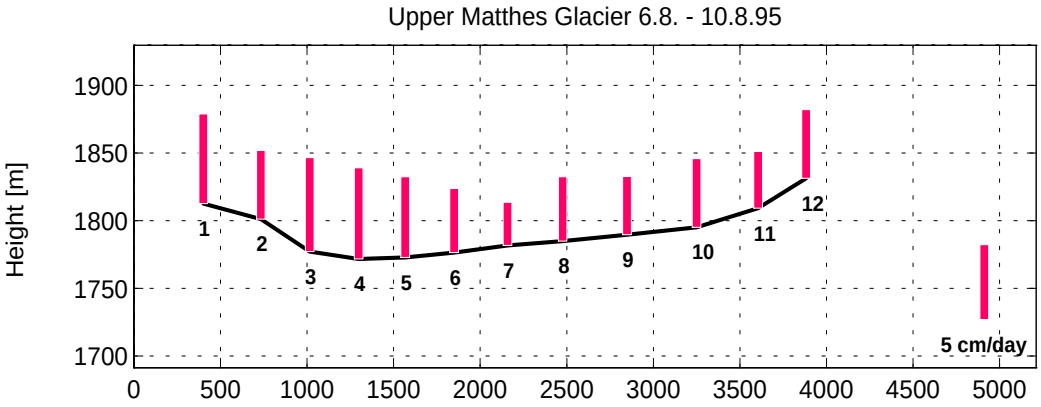

Icy Basin 24.7. - 1.8.95
1085
1080
1075
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
1
2
3
4
5
6
7
8
9
5 cm/day
Distance across glacier [m]

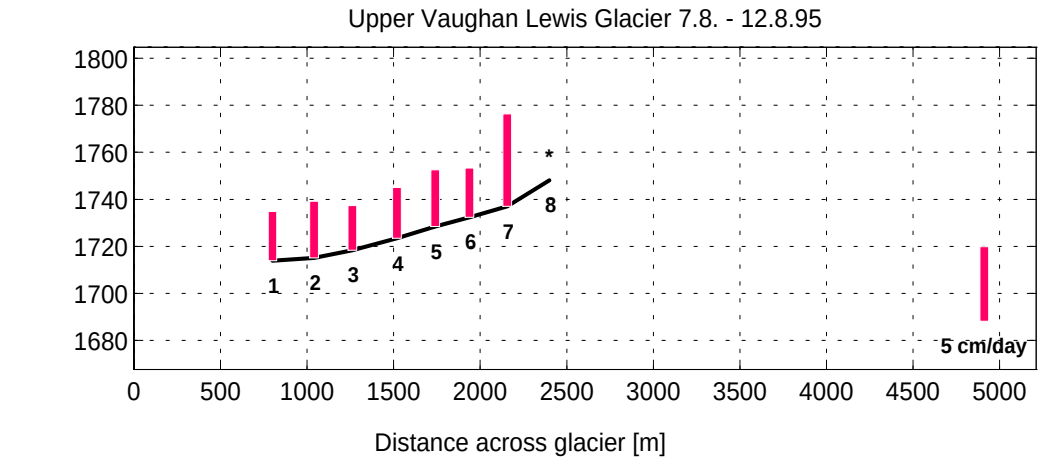

Taku IV Lower line 20./21./22.7. - 28.7.95
1160
1140
1120
1100
1080
1060
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
5 cm/day

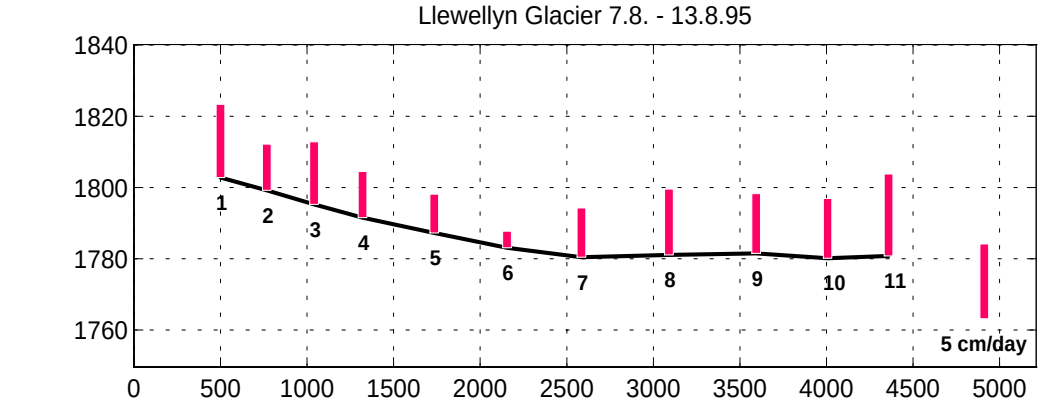

Taku IV Upper line 20./21./22.7. - 28.7.95
Height [m]
1140
1120
1100
1080
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
5 cm/day

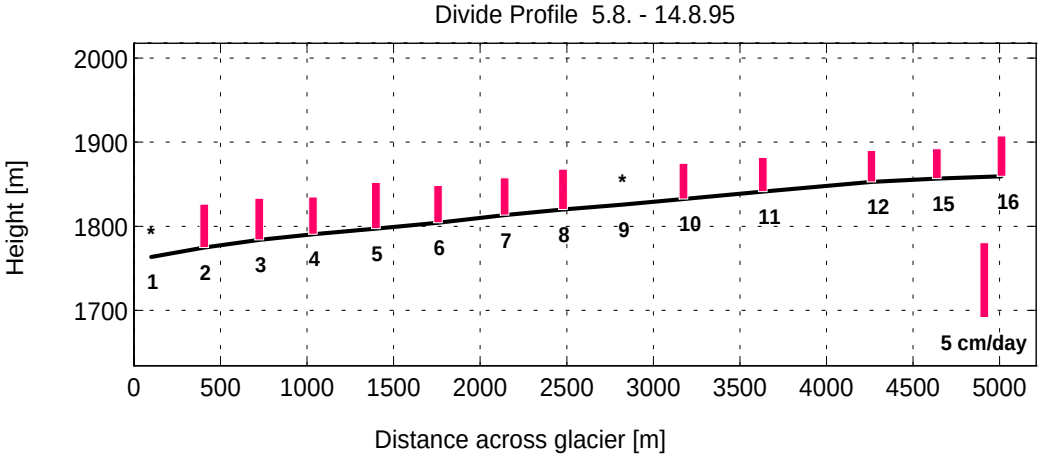

Taku Glacier NW Branch 18.7. - 28.7.95
1280
1270
1260
1250
1240
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
1
2
3
4
5
6
7
8
9
10
5 cm/day
Distance across glacier [m]


Lower Matthes Glacier 18./19.7. - 26.7.95
1310
1300
1290
1280
1270
1260
1250
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
1
2
3
4
5
6
7
8
9
10
11
12
13
*
5 cm/day


Upper Matthes Glacier 6.8. - 10.8.95
Height [m]
1900
1850
1800
1750
1700
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
1
2
3
4
5
6
7
8
9
10
11
12
5 cm/day


Upper Vaughan Lewis Glacier 7.8. - 12.8.95
1800
1780
1760
1740
1720
1700
1680
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
1
2
3
4
5
6
7
8
*
5 cm/day
Distance across glacier [m]


Llewellyn Glacier 7.8. - 13.8.95
1840
1820
1800
1780
1760
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
1
2
3
4
5
6
7
8
9
10
11
5 cm/day


Divide Profile 5.8. - 14.8.95
Height [m]
2000
1900
1800
1700
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Distance across glacier [m]
1
2
3
4
5
6
7
8
9
10
11
12
15
16
5 cm/day

Appendix C3

Movement Vectors and Ablation (Tables)

Profile III (Demorest Glacier)

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
DEM 01	0.00	0.00	0.18	0.02	303.22	24.5	3.0
DEM 02	422.44	422.44	0.92	0.11	266.84	33.0	4.1
DEM 03	355.73	778.16	1.60	0.20	266.33	37.7	4.7
DEM 04	321.85	1100.01	2.08	0.26	268.17	39.1	4.8
DEM 05	373.96	1473.97	1.99	0.24	270.74	44.5	5.5
DEM 06	515.45	1989.42	1.98	0.24	273.63	52.4	6.5
DEM 07	375.18	2364.60	1.95	0.24	274.52	49.3	6.1
DEM 08	342.67	2707.27	1.55	0.19	270.21	46.7	5.8
DEM 09	324.42	3031.69	1.19	0.15	267.09	43.6	5.4
DEM 10	272.28	3303.97	1.06	0.09	268.02	61.0	5.0

Profile V (Taku Glacier SW Branch)

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
SW TAKU 01	0.00	0.00	0.22	0.04	43.74	29.2	4.9
SW TAKU 02	199.05	199.05	0.29	0.05	49.54	33.6	5.6
SW TAKU 03	172.94	371.99	0.58	0.10	43.65	20.5	3.4
SW TAKU 04	237.82	609.81	0.48	0.08	53.87	27.5	4.6
SW TAKU 05	256.09	865.91	0.62	0.10	42.25	31.3	5.3
SW TAKU 06	270.84	1136.74	0.66	0.11	28.32	35.6	6.0
SW TAKU 07	200.27	1337.02	0.63	0.11	43.36	35.0	5.9
SW TAKU 08	171.16	1508.17	0.65	0.11	55.07	34.5	5.8
SW TAKU 09	175.26	1683.43	0.75	0.13	55.26	43.3	7.3
SW TAKU 10	148.38	1831.81	0.32	0.05	67.81	40.2	6.8
SW TAKU 11	170.31	2002.12	0.31	0.05	42.66	42.3	7.1
SW TAKU 12	168.85	2170.98	0.26	0.04	74.35	29.8	5.0

Profile IV - Lower Line (Taku Glacier)

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
TAKU IV 01	0.00	0.00	0.23	0.03	97.82	31.9	3.9
TAKU IV 03	192.85	192.85	0.27	0.03	130.68	38.9	4.8
TAKU IV 05	198.95	391.80	0.61	0.08	152.36	44.2	5.5
TAKU IV 07	251.63	643.44	1.43	0.20	145.75	35.4	4.9
TAKU IV 09	235.54	878.97	2.23	0.37	145.37	30.8	5.1
TAKU IV 11	183.64	1062.61	3.30	0.46	145.12	38.2	5.3
TAKU IV 13	324.36	1386.97	3.89	0.55	145.15	31.0	4.4
TAKU IV 15	313.28	1700.24	4.27	0.61	145.15	43.7	6.2
TAKU IV 17	391.00	2091.24	4.30	0.61	143.13	38.1	5.4
TAKU IV 19	374.80	2466.05	4.10	0.59	141.22	44.1	6.3
TAKU IV 21	374.25	2840.30	3.43	0.57	139.46	38.1	6.4
TAKU IV 23	328.08	3168.38	3.23	0.56	139.60	37.7	6.5
TAKU IV 25	386.01	3554.39	2.52	0.44	137.92	33.5	5.8
TAKU IV 27	373.14	3927.52	1.35	0.23	134.28	27.0	4.7
TAKU IV 29	354.26	4281.79	0.41	0.07	114.73	29.7	5.2
TAKU IV 31	335.82	4617.61	0.11	0.02	18.78	35.2	6.1

Profile IV - Upper Line (Taku Glacier)

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
TAKU IV 02	0.00	0.00	0.09	0.01	184.40	31.6	3.9
TAKU IV 04	210.44	210.44	0.37	0.05	146.97	39.6	4.9
TAKU IV 06	229.29	439.73	0.95	0.12	143.71	34.4	4.3
TAKU IV 08	198.28	638.01	1.69	0.21	147.55	34.6	4.3
TAKU IV 10	207.70	845.71	3.00	0.38	149.61	39.0	4.9
TAKU IV 12	257.50	1103.21	3.60	0.51	145.80	30.6	4.3
TAKU IV 14	349.82	1453.03	4.08	0.58	142.66	44.2	6.3
TAKU IV 16	346.52	1799.55	4.15	0.59	146.04	38.2	5.4
TAKU IV 18	446.86	2246.41	4.20	0.60	143.28	45.8	6.6
TAKU IV 20	340.19	2586.60	4.05	0.58	140.82	37.9	5.5
TAKU IV 22	333.35	2919.95	4.06	0.59	141.36	29.8	4.3
TAKU IV 24	351.98	3271.92	3.55	0.52	142.83	34.8	5.1
TAKU IV 26	339.60	3611.53	2.11	0.36	143.93	25.2	4.3
TAKU IV 28	449.34	4060.87	0.87	0.15	140.31	20.1	3.5
TAKU IV 30	336.64	4397.51	0.21	0.04	141.80	21.8	3.8

Profile IV (Taku Glacier NW Branch)

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
NW TAKU 01	0.00	0.00	0.82	0.08	147.48	53.4	5.4
NW TAKU 02	391.24	391.24	1.67	0.17	134.58	53.7	5.4
NW TAKU 03	461.59	852.83	2.59	0.26	133.11	60.7	6.1
NW TAKU 04	365.04	1217.88	3.03	0.31	129.56	54.7	5.5
NW TAKU 05	346.86	1564.73	3.12	0.31	127.44	55.7	5.6
NW TAKU 06	422.84	1987.58	2.89	0.29	126.60	59.6	6.0
NW TAKU 07	330.99	2318.57	2.69	0.27	124.70	60.8	6.1
NW TAKU 08	354.87	2673.44	2.55	0.26	123.43	63.3	6.4
NW TAKU 09	339.23	3012.67	2.14	0.22	121.92	53.6	5.4
NW TAKU 10	340.31	3352.98	1.19	0.12	120.62	52.5	5.3

Profile VIIa (Lower Matthes Glacier)

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
LOW MAT 01	0.00	0.00	0.11	0.02	157.97	36.4	5.3
LOW MAT 02	332.30	332.30	1.01	0.15	237.90	38.2	5.5
LOW MAT 03	249.68	581.98	1.83	0.26	241.39	44.6	6.4
LOW MAT 04	279.95	861.94	2.48	0.36	243.71	43.5	6.2
LOW MAT 05	230.87	1092.81	2.73	0.39	246.14	39.7	5.7
LOW MAT 06	261.42	1354.23	3.05	0.43	248.91	46.1	6.5
LOW MAT 07	221.82	1576.05	3.08	0.44	247.41	41.5	5.9
LOW MAT 08	202.69	1778.74	3.55	0.45	249.25	54.6	6.9
LOW MAT 09	253.02	2031.76	3.25	0.41	252.02	64.2	8.1
LOW MAT 10	299.83	2331.59	3.14	0.40	247.53	56.8	7.2
LOW MAT 11	262.99	2594.58	2.61	0.33	245.44	52.6	6.7
LOW MAT 12	278.47	2873.06	2.05	0.26	237.33	47.9	6.0
LOW MAT 13	326.54	3199.60	-	-	-	-	-

Profile VIII (Upper Matthes Glacier)

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
MATTHES 01	0.00	0.00	0.33	0.08	264.42	24.1	6.0
MATTHES 02	333.03	333.03	0.51	0.13	255.87	18.4	4.6
MATTHES 03	282.51	615.54	0.44	0.11	266.52	25.0	6.3
MATTHES 04	282.55	898.10	0.48	0.12	239.13	24.0	6.1
MATTHES 05	268.19	1166.29	0.63	0.16	231.47	21.1	5.4
MATTHES 06	283.57	1449.86	0.53	0.14	225.10	16.5	4.3
MATTHES 07	307.75	1757.61	0.47	0.12	198.50	11.8	2.9
MATTHES 08	318.56	2076.17	0.62	0.16	223.48	17.2	4.3
MATTHES 09	371.03	2447.20	0.46	0.12	219.92	15.3	3.9
MATTHES 10	402.81	2850.01	0.32	0.08	175.30	17.9	4.6
MATTHES 11	355.66	3205.68	0.17	0.05	219.22	14.8	3.8
MATTHES 12	277.07	3482.74	0.15	0.04	167.80	17.8	4.6

Matthes/Vaughan-Lewis Glacier Divide Profile

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
MATVL 01	0.00	0.00	0.53	0.09	200.36	29.2	4.9
MATVL 02	292.58	292.58	-	-	-	-	-
MATVL 03	267.89	560.48	0.32	0.05	172.35	30.0	5.0
MATVL 04	230.76	791.24	0.25	0.04	116.59	29.6	5.0
MATVL 05	361.10	1152.34	0.58	0.10	187.67	31.8	5.3
MATVL 06	251.41	1403.75	0.99	0.17	190.71	24.9	4.2
MATVL 07	205.38	1609.13	1.30	0.22	206.47	31.5	5.4
MATVL 08	263.77	1872.90	1.08	0.18	212.29	32.2	5.5
MATVL 09	277.38	2150.28	0.83	0.14	204.83	29.7	5.0

Upper Vaughan-Lewis Glacier Profile

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
VAUGHAN 01	0.00	0.00	0.58	0.12	242.84	16.7	3.3
VAUGHAN 02	240.10	240.10	0.58	0.11	266.75	19.3	3.8
VAUGHAN 03	221.24	461.34	1.43	0.28	300.71	15.3	3.0
VAUGHAN 04	257.82	719.16	1.38	0.27	312.00	17.3	3.4
VAUGHAN 05	221.00	940.16	1.85	0.36	320.00	19.6	3.8
VAUGHAN 06	197.23	1137.39	1.83	0.36	329.19	16.9	3.3
VAUGHAN 07	219.08	1356.47	1.71	0.33	335.93	31.6	6.2
VAUGHAN 08	242.56	1599.03	-	-	-	-	-

Llewellyn Glacier Profile

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
LLEW 01	0.00	0.00	0.12	0.02	368.13	30.3	4.9
LLEW 02	267.62	267.62	0.14	0.02	18.42	19.4	3.1
LLEW 03	273.04	540.67	0.22	0.03	41.62	25.6	4.2
LLEW 04	279.88	820.55	0.20	0.03	399.05	19.2	3.1
LLEW 05	413.71	1234.27	0.21	0.03	12.74	15.6	2.6
LLEW 06	420.59	1654.86	0.32	0.05	9.92	6.9	1.1
LLEW 07	429.76	2084.62	0.45	0.07	36.41	19.9	3.3
LLEW 08	505.25	2589.87	0.70	0.12	32.92	26.5	4.4
LLEW 09	504.30	3094.18	0.82	0.14	31.26	23.5	4.0
LLEW 10	412.05	3506.23	0.74	0.13	40.95	23.8	4.0
LLEW 11	351.97	3858.20	0.89	0.15	49.70	32.0	5.5

Divide Profile (Matthes/Llewellyn Glacier)

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
CREST 01 ***	0.00	0.00	-	-	-	-	-
CREST 02	303.22	303.22	1.25	0.14	216.69	25.8	2.9
CREST 03	318.10	621.32	1.36	0.15	218.81	25.2	2.8
CREST 04	309.69	931.01	1.15	0.13	216.87	22.3	2.5
CREST 05	363.23	1294.24	1.10	0.12	226.33	27.2	3.1
CREST 06	359.05	1653.29	0.89	0.10	218.34	22.1	2.5
CREST 07	384.91	2038.20	0.75	0.08	209.17	22.0	2.5
CREST 08	336.93	2375.12	0.78	0.09	214.91	23.8	2.7
CREST 09	344.97	2720.09	-	-	-	-	-
CREST 10	350.82	3070.91	0.69	0.08	202.60	20.8	2.4
CREST 11	457.36	3528.27	0.49	0.06	186.18	19.6	2.3
CREST 12	628.36	4156.63	0.35	0.04	167.20	18.2	2.1
CREST 15	377.10	4533.73	0.33	0.05	148.91	13.6	2.0
CREST 16	374.28	4908.01	0.45	0.07	82.55	18.1	2.7
CREST 13	-	-	1.06	0.13	211.18	22.9	2.9
CREST 14	-	-	0.83	0.10	213.56	19.3	2.4

*** = Movement and ablation data for CREST 01 are obviously wrong and therefore neither listed in table above nor shown in the movement vector plot.

Point CREST 13 is located east of the profile line near point CREST 04; point CREST 14 is located west of the profile line near point CREST 04.

Icy Basin Profile

Point	Distance from point to point [m]	Sum of distances [m]	Total movement [m]	Daily movement [m]	Bearing of movement [gon]	Total ablation [cm]	Daily ablation [cm]
ICY BASIN 01	0.00	0.00	-	-	-	26.1	3.3
ICY BASIN 02	178.53	178.53	-	-	-	36.0	4.5
ICY BASIN 03	165.96	344.49	-	-	-	31.7	4.0
ICY BASIN 04	170.34	514.84	-	-	-	19.2	2.4
ICY BASIN 05	170.35	685.19	-	-	-	37.1	4.6
ICY BASIN 06	157.27	842.47	-	-	-	28.2	3.5
ICY BASIN 07	166.91	1009.38	-	-	-	31.2	3.9
ICY BASIN 08	156.50	1165.88	-	-	-	38.5	4.8
ICY BASIN 09	154.93	1320.81	-	-	-	29.2	3.6

Movement data for all Icy Basin points are not significant and therefore neither listed in table above nor shown in the movement vector plot.

Appendix D

Height comparison

Profile IV (Taku Glacier) height differences 1994/1995

Lower line

Point	Position difference [m]	Delta Height [m]
TAKU IV 01	6.3	-0.288
TAKU IV 03	3.7	-0.638
TAKU IV 05	3.6	-0.712
TAKU IV 07	2.0	-0.873
TAKU IV 09	3.9	-1.068
TAKU IV 11	0.7	-1.240
TAKU IV 13	2.8	-0.924
TAKU IV 15	3.5	-1.052
TAKU IV 17	1.7	-1.523
TAKU IV 19	2.0	-1.228
TAKU IV 21	2.1	-1.277
TAKU IV 25	0.9	-1.590
TAKU IV 27	4.9	-1.095
TAKU IV 29	0.6	-0.945
TAKU IV 31	0.3	-1.023

Upper line

Point	Position difference [m]	Delta Height [m]
TAKU IV 02	2.6	-0.840
TAKU IV 04	2.7	-0.973
TAKU IV 06	2.8	-0.901
TAKU IV 08	5.7	-0.898
TAKU IV 10	2.8	-1.238
TAKU IV 12	0.8	-1.085
TAKU IV 14	2.1	-1.251
TAKU IV 16	2.1	-0.942
TAKU IV 18	1.1	-1.323
TAKU IV 20	1.1	-1.603
TAKU IV 22	2.3	-1.158
TAKU IV 24	3.3	-1.214
TAKU IV 26	0.6	-1.301
TAKU IV 28	0.3	-1.231
TAKU IV 30	0.9	-1.372

Profile V (Taku Glacier SW Branch) height differences 1994/1995

Point	Position difference [m]	Delta Height [m]
SW TAKU 01	3.0	-0.887
SW TAKU 02	2.7	-0.950
SW TAKU 03	5.8	-1.011
SW TAKU 04	2.4	-1.084
SW TAKU 05	0.7	-0.839
SW TAKU 06	1.4	-0.887

Point	Position difference [m]	Delta Height [m]
SW TAKU 07	5.9	-1.112
SW TAKU 08	2.5	-1.038
SW TAKU 09	0.6	-1.066
SW TAKU 10	3.1	-1.073
SW TAKU 11	4.0	-1.053
SW TAKU 12	0.5	-1.142

Appendix E

Volume Change

Volume Change Profile IV (Taku Glacier) 1994 - 1995

	July 25, 1994			July 25, 1995				
Triangle points	Area [m^2]	Sum height/3 [m]	Volume [m^3]	Area [m^2]	Sum height/3 [m]	Volume [m^3]	Delta Area [m^2]	Delta Volume [m^3]
1 2 3	25058,9	15,73	394176,5	24716,5	14,93	369017,3	-342,4	-25159,2
2 3 4	26051,2	17,88	465795,5	26375,6	16,83	443901,3	324,4	-21894,1
3 4 5	24145,6	16,53	399126,8	24522,6	15,49	379855,1	377,0	-19271,7
4 5 6	27235,9	16,74	455929,0	26998,7	15,63	421989,7	-237,2	-33939,3
5 6 7	29357,7	14,99	440071,9	28712,7	13,93	399967,9	-645,0	-40104,0
6 7 8	22256,1	14,96	332951,3	21406,2	13,85	296475,9	-849,9	-36475,4
7 8 9	26334,1	14,29	376314,3	24988,4	13,15	328597,5	-1345,7	-47716,8
8 9 10	21211,0	14,91	316256,0	21202,8	13,64	289206,2	-8,2	-27049,8
9 10 11	18682,5	14,71	274819,6	18725,6	13,32	249425,0	43,1	-25394,6
10 11 12	25607,0	14,81	379239,7	25354,7	13,40	339753,0	-252,3	-39486,7
11 12 13	30915,7	14,44	446422,7	30987,3	13,17	408102,7	71,6	-38320,0
12 13 14	35564,5	14,90	529911,1	35543,5	13,61	483747,0	-21,0	-46164,0
13 14 15	32956,2	13,58	447545,2	32912,5	12,28	404165,5	-43,7	-43379,7
14 15 16	37096,1	13,77	510813,3	36971,8	12,45	460298,9	-124,3	-50514,4
15 16 17	42684,0	13,30	567697,2	42534,7	11,90	506162,9	-149,3	-61534,3
16 17 18	48518,0	16,76	813161,7	48857,6	15,27	746055,6	339,6	-67106,1
17 18 19	40600,2	18,82	764095,8	40980,5	17,22	705684,2	380,3	-58411,6
18 19 20	36941,9	22,98	848924,9	37206,1	21,35	794350,2	264,2	-54574,6
19 20 21	41057,6	25,16	1033009,2	40716,6	23,57	959690,3	-341,0	-73319,0
20 21 22	36391,1	28,58	1040057,6	36400,5	27,05	984633,5	9,4	-55424,1
21 22 23	24467,1	29,23	715173,3	35918,8	27,84	999979,4	11451,7	284806,1
22 23 24	39508,6	30,78	1216074,7	39296,9	29,41	1155721,8	-211,7	-60352,9
23 24 25	56905,1	30,89	1757798,5	44010,5	29,38	1293028,5	-12894,6	-464770,0
24 25 26	41393,8	32,51	1345712,4	41190,7	30,99	1276499,8	-203,1	-69212,6
25 26 27	47374,2	32,48	1538714,0	46770,7	31,01	1450359,4	-603,5	-88354,6
26 27 28	59424,2	33,19	1972289,2	59710,6	31,86	1902379,7	286,4	-69909,5
27 28 29	47914,7	33,66	1612808,8	48824,9	32,44	1583879,8	910,2	-28929,0
28 29 30	47452,6	34,73	1648028,8	47609,7	33,44	1592068,4	157,1	-55960,4
29 30 31	49115,2	36,75	1804983,6	48996,9	35,50	1739390,0	-118,3	-65593,7
sum	1042222,8	635,06	24447905,5	1038446,6	596,91	22964389,5	-3776,2	-1483516,0

Volume Change Profile IV (Taku Glacier) 1995, July 22 - July 28

	July 22, 1995			July 28, 1995				
Triangle points	Area [m^2]	Sum height/3 [m]	Volume [m^3]	Area [m^2]	Sum height/3 [m]	Volume [m^3]	Delta Area [m^2]	Delta Volume [m^3]
1 2 3	24708,9	7,81	192976,5	24724,1	7,56	186914,2	15,2	-6062,3
2 3 4	26379,5	9,72	256408,7	26371,4	9,45	249209,7	-8,1	-7199,0
3 4 5	24517,9	8,41	206195,5	24527,2	8,10	198670,3	9,3	-7525,2
4 5 6	27006,3	8,54	230633,8	26991,1	8,25	222676,6	-15,2	-7957,2
5 6 7	28716,3	6,83	196132,3	28709,3	6,54	187758,8	-7,0	-8373,5
6 7 8	21403,2	6,75	144471,6	21409,4	6,48	138732,9	6,2	-5738,7
7 8 9	24987,1	6,05	151172,0	24989,7	5,76	143940,7	2,6	-7231,3
8 9 10	21201,5	6,54	138657,8	21204,1	6,25	132525,6	2,6	-6132,2
9 10 11	18730,0	6,23	116687,9	18721,4	5,92	110830,7	-8,6	-5857,2
10 11 12	25364,5	6,31	160050,0	25345,1	6,02	152577,5	-19,4	-7472,5
11 12 13	30999,6	6,07	188167,6	30975,0	5,79	179345,3	-24,6	-8822,3
12 13 14	35555,0	6,52	231818,6	35531,6	6,22	221006,6	-23,4	-10812,0
13 14 15	32916,0	5,21	171492,4	32908,7	4,87	160265,4	-7,3	-11227,0
14 15 16	36951,0	5,38	198796,4	36992,6	5,03	186072,8	41,6	-12723,6
15 16 17	42531,9	4,83	205429,1	42538,0	4,48	190570,2	6,1	-14858,8
16 17 18	48856,4	8,20	400622,5	48859,1	7,85	383543,9	2,7	-17078,5
17 18 19	40987,1	10,17	416838,8	40973,8	9,80	401543,2	-13,3	-15295,6
18 19 20	37215,1	14,30	532175,9	37197,0	13,93	518154,2	-18,1	-14021,7
19 20 21	40722,2	16,51	672323,5	40711,2	16,15	657485,9	-11,0	-14837,6
20 21 22	36407,1	19,97	727049,8	36393,9	19,64	714776,2	-13,2	-12273,6
21 22 23	35929,9	20,77	746264,0	35908,2	20,42	733245,4	-21,7	-13018,6
22 23 24	39287,2	22,33	877283,2	39306,7	22,01	865140,5	19,5	-12142,7
23 24 25	44015,3	22,31	981981,3	44005,7	21,96	966365,2	-9,6	-15616,2
24 25 26	41172,3	23,90	984018,0	41208,8	23,59	972115,6	36,5	-11902,4
25 26 27	46753,3	23,92	1118338,9	46787,8	23,62	1105127,8	34,5	-13211,1
26 27 28	59709,6	24,75	1477812,6	59711,2	24,50	1462924,4	1,6	-14888,2
27 28 29	48818,5	25,34	1237060,8	48831,0	25,07	1224193,2	12,5	-12867,6
28 29 30	47616,9	26,32	1253276,8	47601,9	26,07	1240981,5	-15,0	-12295,3
29 30 31	48992,5	28,41	1391876,9	49001,4	28,10	1376939,3	8,9	-14937,6
sum	1038454,1	391,40	15606016,3	1038438,4	382,43	15283636,6	-15,7	-322379,6

Appendix F

Strain Rates

Profile IV (Taku Glacier) strainrates

Triangle points	E1 [µstrain/day]	E2 [µstrain/day]	E3 [µstrain/day]	Θ [gon]
1, 2, 3	66.6	36.1	-102.7	10.16
2, 3, 4	40.4	-91.4	50.9	193.96
3, 4, 5	138.4	-76.0	-62.4	97.69
4, 5, 6	130.7	-224.3	93.5	0.82
5, 6, 7	246.5	40.0	-286.6	111.17
6, 7, 8	253.0	-204.2	-48.7	199.17
7, 8, 9	355.7	-336.8	-18.8	113.47
8, 9, 10	352.7	-331.1	-21.5	1.58
9, 10, 11	158.9	-235.0	76.1	105.90
10, 11, 12	159.2	-286.0	126.8	191.99
11, 12, 13	63.7	-196.0	132.3	95.15
12, 13, 14	81.1	-190.7	109.6	192.20
13, 14, 15	127.7	-164.6	36.8	104.28
14, 15, 16	128.0	58.9	-187.0	193.89
15, 16, 17	84.0	-60.1	-23.9	168.39
16, 17, 18	75.5	-66.1	-9.4	140.45
17, 18, 19	34.7	-88.9	54.2	197.86
18, 19, 20	12.0	-92.5	80.5	113.54
19, 20, 21	11.9	-57.0	45.0	192.96
20, 21, 22	15.8	-76.7	60.9	67.16
21, 22, 23	30.8	-128.1	97.3	31.95
22, 23, 24	189.0	-106.1	-82.9	97.62
23, 24, 25	209.3	-245.2	35.8	10.80
24, 25, 26	387.0	-238.3	-148.6	102.16
25, 26, 27	413.3	-289.3	-124.0	5.55
26, 27, 28	296.2	-291.1	-5.6	98.67
27, 28, 29	304.6	-261.1	-43.4	10.27
28, 29, 30	198.9	-250.9	51.9	89.71
29, 30, 31	165.1	-135.1	-30.0	15.82