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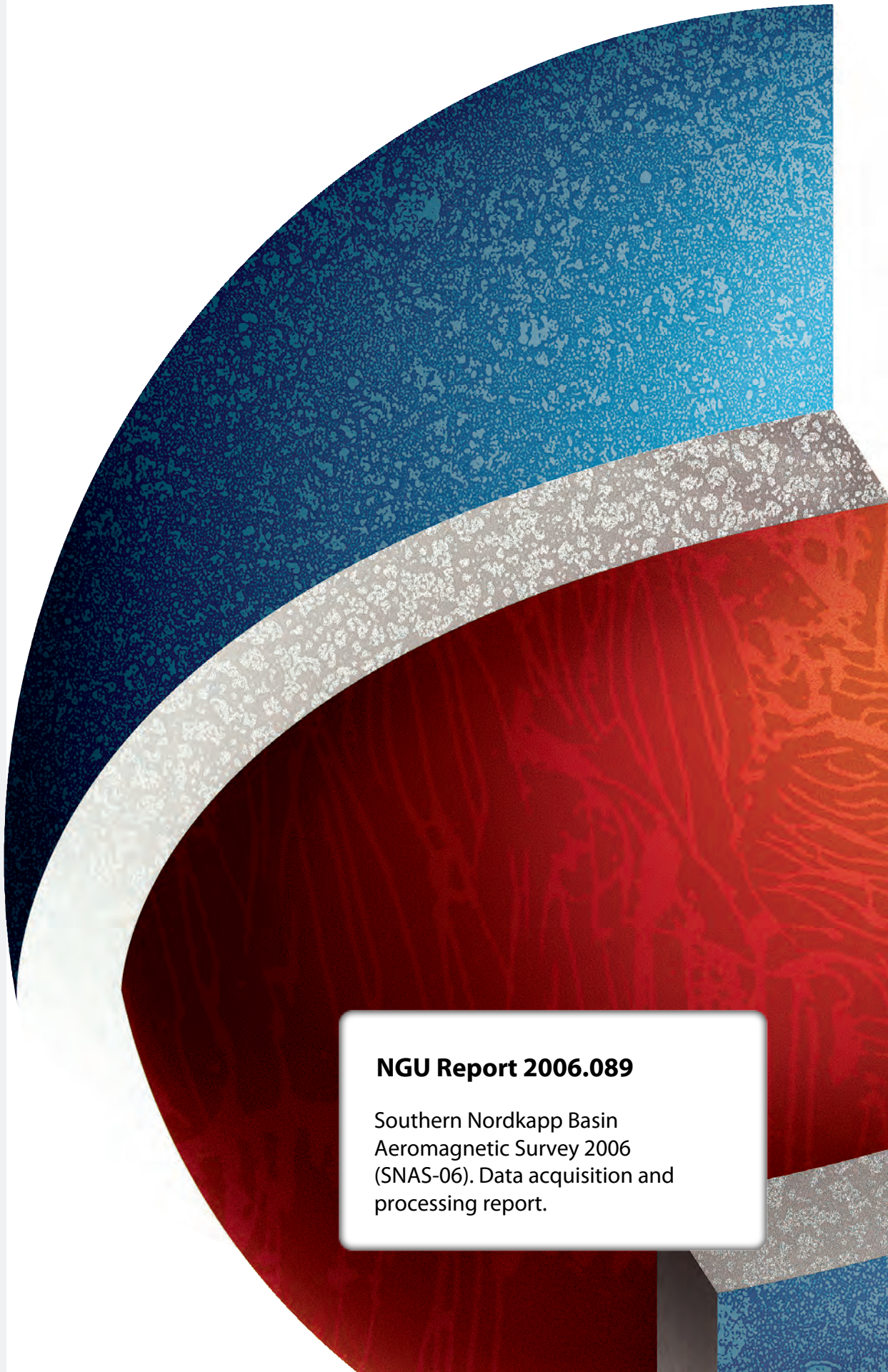

NGU Report 2006.089

Southern Nordkapp Basin Aeromagnetic Survey 2006 (SNAS-06). Data acquisition and processing report.

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REPORT

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Title:
Southern Nordkapp Basin Aeromagnetic Survey 2006 (SNAS-06). Data acquisition and processing report.

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Client:
Statoil

County:

Commune:

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Map-sheet no. and -name (M=1:50.000)

Deposit name and grid-reference:

Number of pages: 49 Price (NOK):
Map enclosures: 3

Fieldwork carried out:	Date of report:	Project no.:	Person responsible:
11.09.06 –13.10.06	14.12.2006	3156.00	

Summary:

The high-sensitivity Southern Nordkapp Basin Aeromagnetic Survey (SNAS-06) was carried out in an area of app. 4000 km^2 in the Barents Sea, offshore Finnmark, northern Norway. Data processing comprised spike removal and data editing, IGRF correction, statistical levelling, floating differential median micro-levelling and directional cosine filtering (decorrugation). Three maps were produced for the survey area. One map shows the magnetic total field anomalies after correction for the IGRF of 2006. Another map shows residual magnetic values after application of a 20 km high-pass filter. A map showing magnetic analytic signal is also presented. The residual map after high-pass filtering delineates anomalies with amplitudes as low as 0.1-0.2 nT, representing shallow and weak magnetic sources in the sedimentary basin. Salt diapirs coincide clearly with negative magnetic anomalies. Small positive magnetic anomalies within the salt-related negative anomalies may reflect slivers of sedimentary rocks (e.g. claystones) within the diapirs.

Keywords: Geofysikk	Berggrunnsgeologi	Magnetometri
Kontinentalsokkel		
		Fagrapport

CONTENTS

Enclosures

Maps

2006.089-01: SNAS-06 Total magnetic field (scale 1:200 000) Referred to IGRF-2006. Statistical, median and micro levelled. 200 m upward continuation.
2006.089-02: SNAS-06 Magnetic residual field (scale 1:200 000), 20 km high-pass Gaussian filtered.
2006.089-03: SNAS-06 Magnetic analytic signal (total gradient amplitude) (scale 1:200 000) 200 m upward continuation. 20 km high-pass Gaussian filtered.

Archive CD of the SNAS-06 survey

Piper Chieftain from Fly Taxi Nord with docking cradle for aeromagnetic sensor.

1. INTRODUCTION

The report describes the acquisition, processing and map production of magnetic data from the Southern Nordkapp Basin offshore Finnmark, Norway. The purpose of the survey was to acquire a high-sensitivity magnetic dataset for an integrated magnetic, gravity and seismic modelling of salt diapers within the basin.

SURVEY AREA

The survey area is located in the Barents Sea northeast of Nordkapp , Finnmark county and is shown in Fig. 1.
The following coordinates define the survey area.

Survey Boundary Coordinates
(UTM zone 35N, datum WGS84)

	X	Y	LONG	LAT
1	**534600.00**	**8060900.00**	**28.02.20.86**	**72.38.33.01**
2	**567200.00**	**8028300.00**	**28.59.06.98**	**72.20.34.75**
3	**505900.00**	**7966800.00**	**27.10.09.33**	**71.48.05.40**
4	**473300.00**	**7999700.00**	**26.13.18.78**	**72.05.41.95**

The following summary details the essence of the survey program:

- Base of operation: Hammerfest
- Survey area SNAS-06
- Traverse line spacing and trend 500 m at 315 / 135°
- Tie line spacing and trend 2000 m at 225 / 45°
- Flying height (sensor altitude) 230 metres
- Speed 225 km/h
- Total line kilometres (planned) 10,100 line kilometres
- Total line kilometres (acquired) 8,965 line kilometres
- Data recorded Total field magnetic intensity, radar altitude and position data

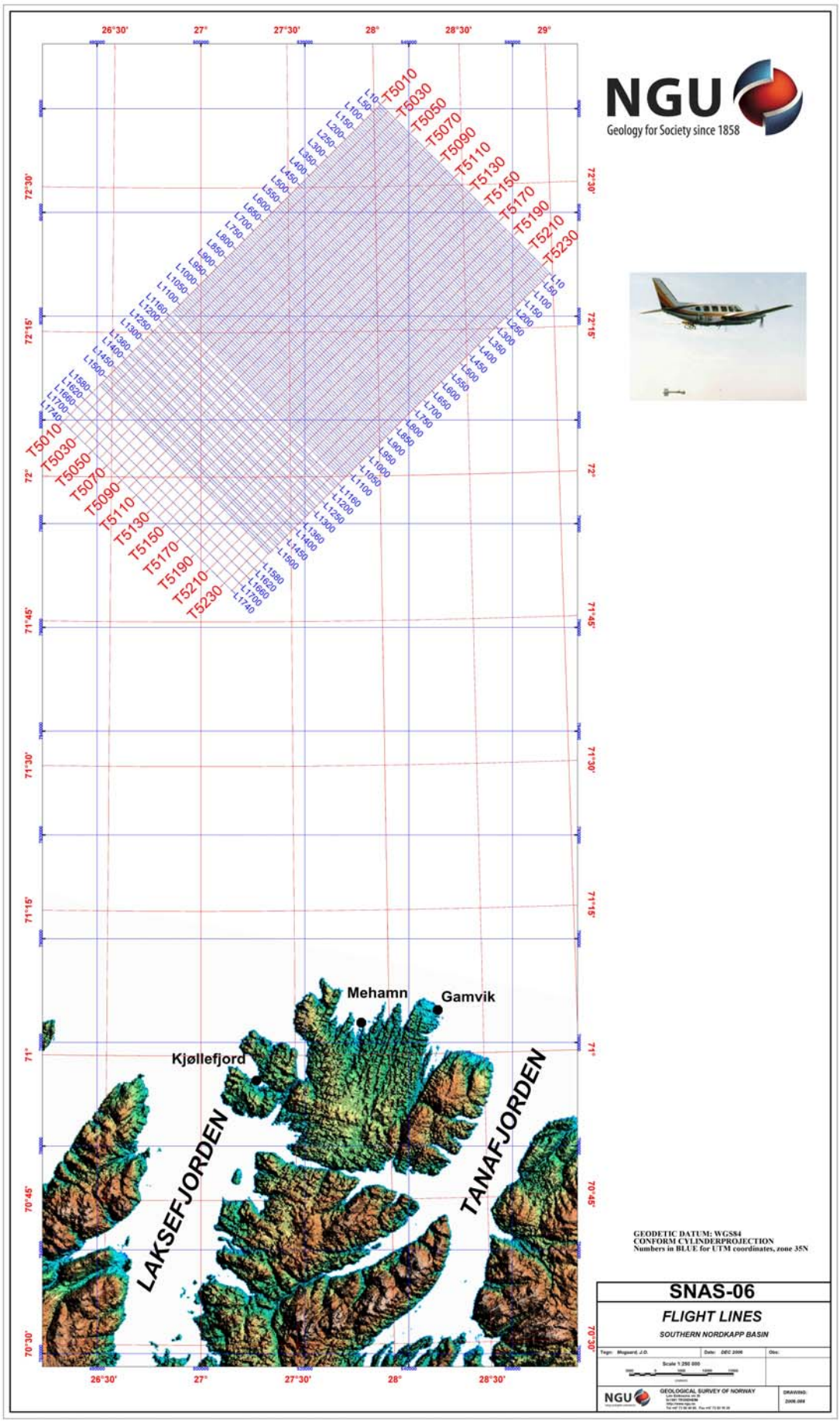

Figure 1. Flight pattern of the Southern Nordkapp Basin Aeromagnetic Survey (SNAS-06).

2. DATA ACQUISITION

Data acquisition was carried out during the period 11.09.2006 to 13.10.2006 and consists of ten flights. The acquisition period was extended for approximately two weeks, mostly due to poor weather conditions and some shorter periods with magnetic disturbances. Fig. 2 shows, however, that the magnetic conditions for aeromagnetic surveying were relatively good during September and October 2006. The survey was terminated with one flight remaining on the 13th of October after several days with very poor weather. The long term forecast was not promising, and since the most interesting part of the area was fully covered, it was decided to terminate the survey. A total of 8965 line km of the planned 10100 km was produced. The survey area constitutes c. 4000 km^2 and consists of 151 traverse lines and 24 tie-lines. The whole area was covered with both tie-lines and traverse lines. To the far south-west in the survey area a total of 23 traverse lines (500 m and 1000 m) is missing. The aircraft altitude was 300 m (1000 feet). The magnetic sensor was towed app. 70 m below and behind the aircraft, giving a sensor altitude of app. 230 m. The flying speed was 225 km/h and magnetic data were sampled at a rate of 5 Hz, giving a spatial sampling interval of 12-14 m along the lines.

Geomagnetic activity index for Tromsø

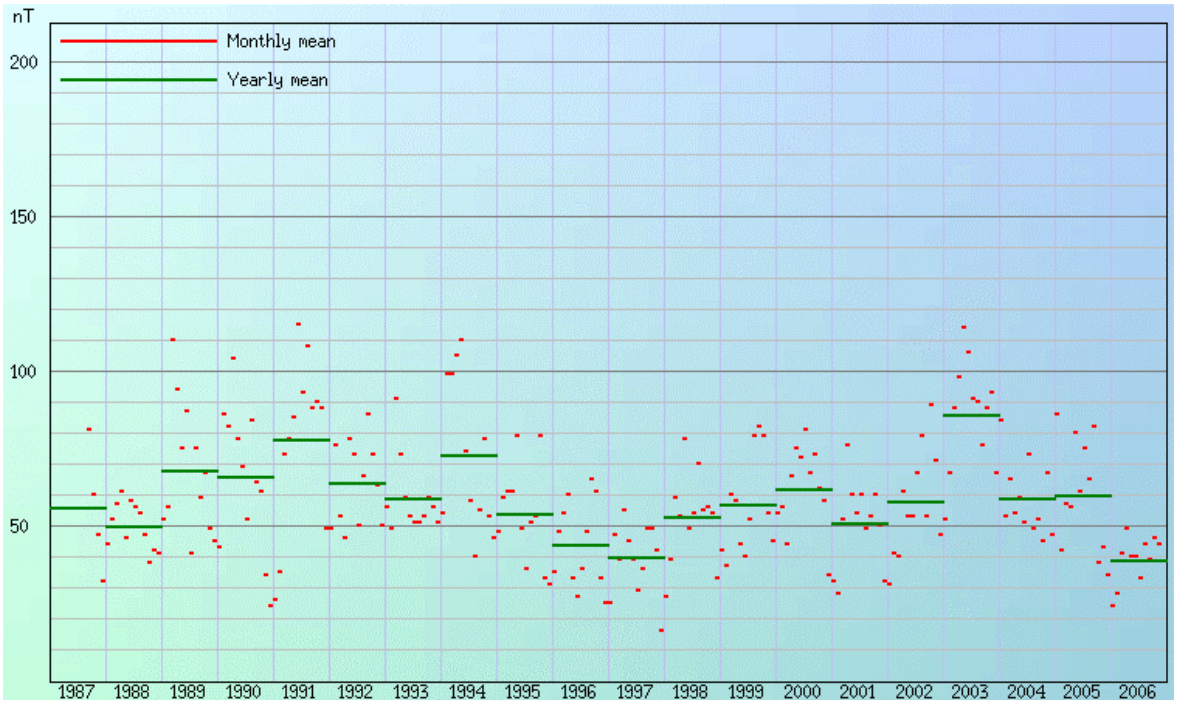

Figure 2. Diagram from the Tromsø Geophysical Observatory (http://www.tgo.uit.no/aix) showing relatively good magnetic conditions for aeromagnetic surveying during the period September-October 2006.

A magnetic heading test (clover-leaf test) for the BAS-06 survey was carried out at the end of flight 9 on the 7th of October 2006 over a small island at an altitude above 1000 meters. The

variations in the four different directions were very small and consequently no corrections were applied to the magnetic dataset.

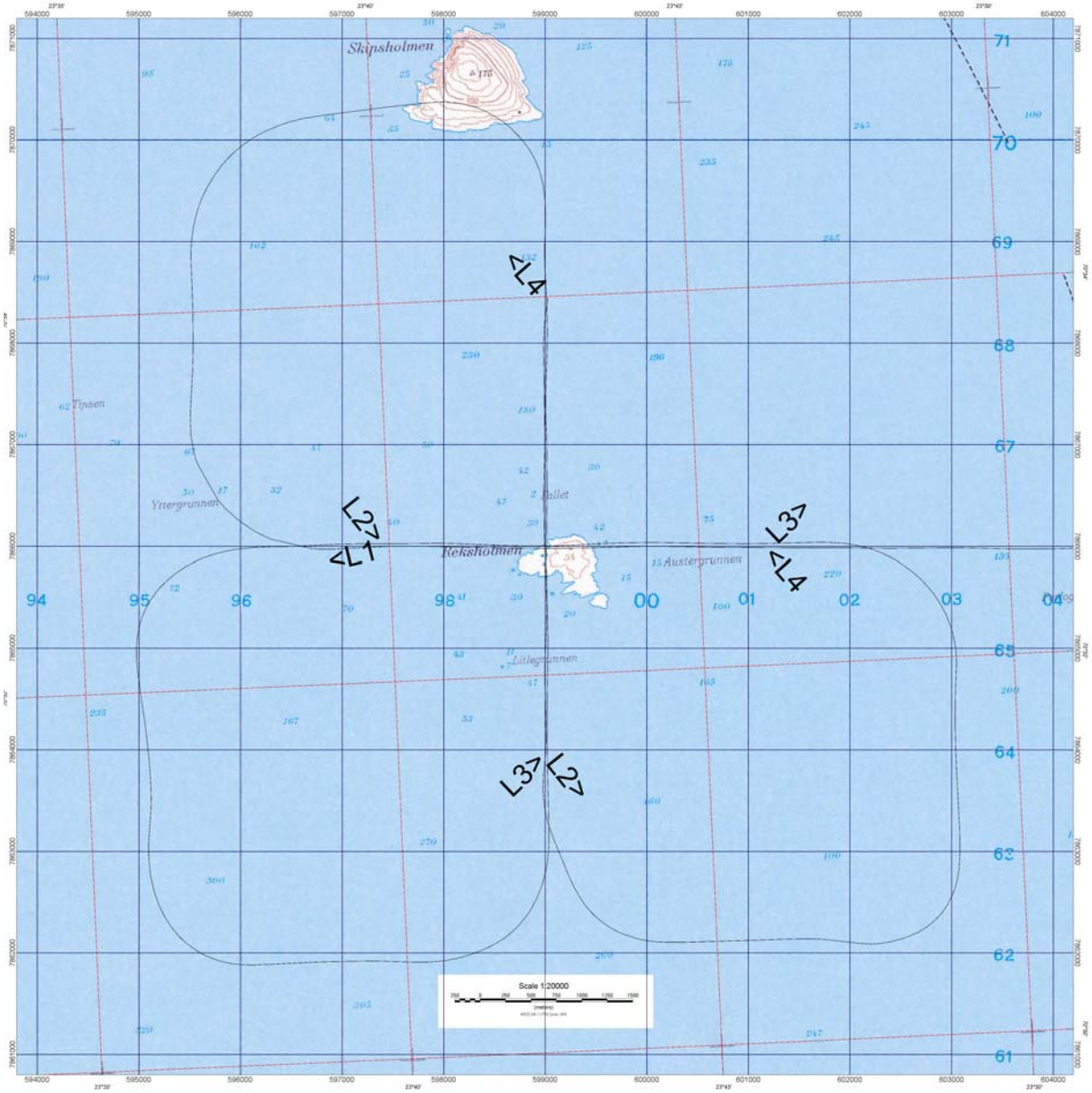

Figure 3. Flight path of clover-leaf test flown on the 7th of October 2006 for the BAS-06 survey. The lines are therefore oriented NS and EW.

The intensities of the total magnetic field (TMI) for the crossing point are shown below:

Line	***TMI***	***Direction***
1	*53462.1*	*EW*
2	*53461.9*	*NS*
3	*53462.5*	*WE*
4	*53461.3*	*SN*

The data from the base magnetometer (EnviMag) located at Hammerfest Airport were transferred to a laptop and plotted out flight by flight. The start and termination of each profile (traverse and tie) are indicated by red, vertical lines (with annotated profile numbers) on the diurnal plots. The curve is coloured red for profiles and blue elsewhere. These plots ease the quality control of the acquired profiles. The diurnals for all flights are shown in Appendix 1. No lines were reflown. The data were classified into two quality groups according to magnetic diurnals:

Class	Criteria	Profile length
1	< 10 nT/10 min. linear	7.237 km
2	10 – 30 nT/10 min. linear	1.728 km
Total		8.965 km

2.1 Personell

From NGU participated

- Senior engineer: John Olav Mogaard (leader field operations)
- Senior engineer: Janusz Koziel
- Engineer Rolf Lynum

From Fly Taxi Nord participated

- Captain: Ronny Thorbjørnsen
- Captain: Ole Thorbjørnsen

- Copilot: Karen Anne Hassel
- Copilot: Gard Pettersen

2.2 Equipment

The following equipment was used for the survey:

Aircraft: Piper Chieftain PA31 (Registration: LN-ABZ) with long range fuel tanks from FlyTaxi Nord in Tromsø.

Magnetometer: A Scintrex Cesium Vapour MEP 410 high sensitivity magnetometer with a CS-2 sensor was applied in the data acquisition. The noise envelope of the onboard magnetometer was 0.1 nT. Most of the data fell within the limits of ±0.04 nT.

Base Magnetometer: A Scintrex MP-3 and an EnviMAG proton magnetometer was used for recording diurnals at the base station which was located at Hammerfest airport. Data from the base magnetometer were used in the planning of flights and to decide on which lines eventually to refly.

Data logging: A DAS8 datalogger, GR33 chart recorder and a HDR150 tape station from RMS Instruments were used to record the different data from the survey.

Navigation: An Ashtech G12, 12 channel GPS receiver combined with a Trimble Navbeacon DGPS correctional receiver (SATREF) with flight guidance system from Seatex ASA was used for real time differential navigation. The navigation accuracy was better than ±5 m throughout the survey.

Altimeter: A KING KRA 405 radar altimeter that is an integrated instrument of the aircraft was both recorded and shown on the pilot's display. Accuracy of 0.25% with a resolution of 1 foot.

3. DATA PROCESSING

Processing was carried out using the OASIS Montaj program system (Geosoft 2004, Geosoft 2005a). Micro levelling was performed using OASIS Montaj of Geosoft (2005b), and the Cirkmedian software developed at NGU (Mauring & Kihle 2006). The various processing steps are outlined below.

3.1 Importing and editing

The data were imported into an Oasis Montaj database and interpolated to a regular grid of 200x200 m cells (Fig. 4 & 5). Spikes were removed by non-linear (Naudy) filtering and subsequently smoothed with a light low-pass filter (9 fiducials=110 m).

3.2 Use of base magnetometer readings

Data from the base magnetometer cannot be used directly to correct the magnetic readings from the survey area. The most important reason for this is the time shift in the Earth's magnetic field variations between the survey area and the base station. There is normally a spatial difference in amplitude and frequency of these diurnals. Data from the base magnetometer were mainly used to assess the quality of individual lines and to make decisions on which lines eventually to re-fly.

3.3 IGRF correction

The International Geomagnetic Reference Field for 2006 (IGRF-2006) was calculated using the Oasis Montaj (Geosoft 2005a). IGRF values were subtracted from the observed magnetic total field values before applying corrections and levelling.

3.4 Systematic (lag and heading) corrections

The data were then lag-corrected (Fig. 6), utilizing the Oasis Montaj (Geosoft 2005a) using 5 fiducials (=60 m). The heading correction was not applied because of small variations in values as a function of survey direction.

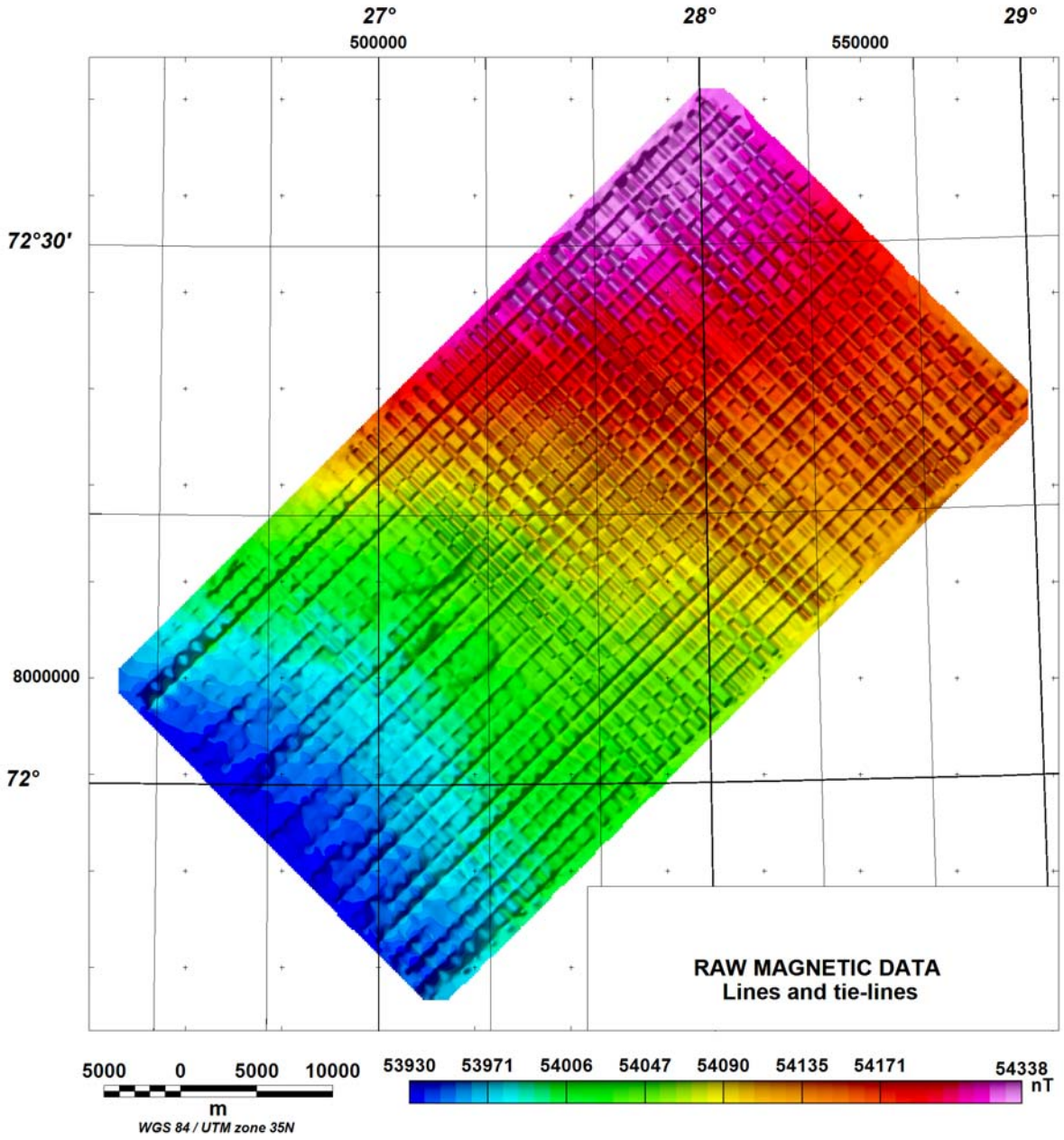

Figure 4. Raw magnetic data. Traverse lines and tie-lines.

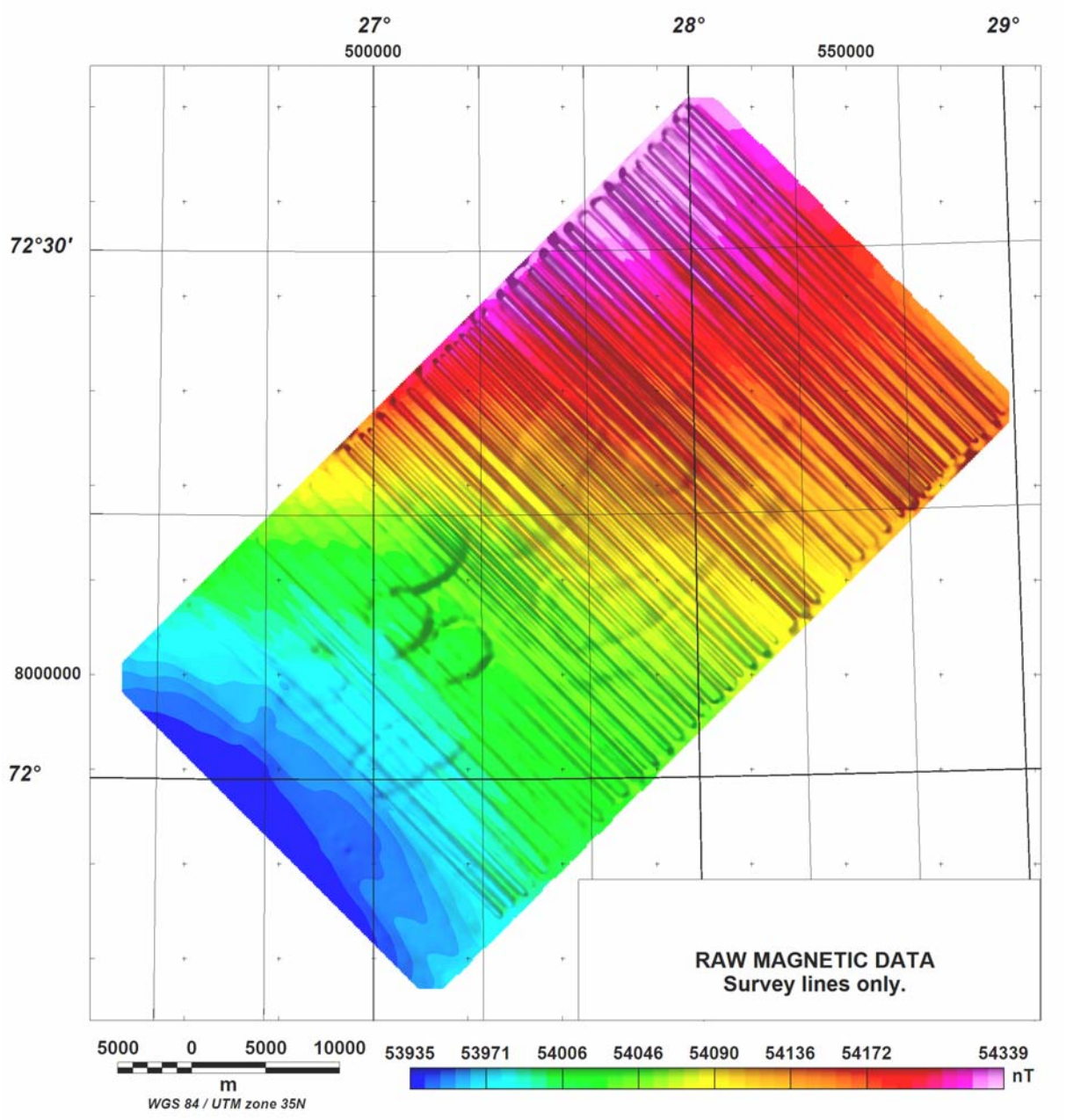

Figure 5. Raw magnetic data. Traverse lines only.

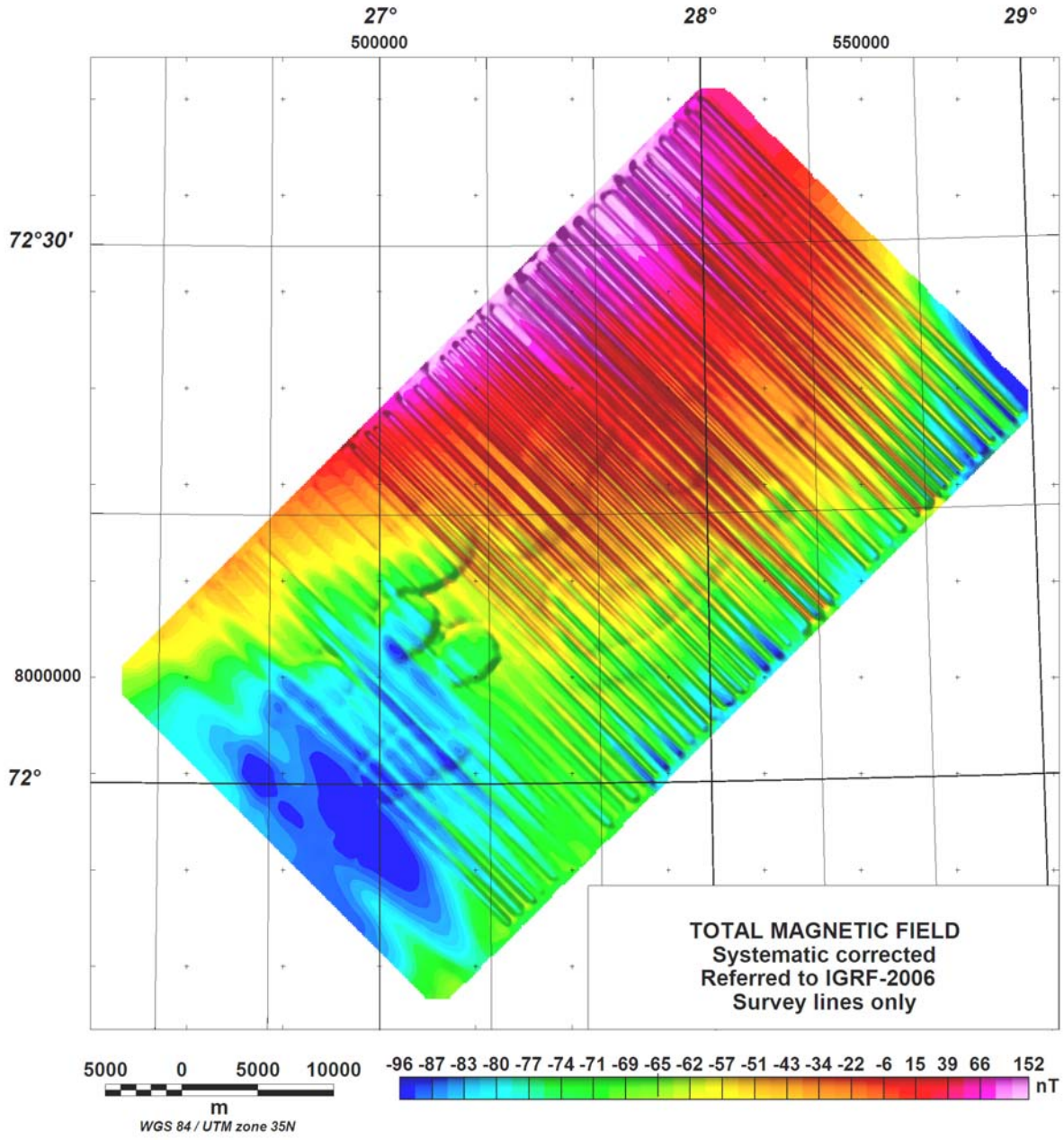

Figure 6. Total magnetic field. Systematic corrected. Referred to IGRF-2006. Traverse lines only.

3.5 Levelling

Levelling was undertaken at NGU using the standard (Geosoft 2005a) statistical levelling method of the tie-lines followed by a statistical levelling of the profiles utilising the levelled tie-lines. We used a first-order (linear) trend removal in the levelling of the tie-lines. 'Suspicious' mis-tie values (outliers) were removed manually before levelling of the tie-lines. The linearly trended tie lines were then used in a full levelling of the survey lines.

No smoothing has been applied to data during the levelling due to the risk of removing the magnetic signal. Instead of smoothing we re-run the full levelling of the lines to further improve the levelling correction. Extreme mis-tie values (outliers) were again removed manually before calculating the next full levelling correction. This process was iterated twice until convergence was achieved (Fig. 7).

We also tried to apply different spline algorithms during the conventional levelling to remove the residual noise, but there were no observable improvements in the resulting grids.

3.6 Micro levelling

To remove levelling errors still remaining along parts of some profiles after levelling, we performed micro levelling techniques. For these techniques to be used successfully, the regional field must first be removed from the magnetic data. This can be obtained by using the residual from high-pass filtering of the magnetic total field. To get the best results, some tuning of filter parameters for both of these techniques was required. The optimal filter parameters for SNAS-06 data were chosen after testing.

We applied two micro levelling techniques:

1. Moving median filtering method (Mauring et al. 2002; Mauring & Kihle 2006).
2. Geosoft micro levelling (Geosoft 2005b).

1. *The moving median levelling method* is described in Mauring & Kihle (2006). A floating median filter is applied to each line. For a given line, the 1-D median is determined at each station based on data values within a given distance of the station. We can in the same way find a 2-D median value for a circular area around the station. The difference between the 2-D and 1-D median value is taken to be the micro-levelling error and is added to the magnetic value at that station after smoothing.

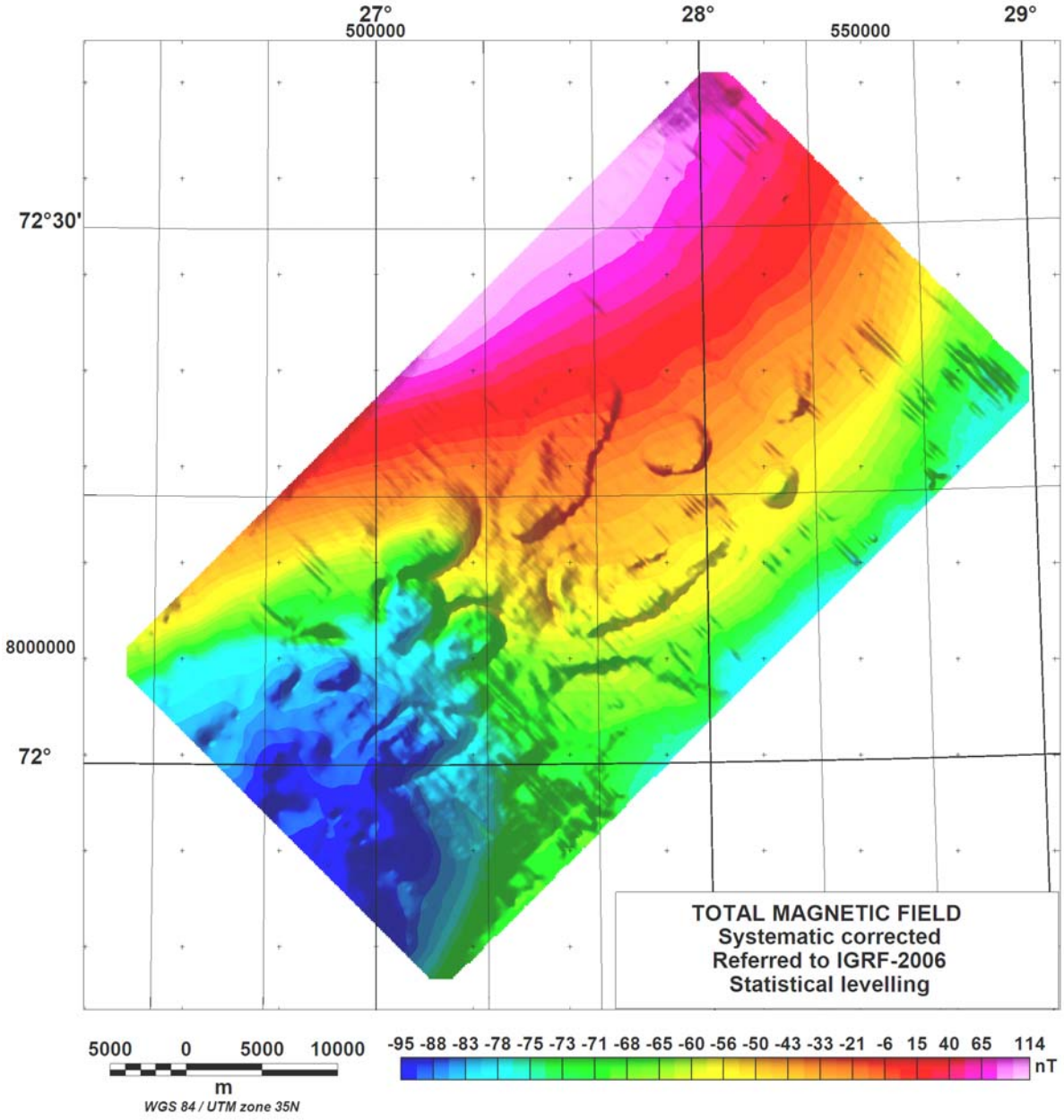

Figure 7. Total magnetic field. Systematic (lag) corrected. Referred to IGRF-2006. Statistical levelling.

The regional field for the SNAS-06 data have been removed by using the residual after 2 km high-pass Butterworth of the magnetic total field. The 1-D and 2-D filter radii were 500 m and 2500 m, respectively.

The median levelling removed partly the levelling errors of the conventionally levelled data (Fig 8). However, small levelling errors still remained, mostly in the eastern part of the survey area.

2. *The Geosoft micro levelling technique (decorrugation).* Using a FFT high-pass filter combined with a directional cosine filter produced a grid that contains the levelling error. The error values were subsequently subtracted from the preprocessed data. We applied a Gaussian high-pass filter with a wavelength cutoff of 6 km and a directional cosine filter with a cosine function degree of 0,9 for the SNAS-06 data.

Applying the micro levelling technique (Geosoft 2005b) after the median levelling technique (Mauring & Kihle 2006) removed a significant part of the remaining errors (Fig. 9). But at the same time, this technique was causing some smoothing of the aeromagnetic signal.

For this reason we produced the following two grids, which can be used for different purposes:

1. For modelling: minimum smoothing of data (Fig. 8).
Processing flow: Systematic correction, statistical and median levelling.

2. For mapping: most of the levelling errors have been removed, but some of the anomalies have been smoothed (Fig. 9).
Processing flow: Systematic correction, statistical, median and micro leveling

4. MAP PRODUCTION

The OASIS Montaj program system (Geosoft 2004) was applied for the map production. The grids are presented with a shaded relief technique (illumination from the northeast). Presentation of the maps with the shaded relief technique enhances lineaments that trend oblique to the illumination direction. Colour scale and colour distribution for the data sets have been computed using a histogram equalisation technique. The grids have a cell size of 200x200 m^2.

The magnetic total field has been upward continued to 200 m (Fig. 10), combined with a 20 km high-pass Gaussian filtering (Fig. 11) before calculation of the analytic signal (total gradient amplitude) (Fig. 12).

The survey data are archived in the enclosed CD in ascii and Geosoft format. The contents of the CD are described in Appendix 2.

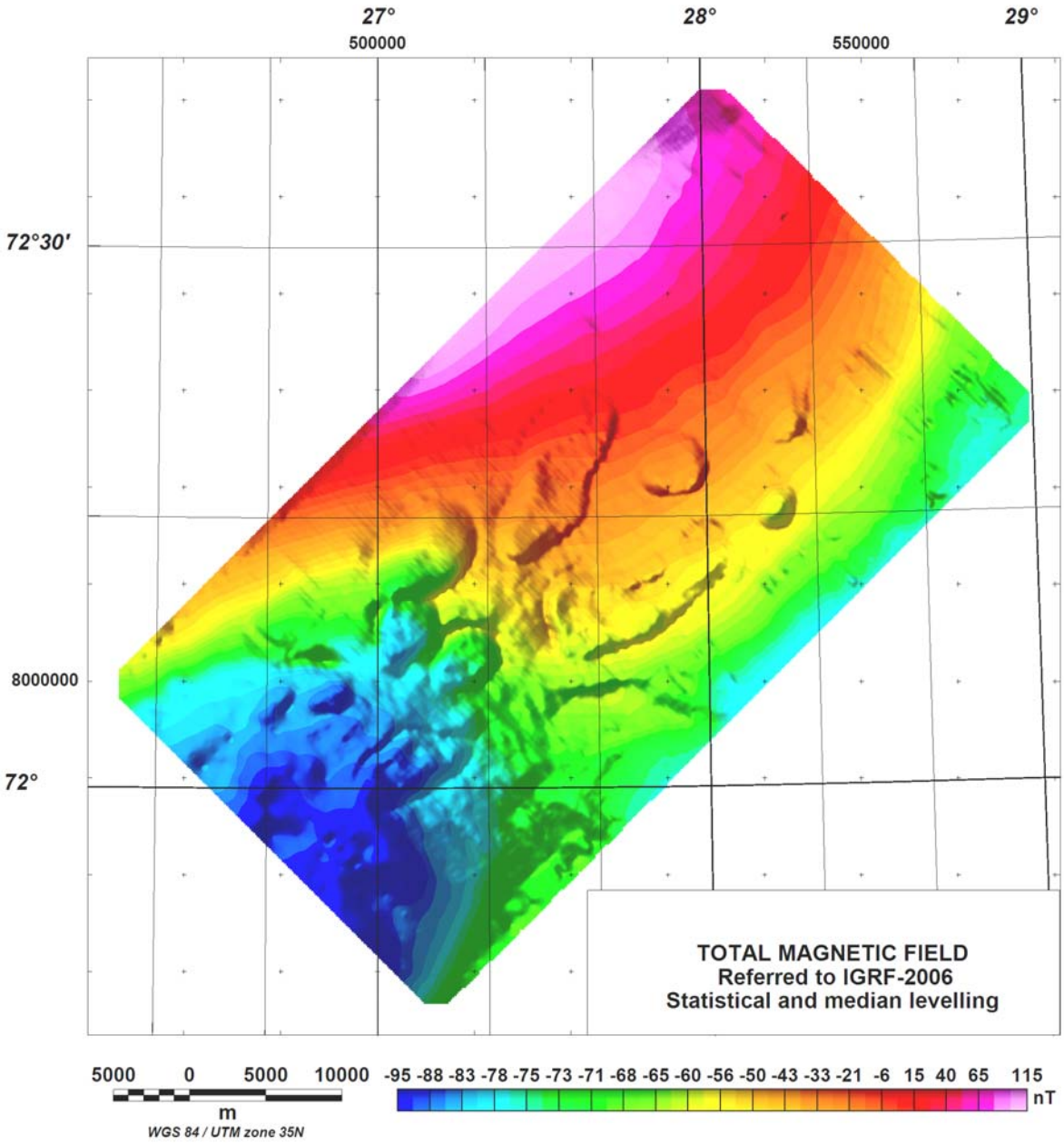

Figure 8. Total magnetic field. Referred to IGRF-2006. Statistical and median levelling.

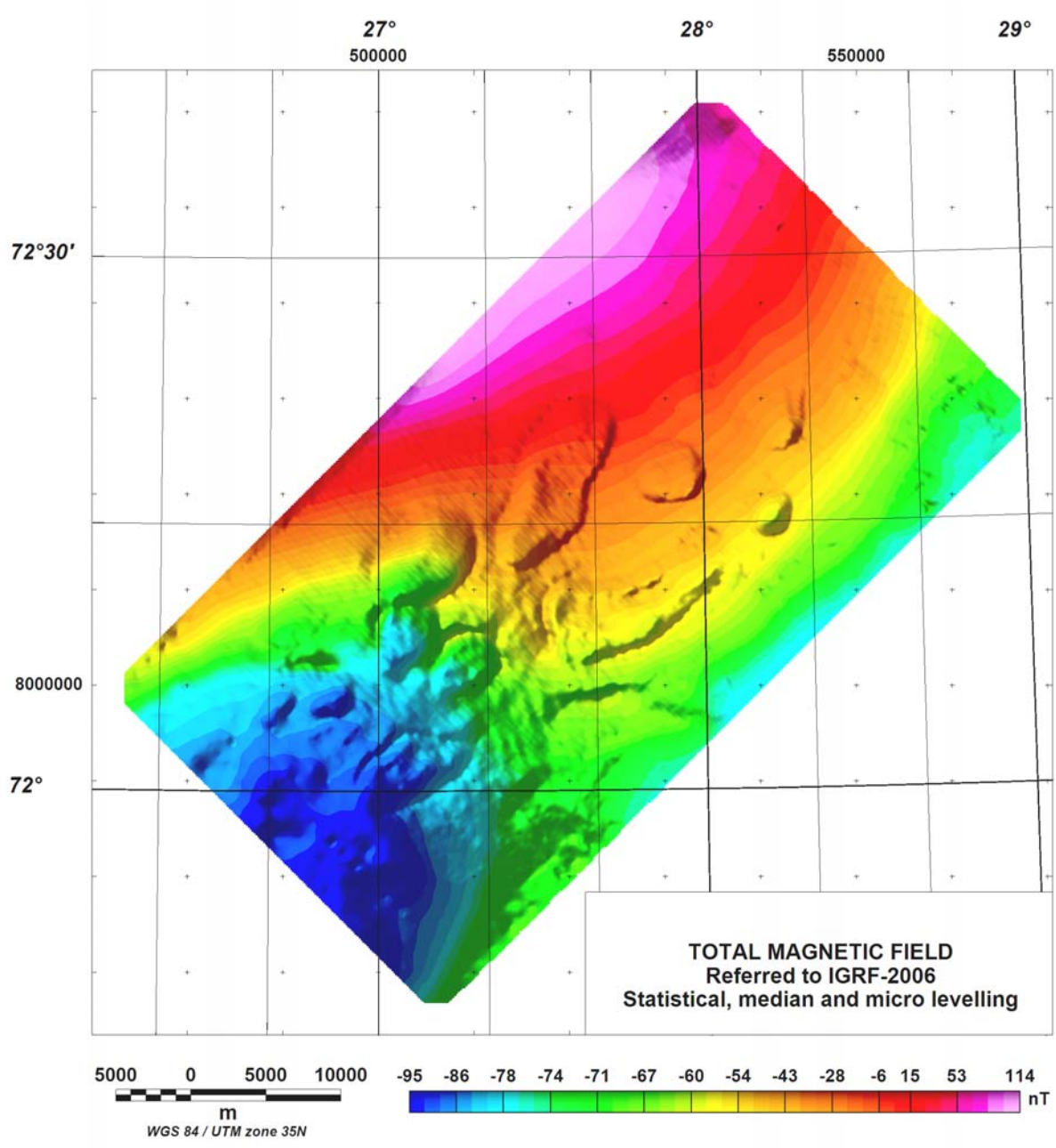

Figure 9. Total magnetic field. Referred to IGRF-2006. Statistical, median and micro levelling.

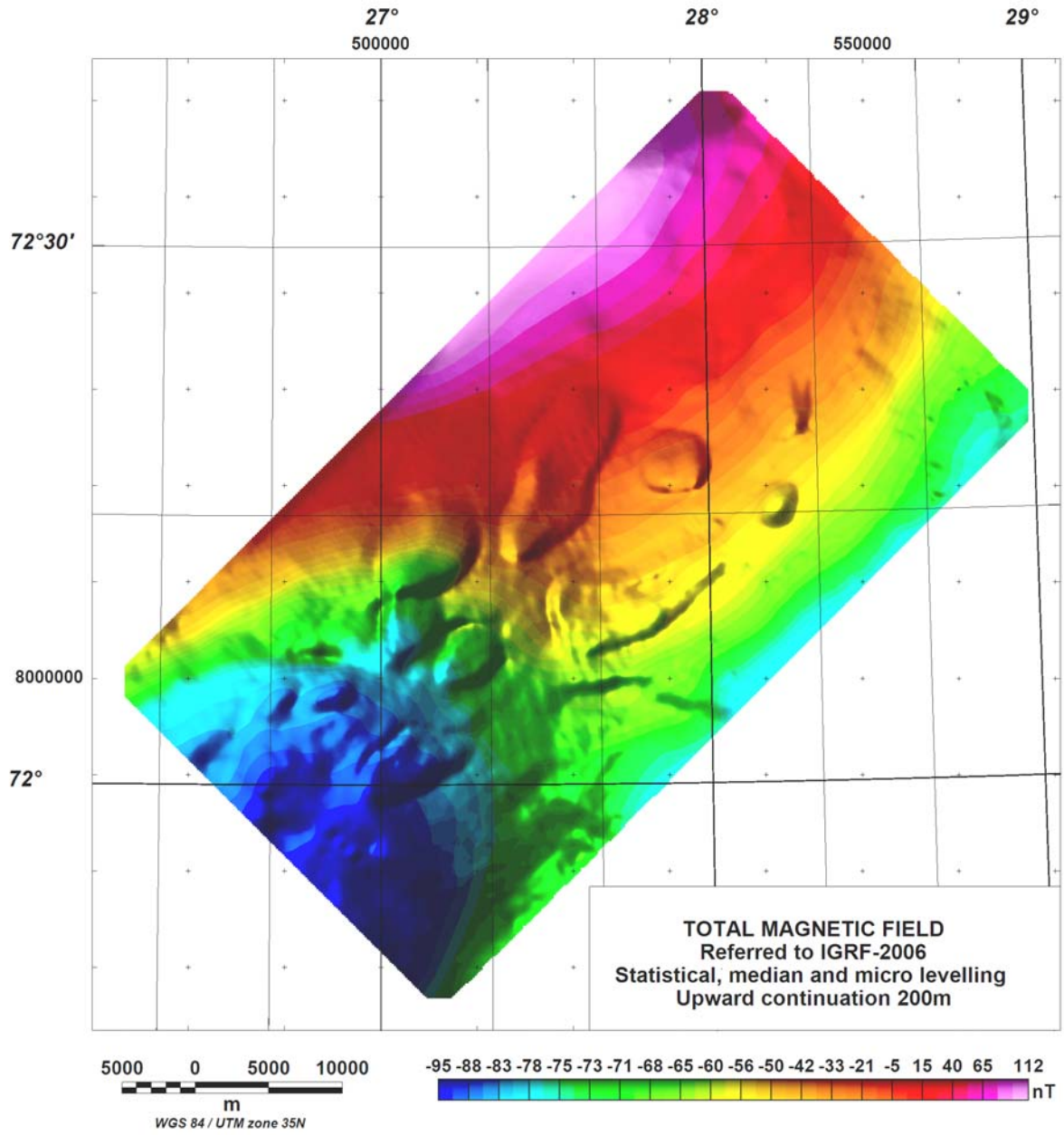

Figure 10. Total magnetic field. Referred to IGRF-2006. Statistical, median and micro levelling. Upward continuation of 200 m.

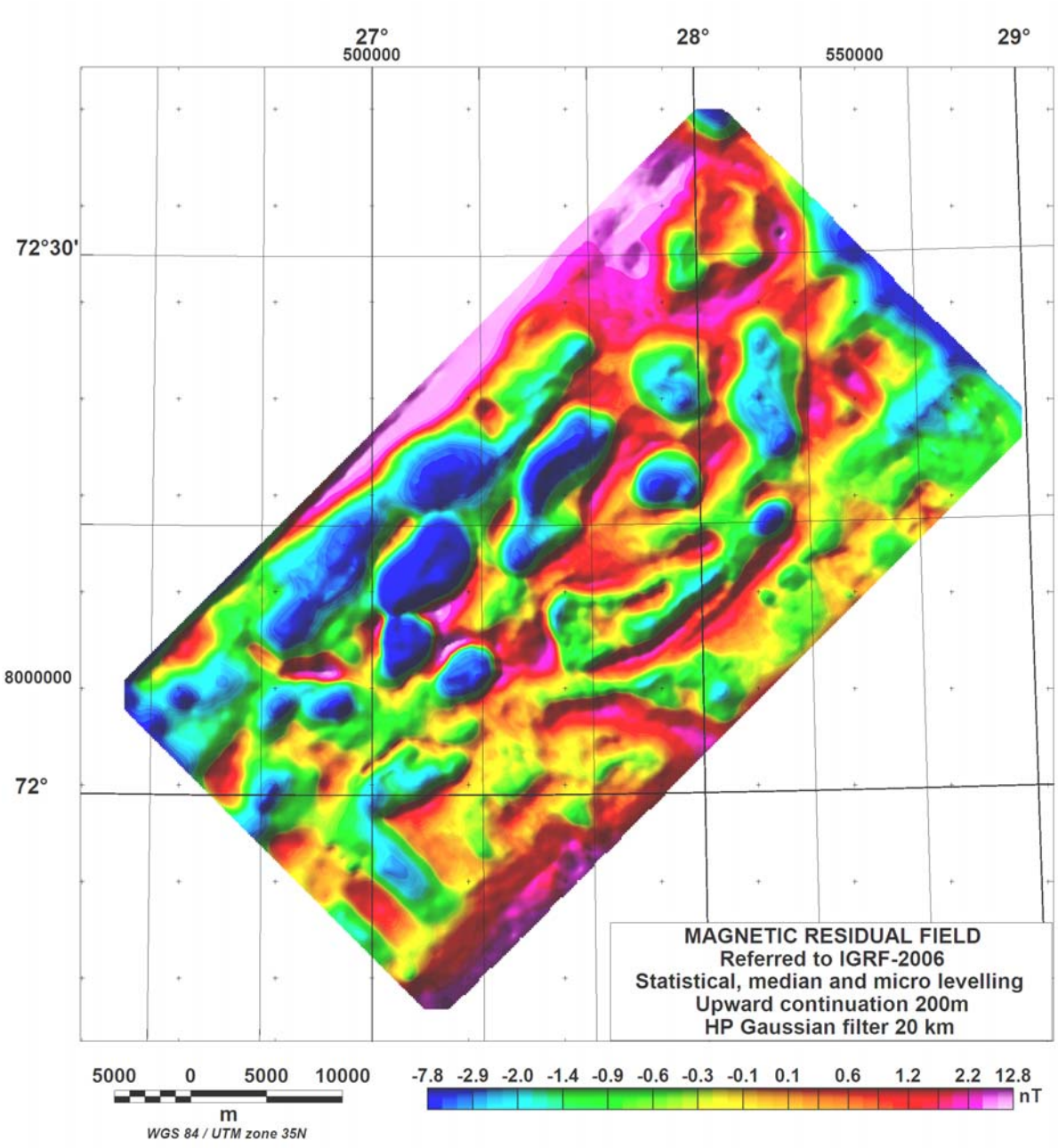

Figure 11. Magnetic residual field. Referred to IGRF-2006. Statistical, median and micro levelling. Upward continuation of 200 m and 20 km high-pass Gaussian filtering.

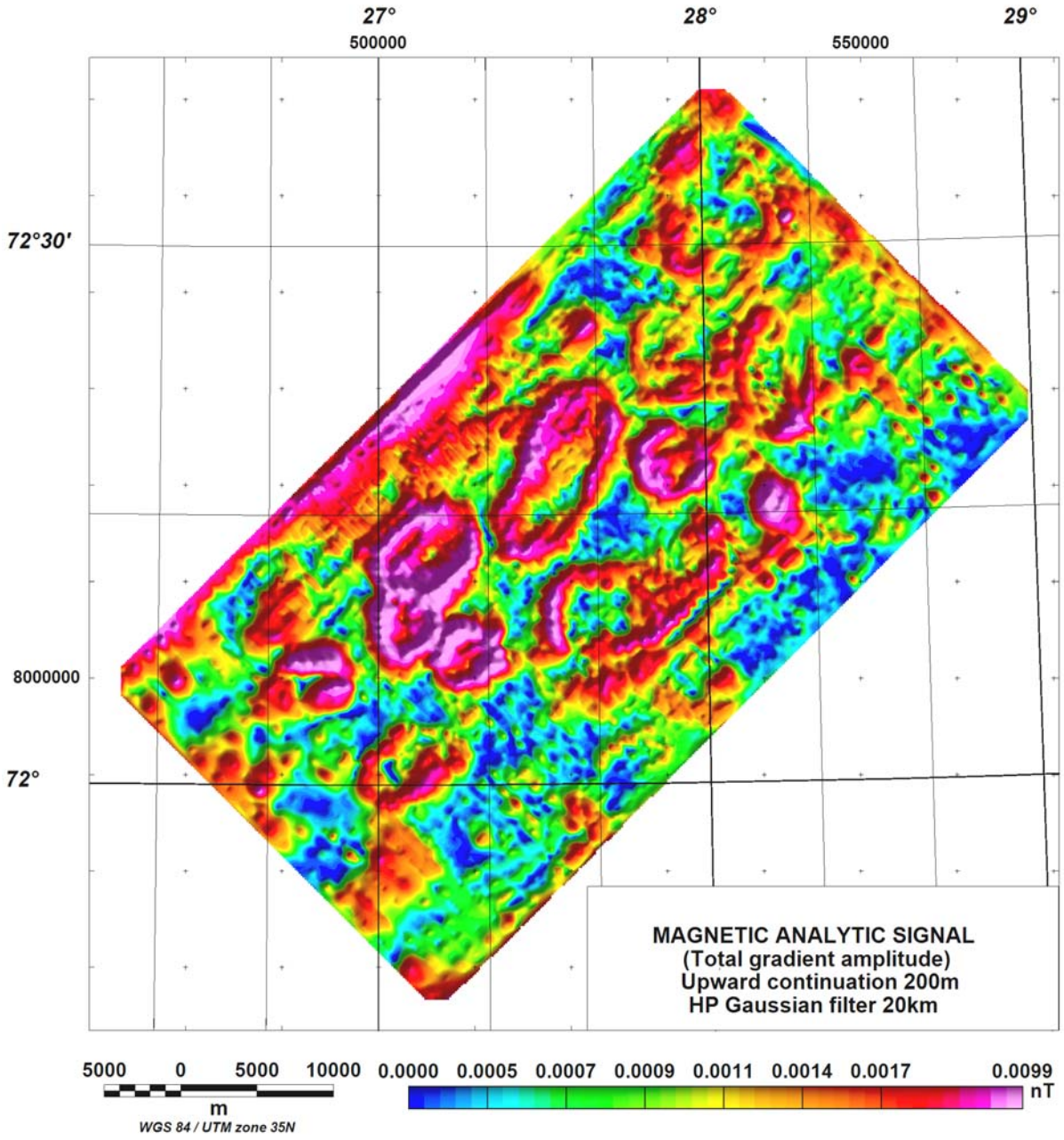

Figure 12. Magnetic analytic signal (total gradient amplitude). 200 m upward continuation and 20 km high-pass Gaussian filtering.

We produced the following maps of the SNAS-06 survey at a scale 1:200 000:

2006.089-01: Total magnetic field. Referred to IGRF-2006. Statistical, median and micro levelling. Upward continuation 200 m

2006.089-02: Magnetic residual field. Referred to IGRF-2006. Statistical, median and micro levelling. Upward continuation 200 m. High-pass Gaussian filter 20 km.

2006.089-03: Magnetic analytic signal (total gradient amplitude). Upward continuation 200 m. High-pass Gaussian filter 20 km.

Maps 1 & 2 have been contoured with intervals of 2.5/10 nT and 0.5/ 5.0 nT, respectively.

5. RECOMMENDATIONS FOR FURTHER WORK

Because of the small amplitudes of the magnetic anomalies (1-2 nT), processing of the survey data was a challenging task with the risk of removing significant parts of the geophysical signal during the levelling.

To achieve improvements in delineating magnetic anomalies from the salt domes in the Nordkapp Basin we propose to carry out additional aeromagnetic tie-lines within the SNAS-06 survey. New aeromagnetic acquisition implies to decrease tie-line spacing from 2000 m to 1000 m by adding a new tie-line between each of the existing tie-lines. There is a need for an increased number of tie-lines because of the low amplitudes of the magnetic anomalies (1-2 nT). We will in addition recommend to complete the survey by flying the remaining 23 traverse lines in the southwestern part of the survey area.

6. CONCLUSIONS

A high sensitivity aeromagnetic survey SNAS-06 was carried out in an area of c. 4 010 km^2 over the Southern Nordkapp Basin in the Barents Sea. Data processing comprised spike removal and data editing, systematic (IGRF and Lag) corrections; statistical, median and (Geosoft) decorrugation micro levelling. Three maps were produced for the survey area. One of these shows magnetic total field anomalies after correction for the IGRF-2006, levelling (statistical, median and Geosoft micro levelling) and upward continuation. Map 2 shows residual magnetic values after application of upward continuation and high-pass filters. A map showing magnetic analytic signal is also presented (Map 3). The residual map after high-pass filtering delineates anomalies with amplitudes as low as 0.1-0.2 nT, representing shallow and weak magnetic sources in the sedimentary basin. Salt diapirs coincide clearly with negative

magnetic anomalies. Small positive magnetic anomalies within the salt-related negative anomalies may reflect slivers of sedimentary rocks (e.g. claystones) within the diapirs.

An archive CD of the survey is enclosed in the present report.

7. REFERENCES

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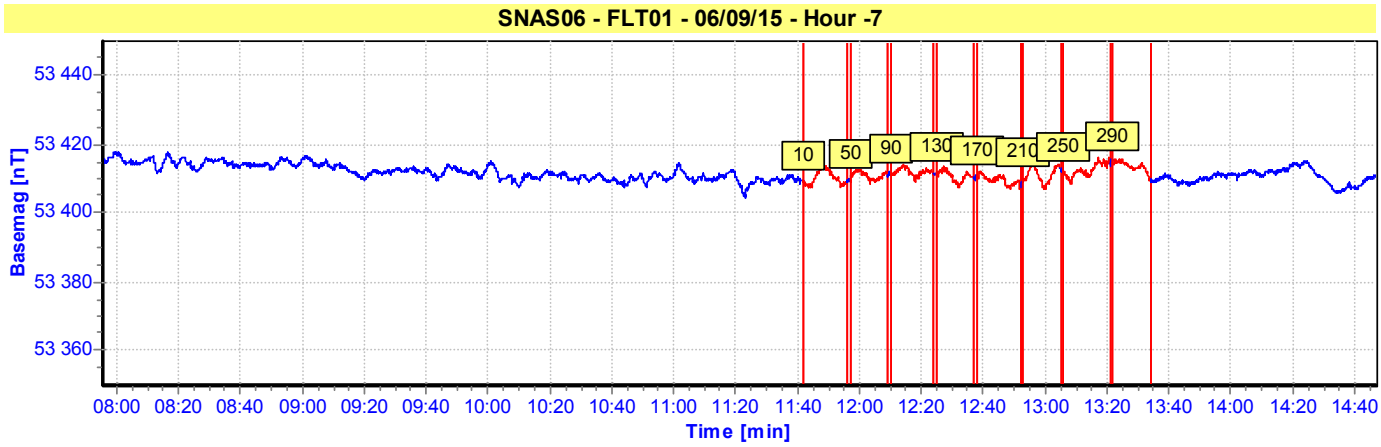
Figures:

APPENDIX 1

Recordings from the base magnetometer at Hammerfest airport

Printout of base magnetic recordings for all flights (1 – 10) acquired during the Southern Nordkapp Basin Aeromagnetic Survey 2006 (SNAS-06). The start and termination times for each profile (both traverse line and tie line) are indicated by red, vertical lines (with annotated profile numbers). Traverse lines: 10-1740 and tie lines: 5010-5240. The curve is coloured red for lines and tie-lines and blue elsewhere.


SNAS06 - FLT01 - 06/09/15 - Hour -7
Basemag [nT]
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53 420
53 400
53 380
53 360
10
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90
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210
250
290
08:00 08:20 08:40 09:00 09:20 09:40 10:00 10:20 10:40 11:00 11:20 11:40 12:00 12:20 12:40 13:00 13:20 13:40 14:00 14:20 14:40
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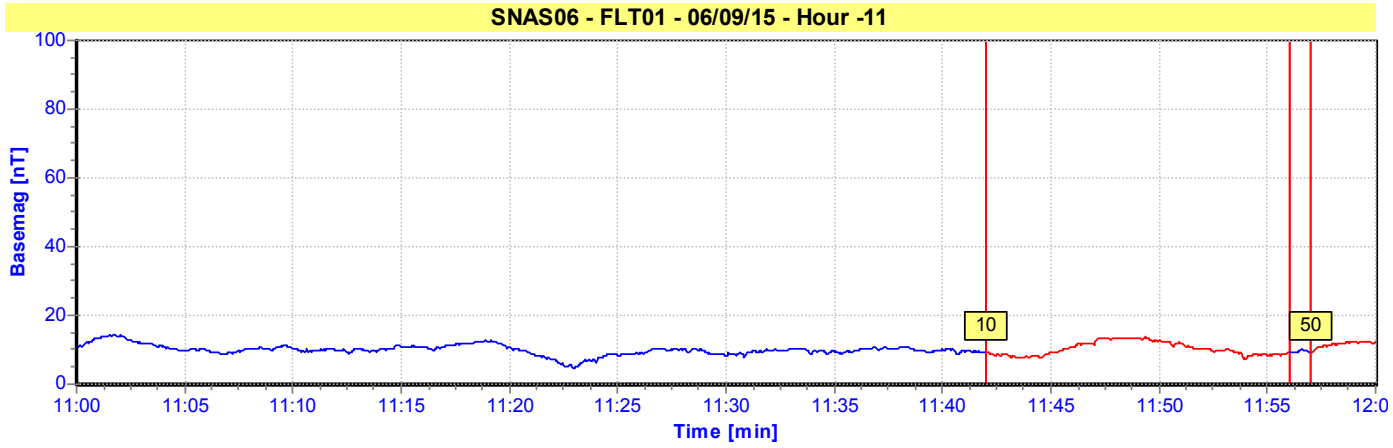
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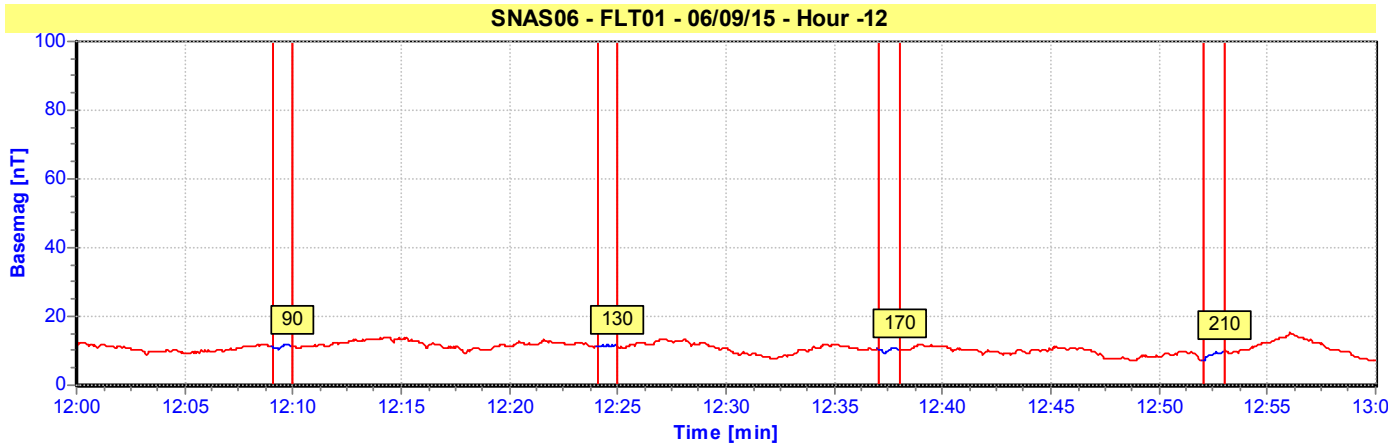
Time [min]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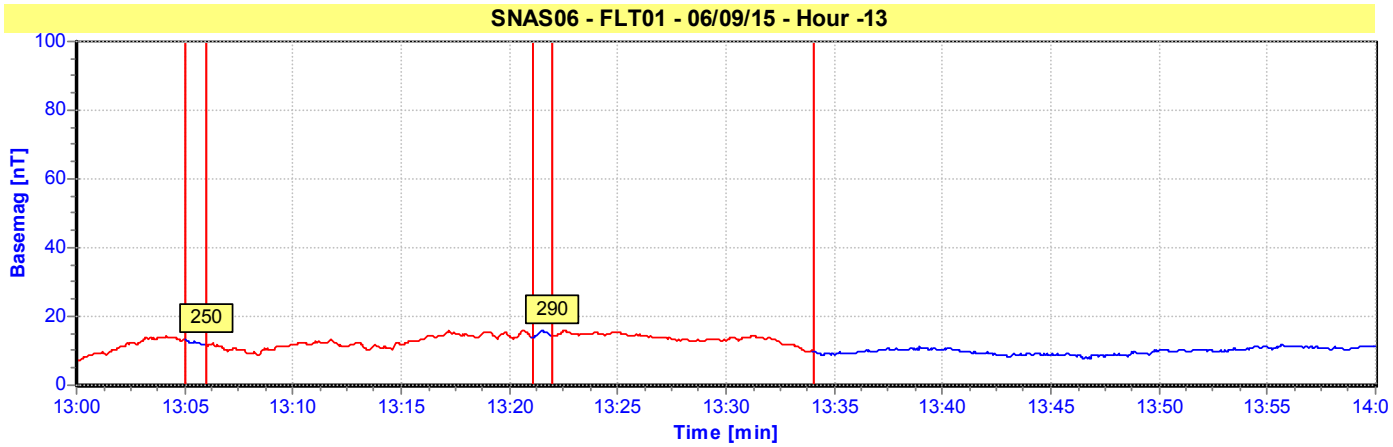
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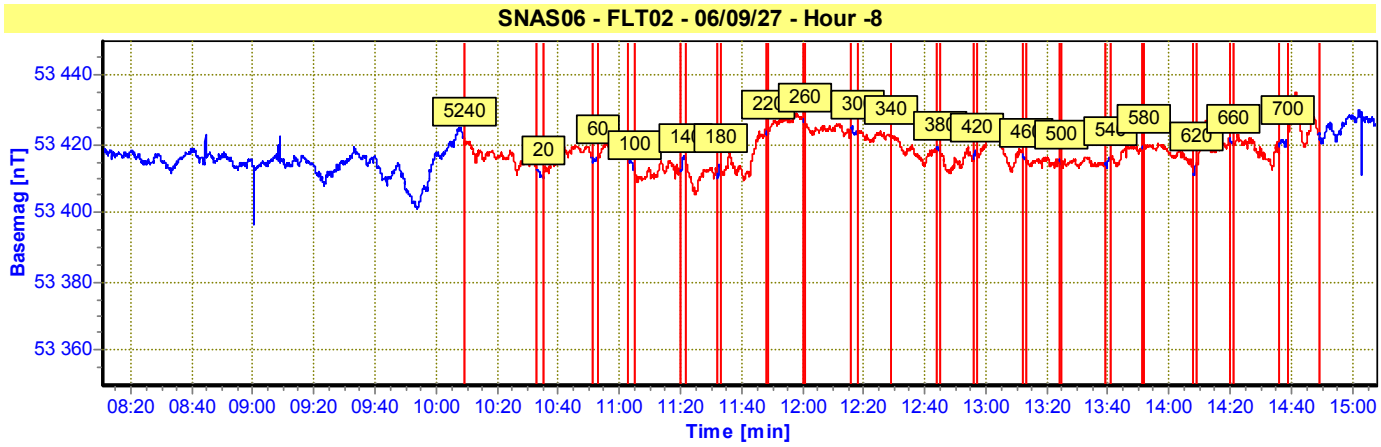
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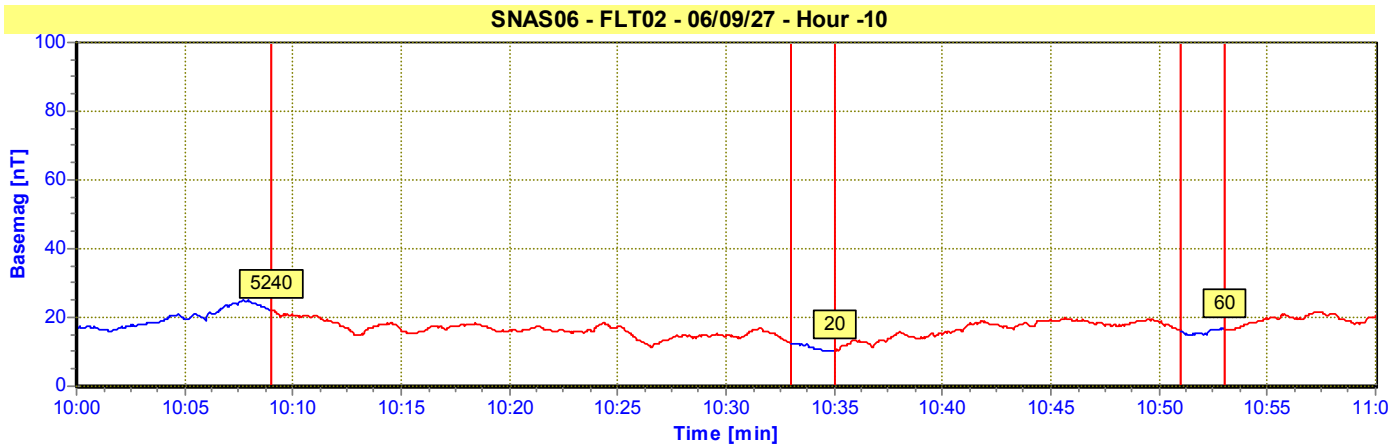
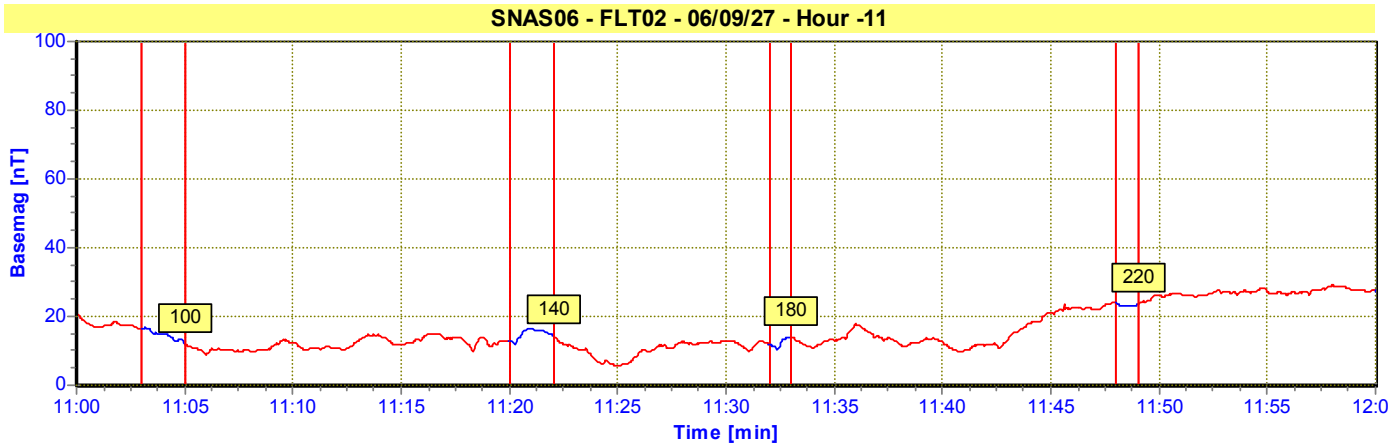
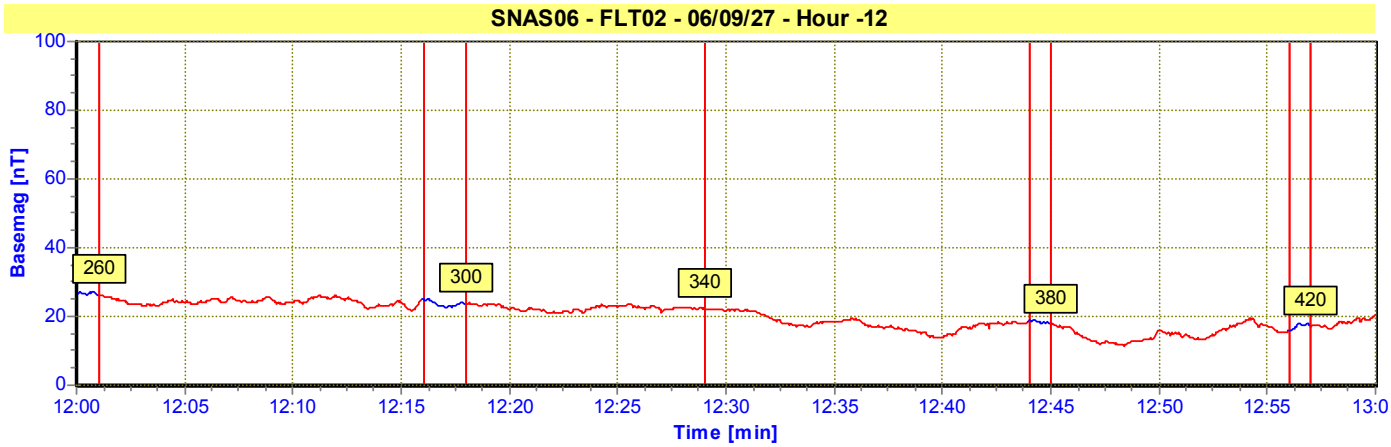
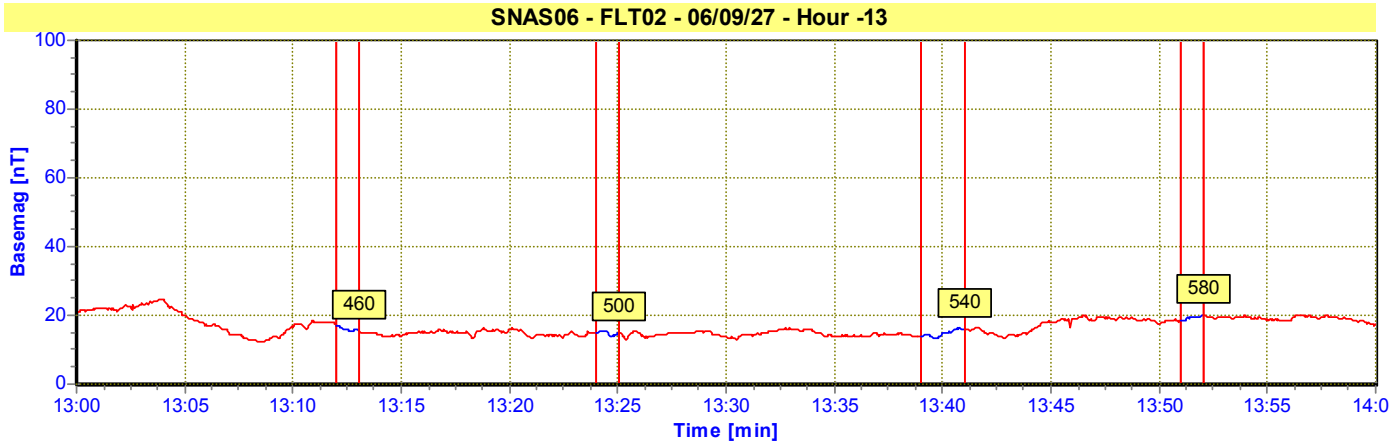
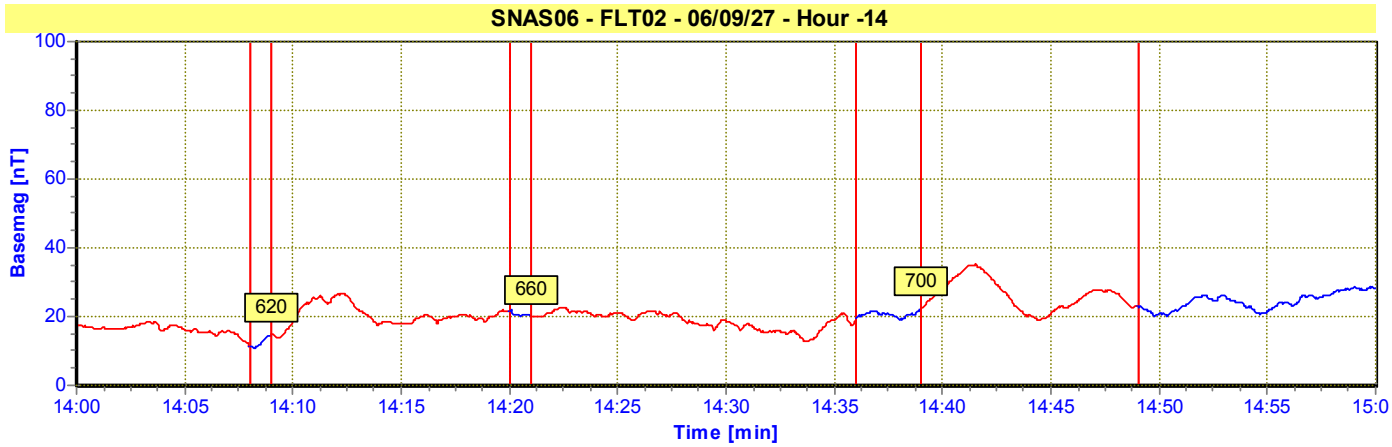
08:20 08:40 09:00 09:20 09:40 10:00 10:20 10:40 11:00 11:20 11:40 12:00 12:20 12:40 13:00 13:20 13:40 14:00 14:20 14:40 15:00
Time [min]

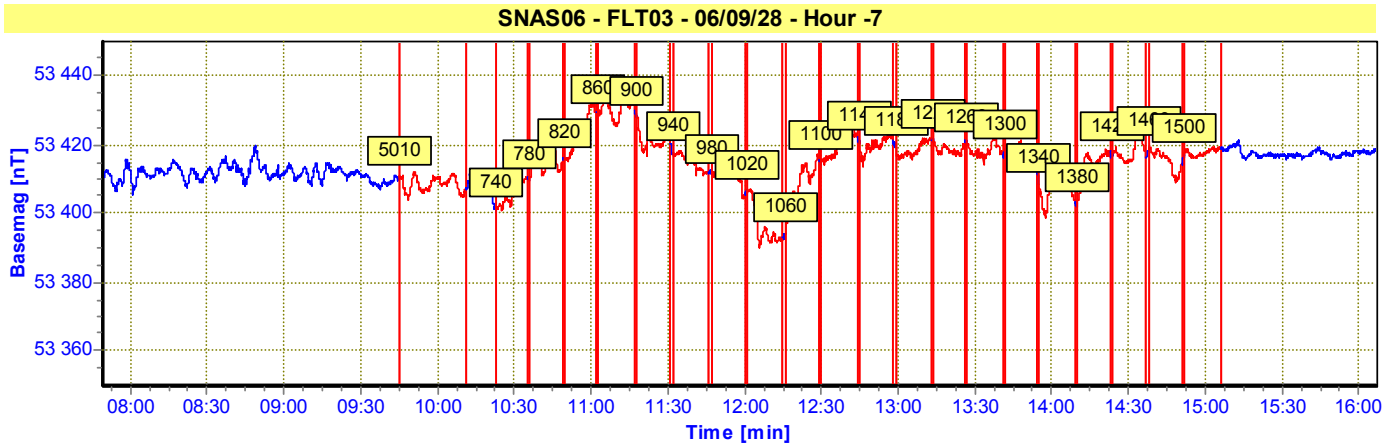

SNAS06 - FLT02 - 06/09/27 - Hour -10
Basemag [nT]
100
80
60
40
20
0
5240
20
60
10:00 10:05 10:10 10:15 10:20 10:25 10:30 10:35 10:40 10:45 10:50 10:55 11:0
Time [min]

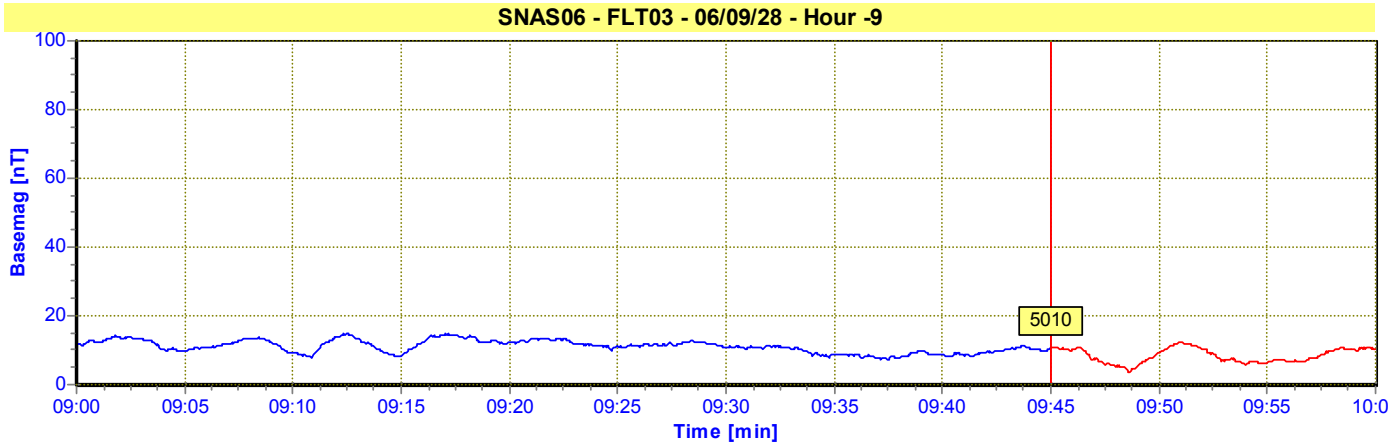

SNAS06 - FLT02 - 06/09/27 - Hour -11
Basemag [nT]
100
80
60
40
20
0
100
140
180
220
11:00 11:05 11:10 11:15 11:20 11:25 11:30 11:35 11:40 11:45 11:50 11:55 12:0
Time [min]

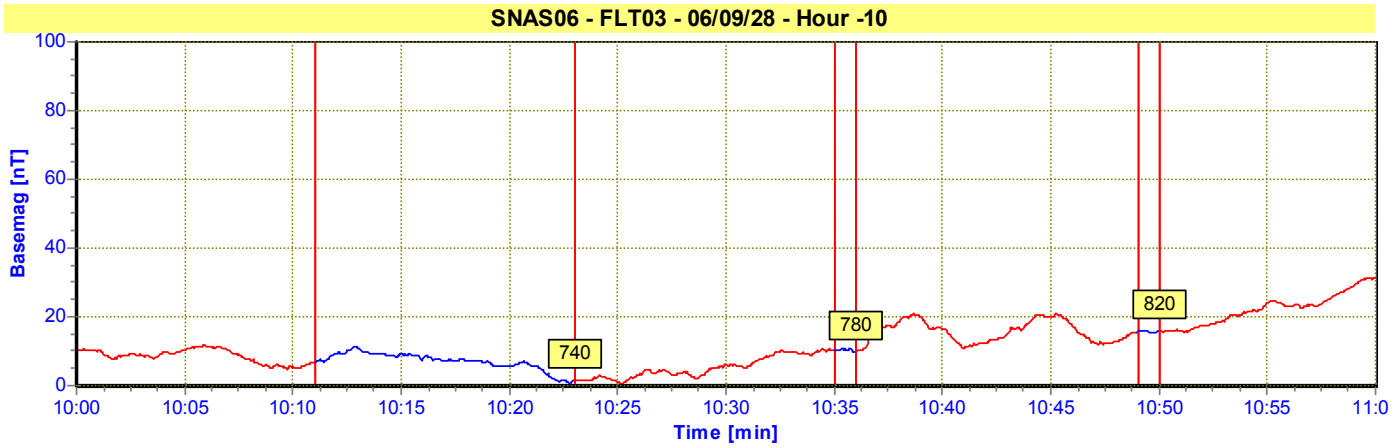

SNAS06 - FLT02 - 06/09/27 - Hour -12
Basemag [nT]
100
80
60
40
20
0
260
300
340
380
420
12:00 12:05 12:10 12:15 12:20 12:25 12:30 12:35 12:40 12:45 12:50 12:55 13:0
Time [min]

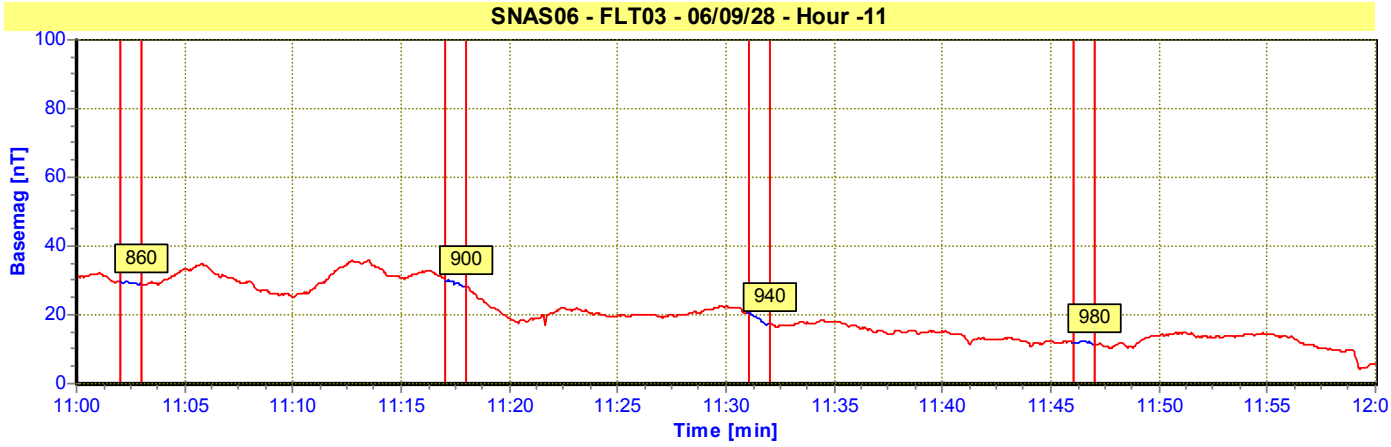

SNAS06 - FLT02 - 06/09/27 - Hour -13
Basemag [nT]
100
80
60
40
20
0
460
500
540
580
13:00
13:05
13:10
13:15
13:20
13:25
13:30
13:35
13:40
13:45
13:50
13:55
14:0
Time [min]

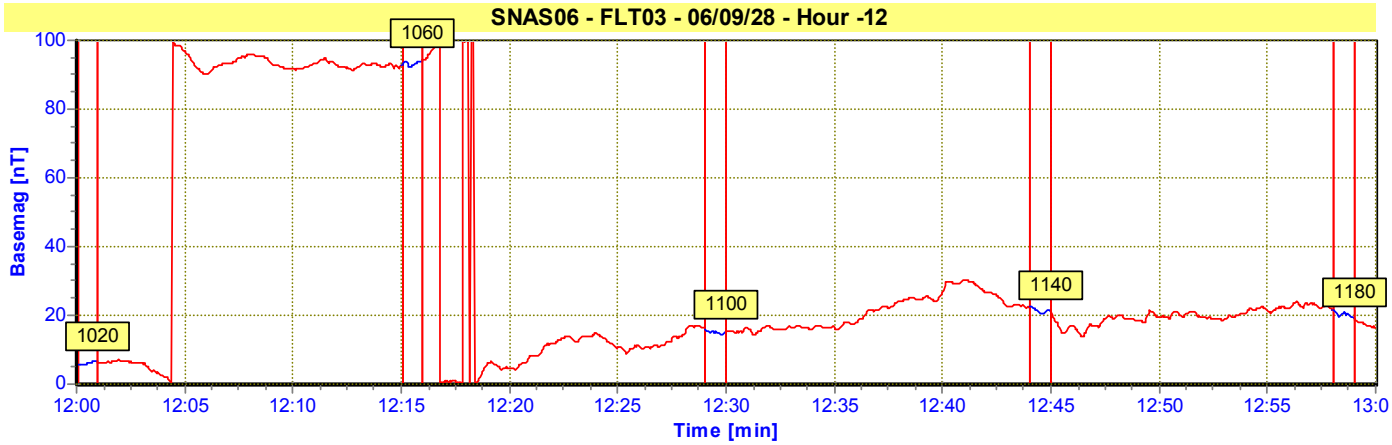

SNAS06 - FLT02 - 06/09/27 - Hour -14
Basemag [nT]
100
80
60
40
20
0
620
660
700
14:00
14:05
14:10
14:15
14:20
14:25
14:30
14:35
14:40
14:45
14:50
14:55
15:0
Time [min]

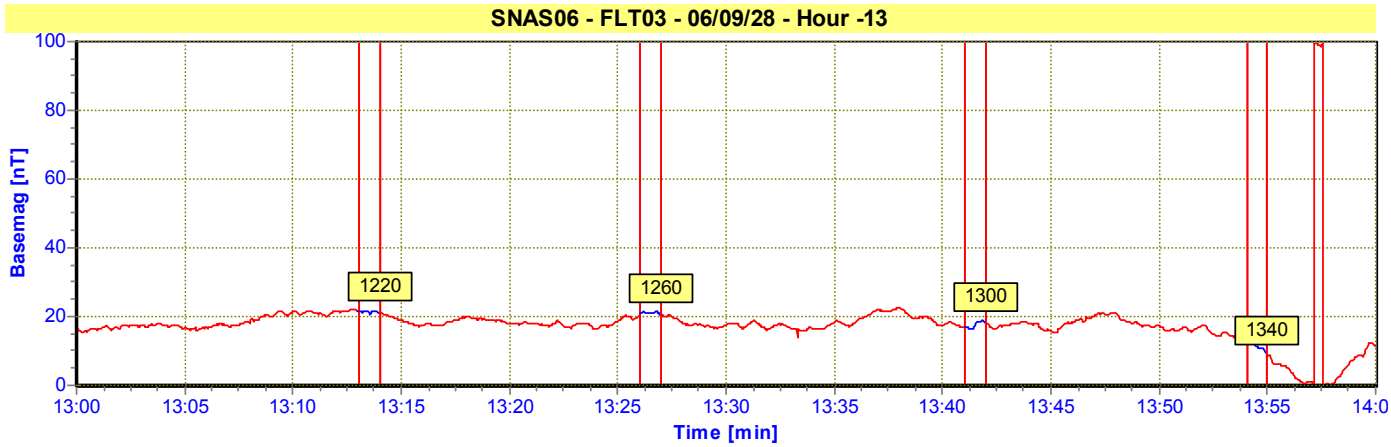

SNAS06 - FLT03 - 06/09/28 - Hour -7
Basemag [nT]
53 440
53 420
53 400
53 380
53 360
5010
740
780
820
860
900
940
980
1020
1060
1100
1300
1340
1380
1500
08:00
08:30
09:00
09:30
10:00
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Time [min]

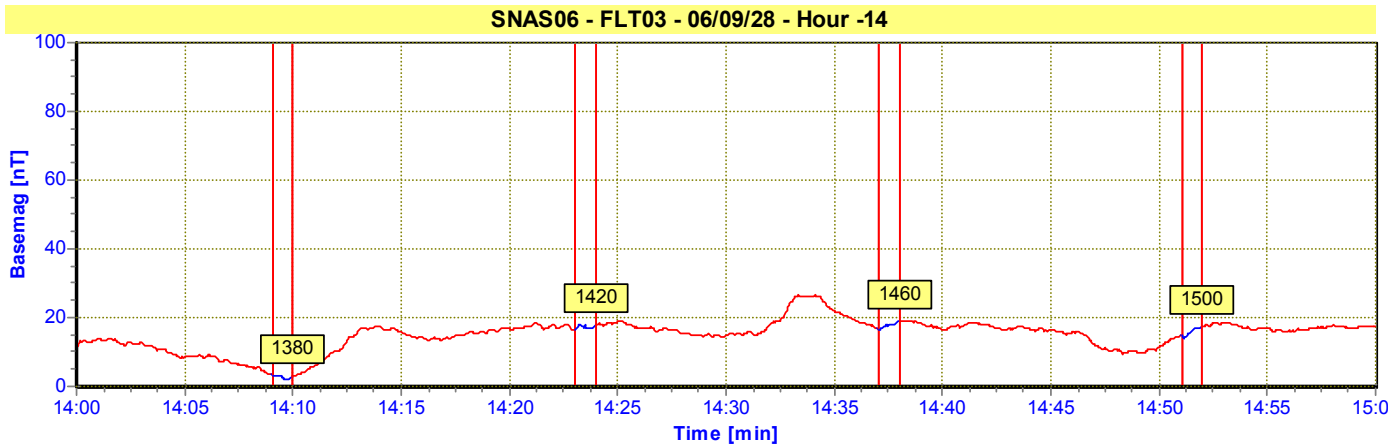

SNAS06 - FLT03 - 06/09/28 - Hour -9
Basemag [nT]
100
80
60
40
20
0
5010
09:00
09:05
09:10
09:15
09:20
09:25
09:30
09:35
09:40
09:45
09:50
09:55
10:0
Time [min]

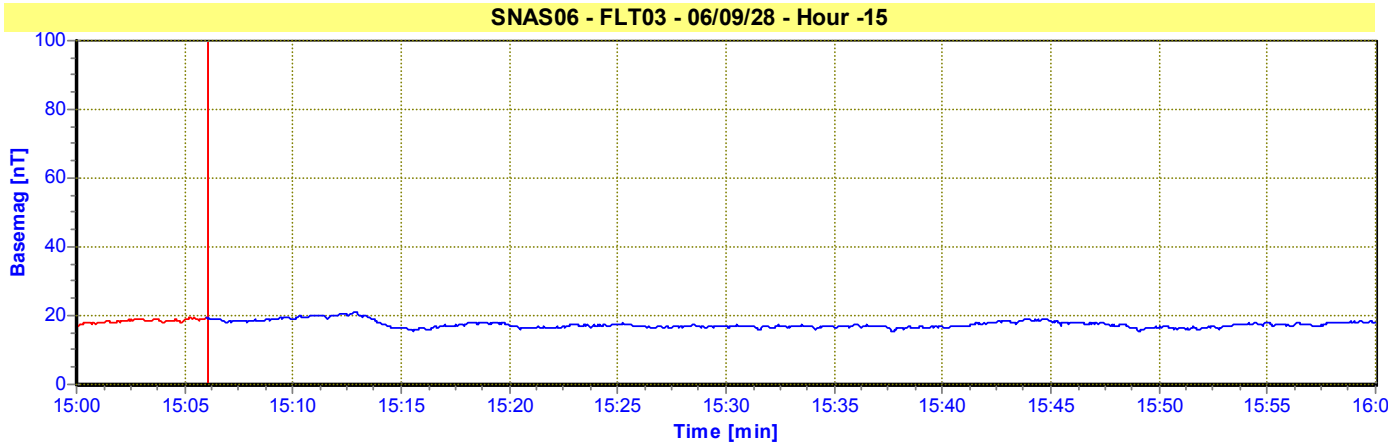

SNAS06 - FLT03 - 06/09/28 - Hour -10
Basemag [nT]
100
80
60
40
20
0
740
780
820
10:00
10:05
10:10
10:15
10:20
10:25
10:30
10:35
10:40
10:45
10:50
10:55
11:0
Time [min]

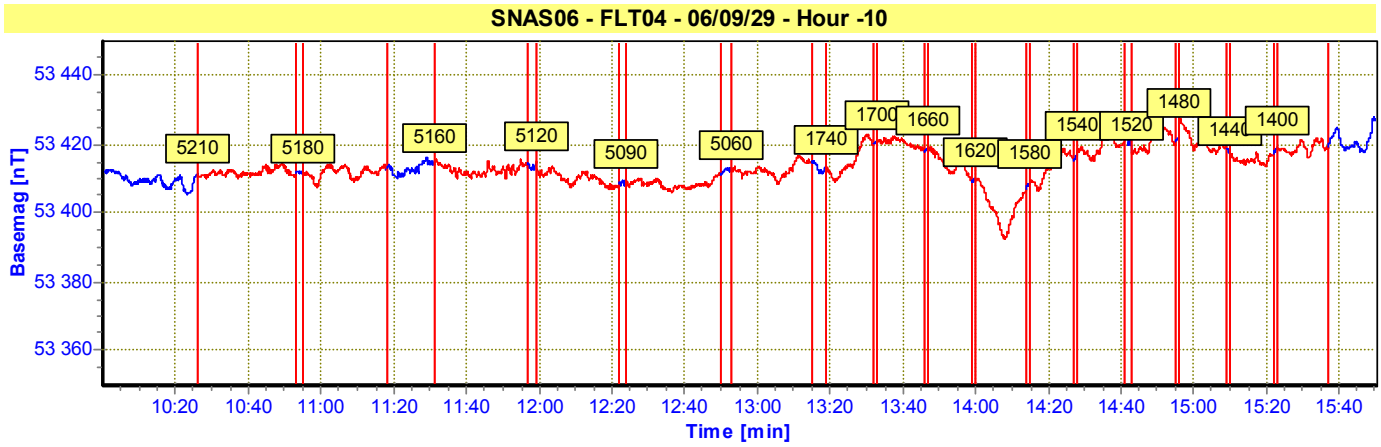

SNAS06 - FLT03 - 06/09/28 - Hour -11
Basemag [nT]
100
80
60
40
20
0
860
900
940
980
11:00
11:05
11:10
11:15
11:20
11:25
11:30
11:35
11:40
11:45
11:50
11:55
12:0
Time [min]

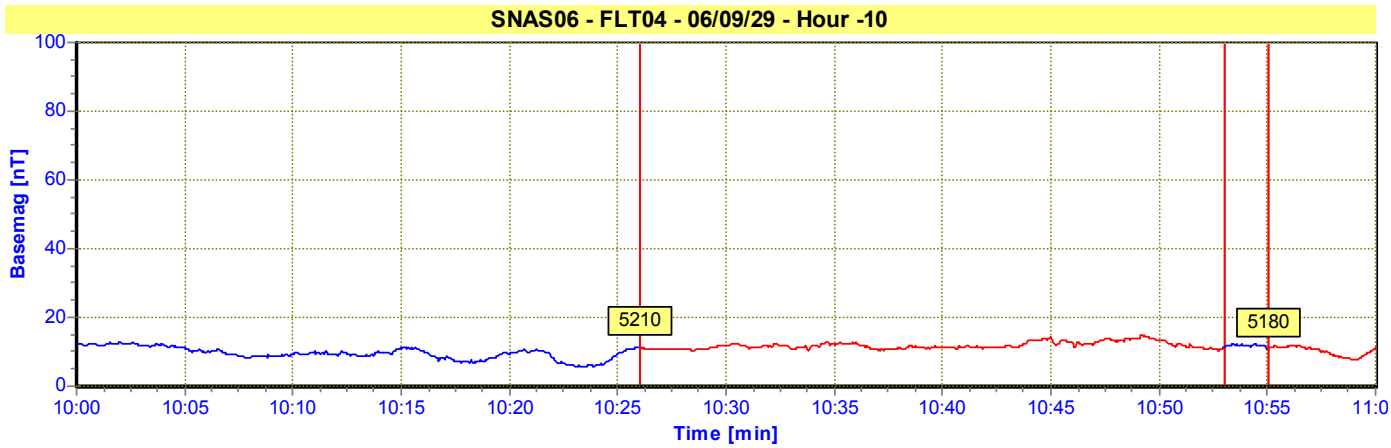

SNAS06 - FLT03 - 06/09/28 - Hour -12
Basemag [nT]
Time [min]
1020
1060
1100
1140
1180

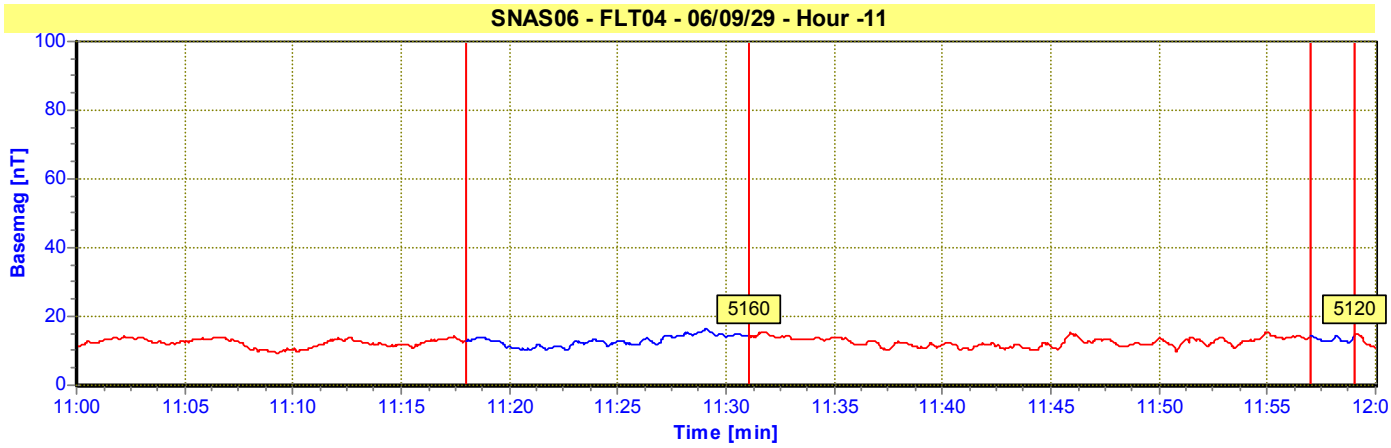

SNAS06 - FLT03 - 06/09/28 - Hour -13
Basemag [nT]
Time [min]
1220
1260
1300
1340

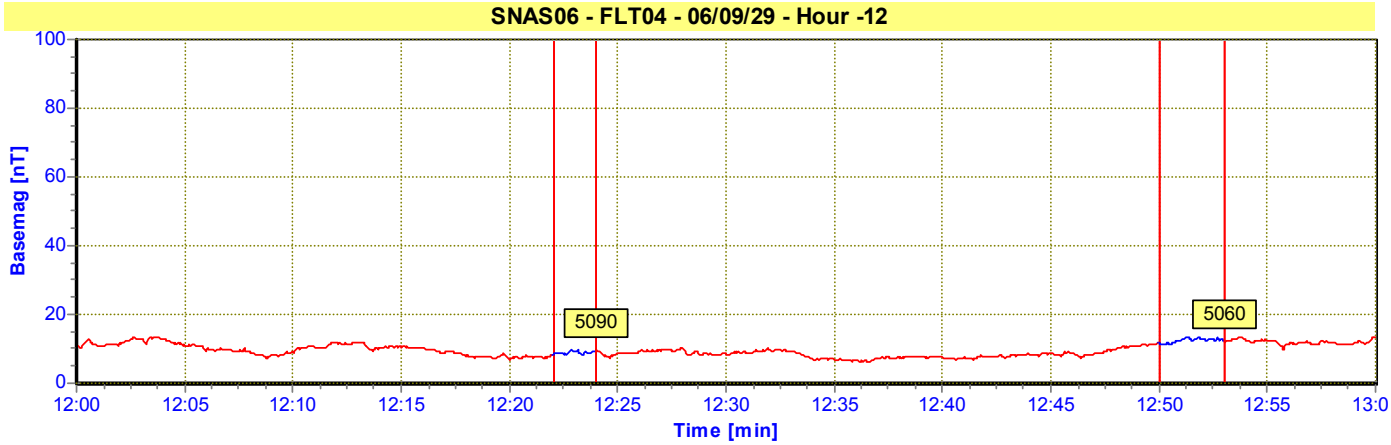

SNAS06 - FLT03 - 06/09/28 - Hour -14
Basemag [nT]
Time [min]
1380
1420
1460
1500

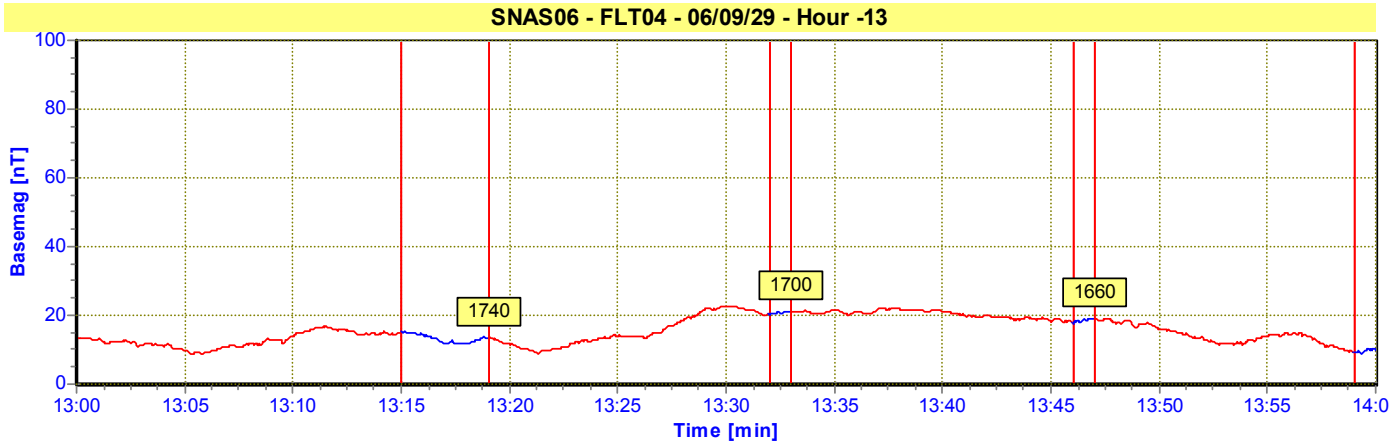

SNAS06 - FLT03 - 06/09/28 - Hour -15
Basemag [nT]
Time [min]

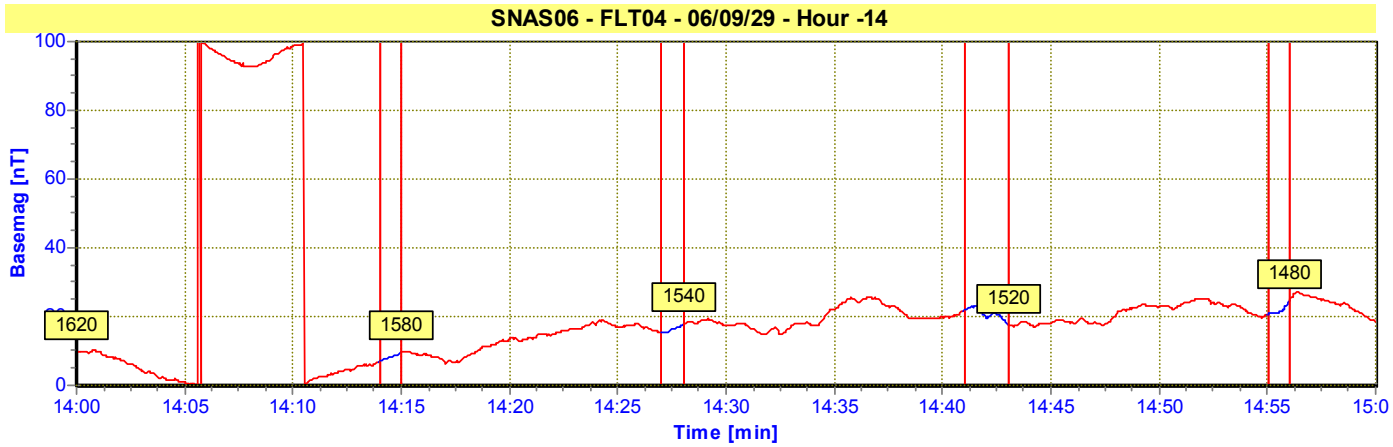

SNAS06 - FLT04 - 06/09/29 - Hour -10
Basemag [nT]
53 440
53 420
53 400
53 380
53 360
5210
5180
5160
5120
5090
5060
1740
1700
1660
1620
1580
1540
1520
1480
1440
1400
10:20
10:40
11:00
11:20
11:40
12:00
12:20
12:40
13:00
13:20
13:40
14:00
14:20
14:40
15:00
15:20
15:40
Time [min]

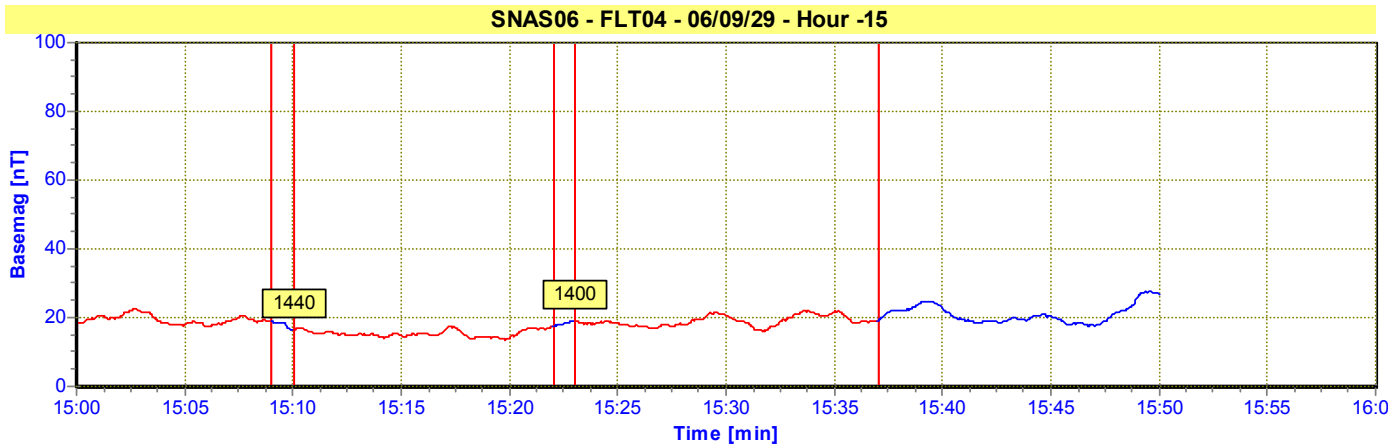

SNAS06 - FLT04 - 06/09/29 - Hour -10
Basemag [nT]
100
80
60
40
20
0
5210
5180
10:00
10:05
10:10
10:15
10:20
10:25
10:30
10:35
10:40
10:45
10:50
10:55
11:0
Time [min]

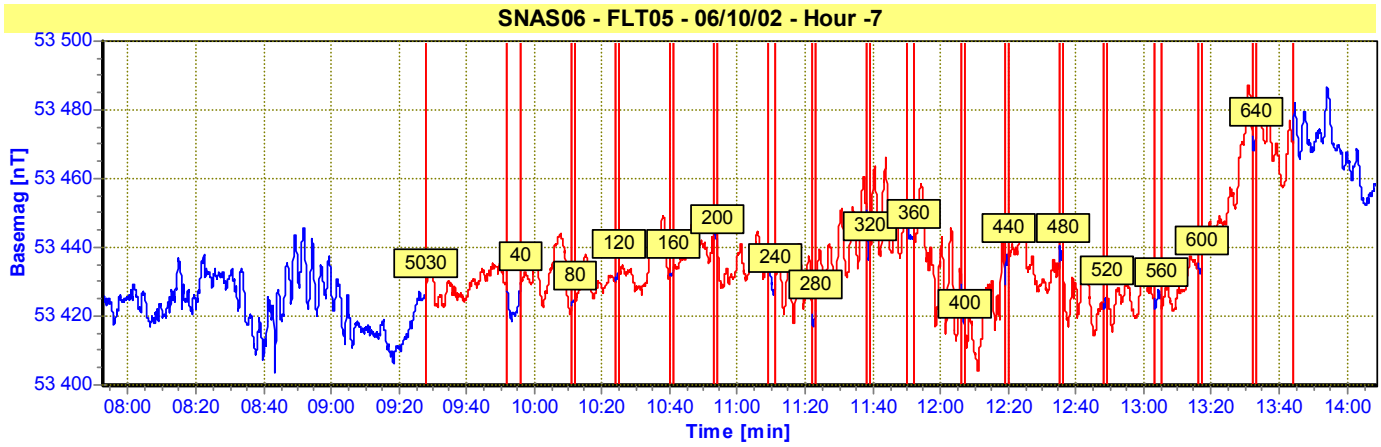

SNAS06 - FLT04 - 06/09/29 - Hour -11
Basemag [nT]
100
80
60
40
20
0
5160
5120
11:00
11:05
11:10
11:15
11:20
11:25
11:30
11:35
11:40
11:45
11:50
11:55
12:0
Time [min]

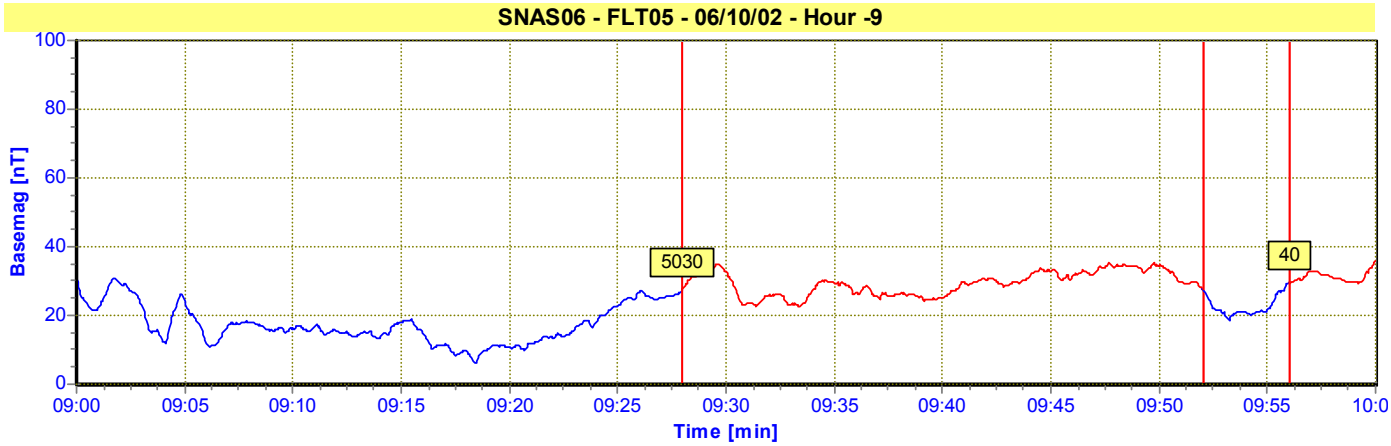

SNAS06 - FLT04 - 06/09/29 - Hour -12
Basemag [nT]
100
80
60
40
20
0
5090
5060
12:00
12:05
12:10
12:15
12:20
12:25
12:30
12:35
12:40
12:45
12:50
12:55
13:0
Time [min]

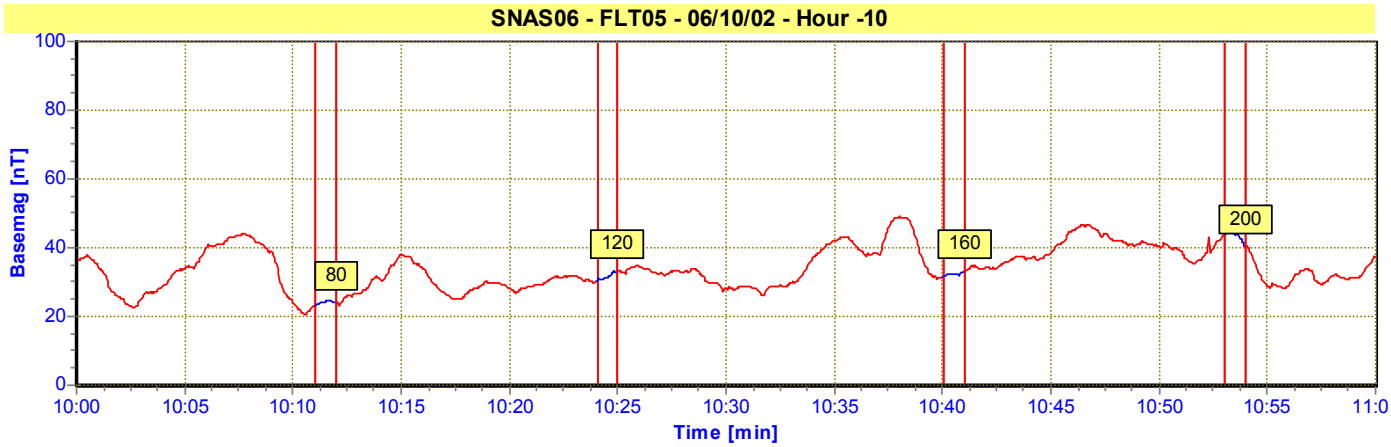

SNAS06 - FLT04 - 06/09/29 - Hour -13
Basemag [nT]
Time [min]
1740
1700
1660

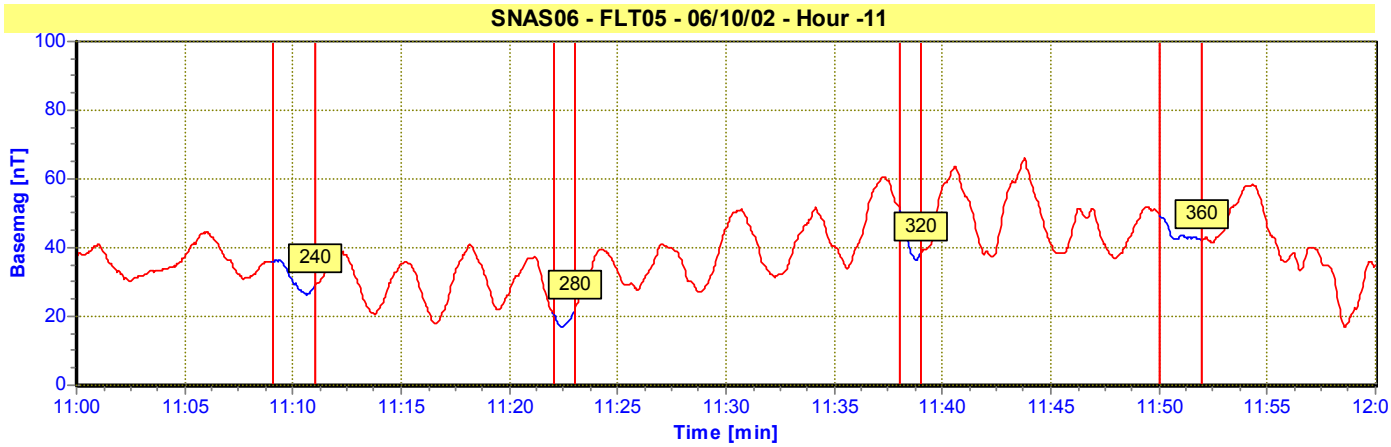

SNAS06 - FLT04 - 06/09/29 - Hour -14
Basemag [nT]
Time [min]
1620
1580
1540
1520
1480

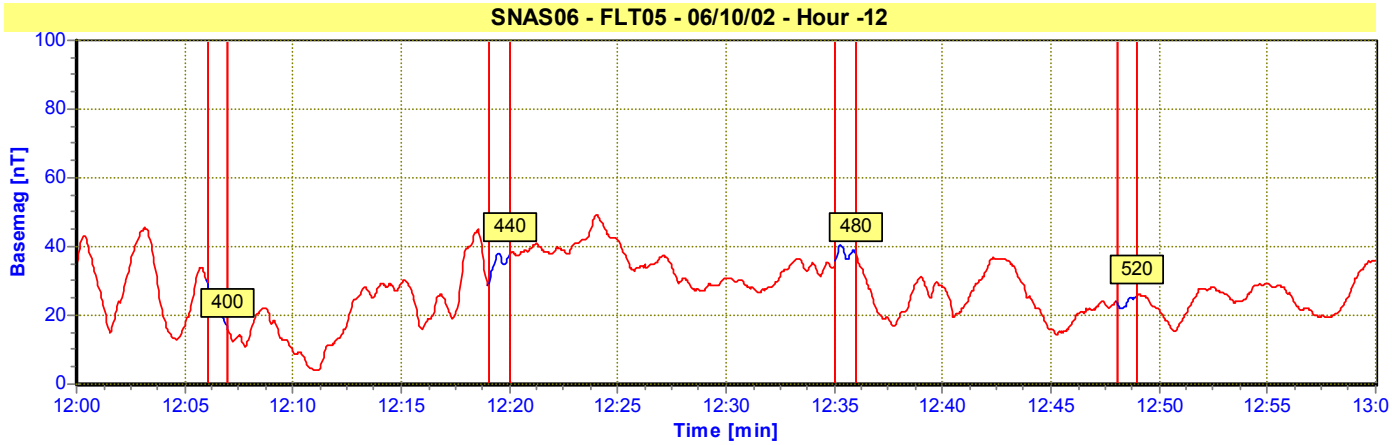

SNAS06 - FLT04 - 06/09/29 - Hour -15
Basemag [nT]
Time [min]
1440
1400

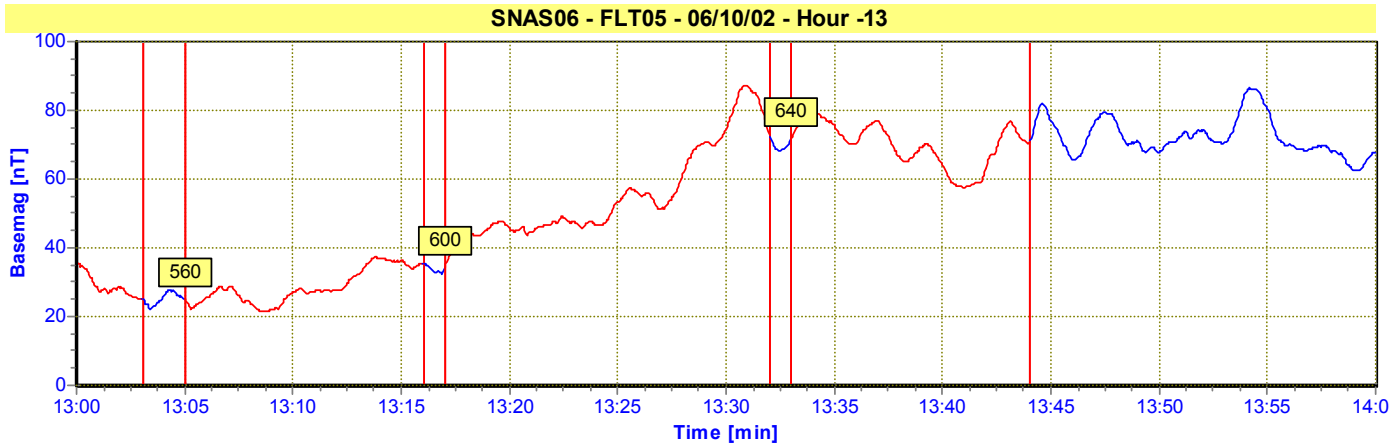

SNAS06 - FLT05 - 06/10/02 - Hour -7
Basemag [nT]
53 500
53 480
53 460
53 440
53 420
53 400
5030
40
80
120
160
200
240
280
320
360
400
440
480
520
560
600
640
08:00
08:20
08:40
09:00
09:20
09:40
10:00
10:20
10:40
11:00
11:20
11:40
12:00
12:20
12:40
13:00
13:20
13:40
14:00
Time [min]

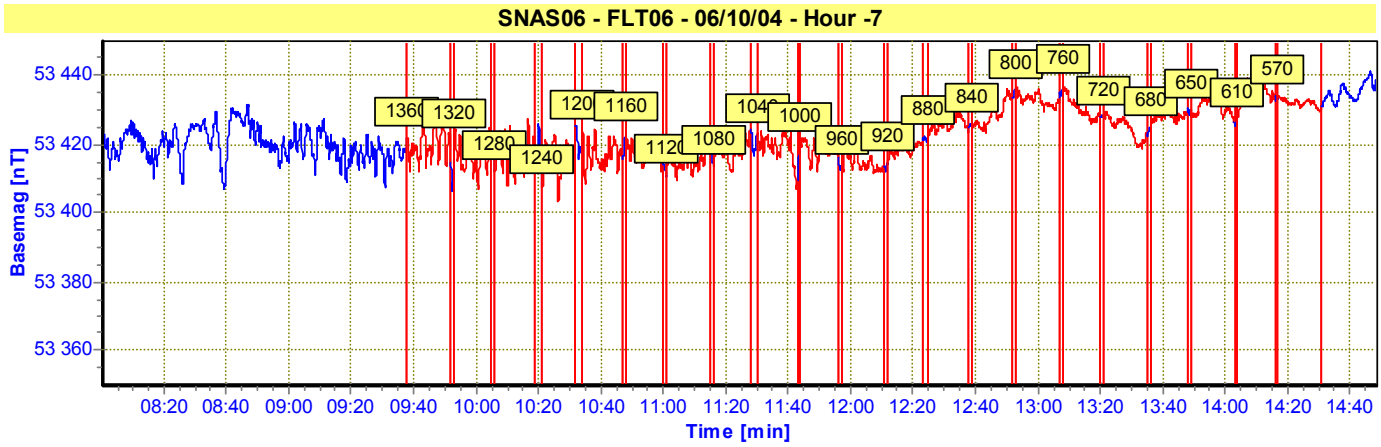

SNAS06 - FLT05 - 06/10/02 - Hour -9
Basemag [nT]
100
80
60
40
20
0
5030
40
09:00
09:05
09:10
09:15
09:20
09:25
09:30
09:35
09:40
09:45
09:50
09:55
10:0
Time [min]

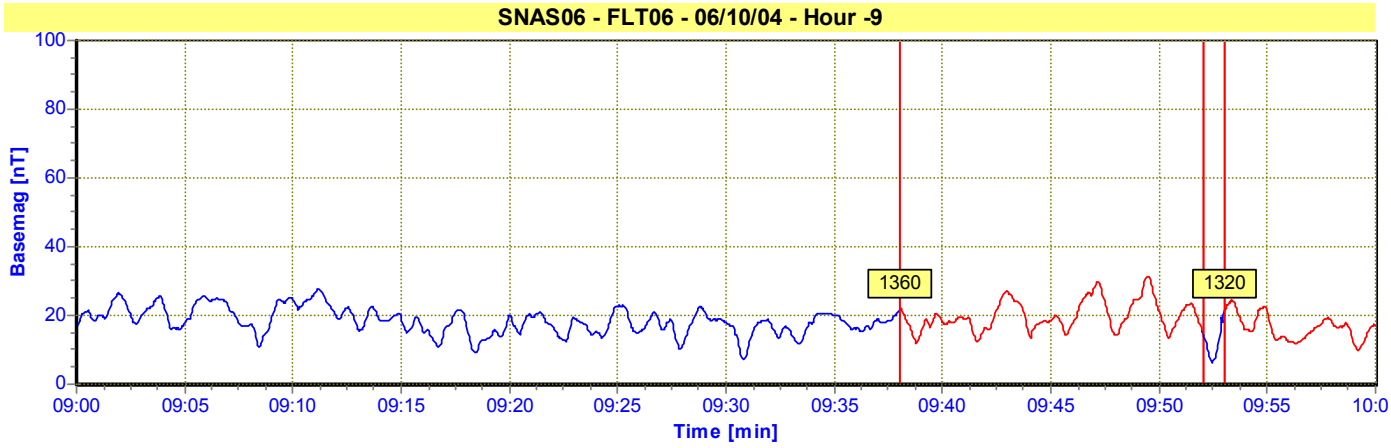

SNAS06 - FLT05 - 06/10/02 - Hour -10
Basemag [nT]
100
80
60
40
20
0
80
120
160
200
10:00
10:05
10:10
10:15
10:20
10:25
10:30
10:35
10:40
10:45
10:50
10:55
11:0
Time [min]

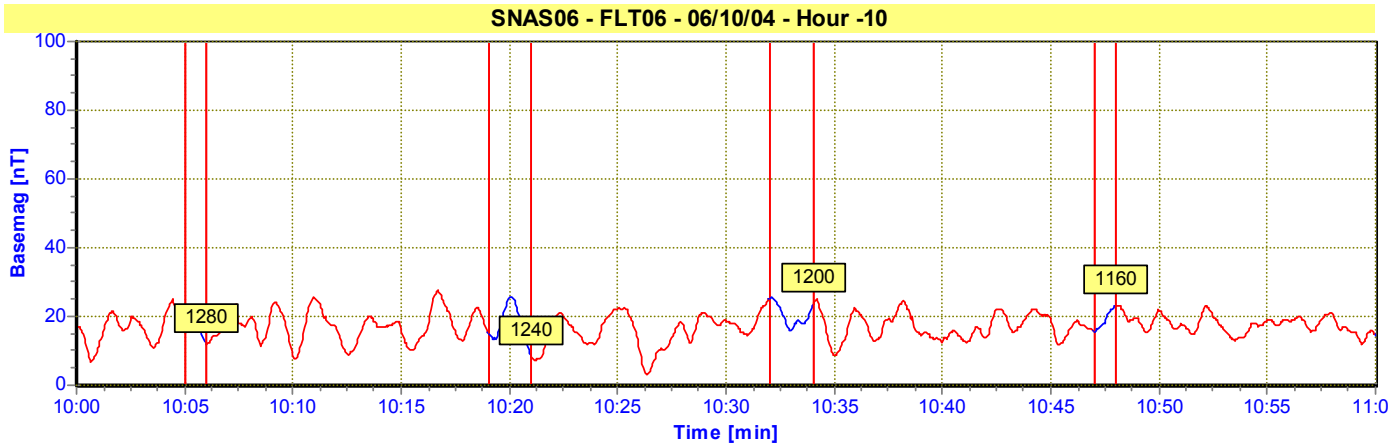

SNAS06 - FLT05 - 06/10/02 - Hour -11
Basemag [nT]
100
80
60
40
20
0
240
280
320
360
11:00
11:05
11:10
11:15
11:20
11:25
11:30
11:35
11:40
11:45
11:50
11:55
12:0
Time [min]

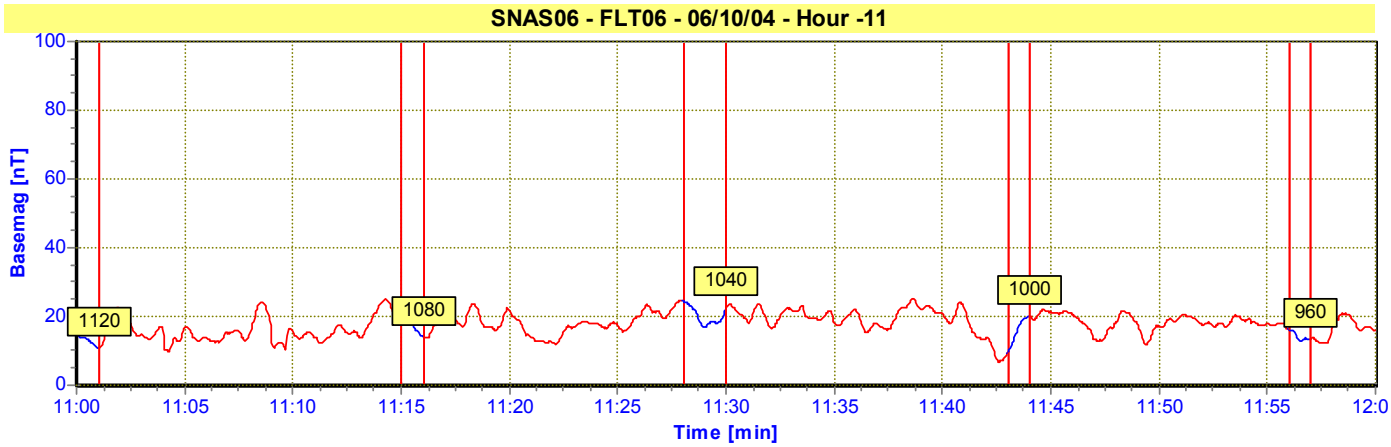

SNAS06 - FLT05 - 06/10/02 - Hour -12
Basemag [nT]
100
80
60
40
20
0
400
440
480
520
12:00
12:05
12:10
12:15
12:20
12:25
12:30
12:35
12:40
12:45
12:50
12:55
13:0
Time [min]

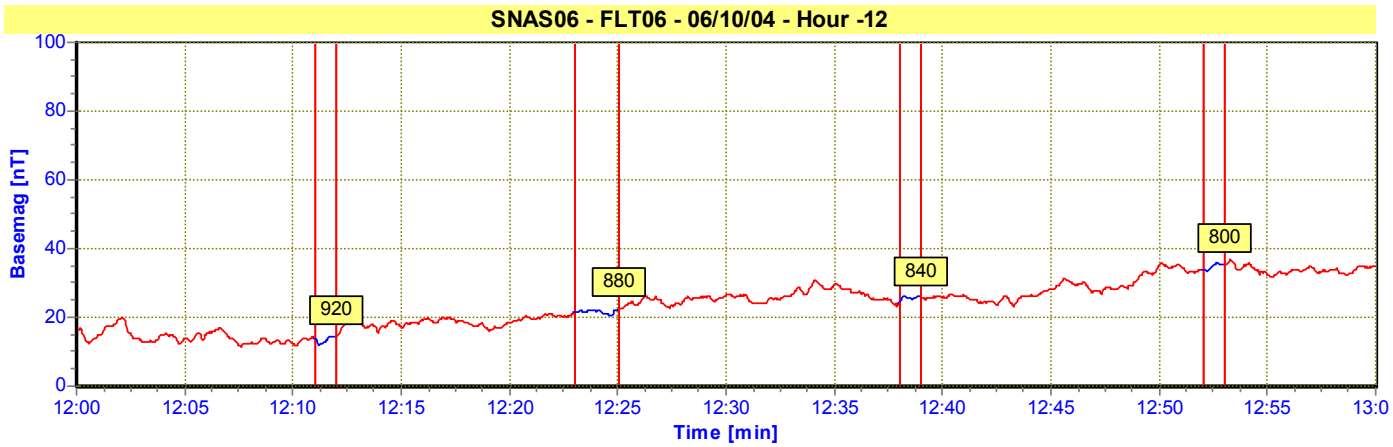

SNAS06 - FLT05 - 06/10/02 - Hour -13
Basemag [nT]
100
80
60
40
20
0
560
600
640
13:00
13:05
13:10
13:15
13:20
13:25
13:30
13:35
13:40
13:45
13:50
13:55
14:0
Time [min]

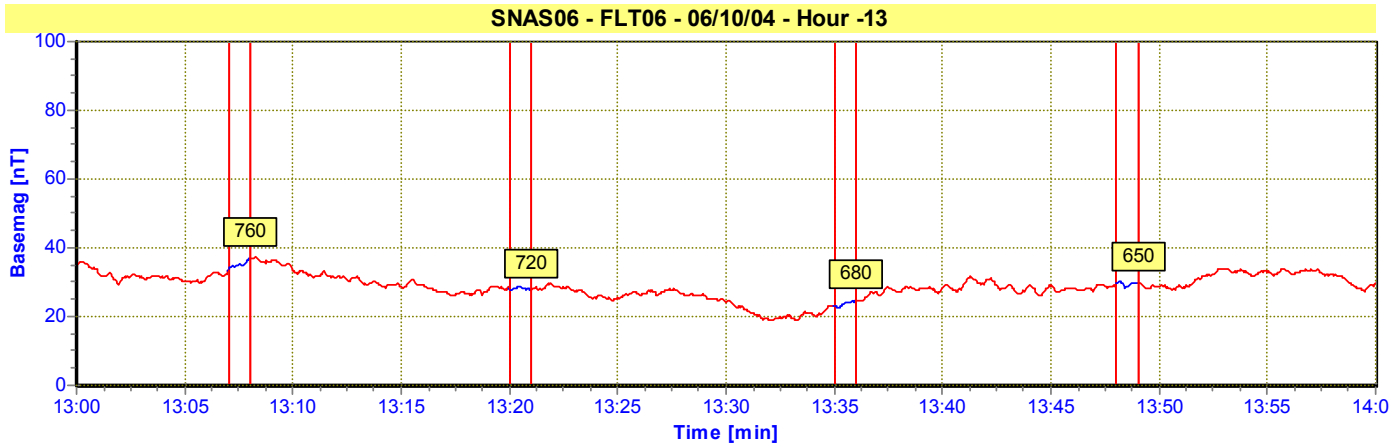

SNAS06 - FLT06 - 06/10/04 - Hour -7
Basemag [nT]
53 440
53 420
53 400
53 380
53 360
1360
1320
1280
1240
120
1160
1120
1080
1040
1000
960
920
880
840
800
760
720
680
650
610
570
08:20 08:40 09:00 09:20 09:40 10:00 10:20 10:40 11:00 11:20 11:40 12:00 12:20 12:40 13:00 13:20 13:40 14:00 14:20 14:40
Time [min]

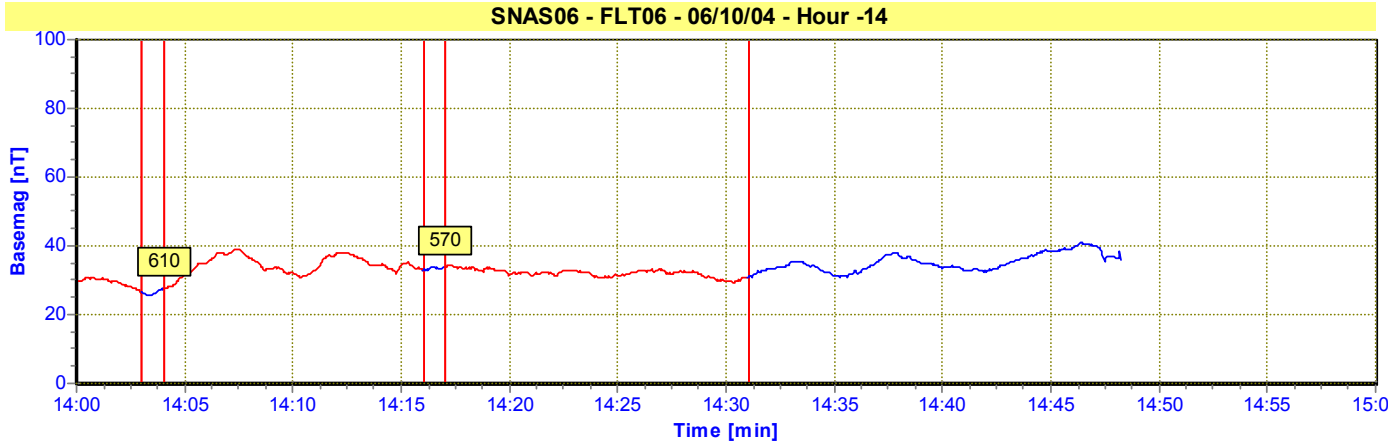

SNAS06 - FLT06 - 06/10/04 - Hour -9
Basemag [nT]
100
80
60
40
20
0
1360
1320
09:00 09:05 09:10 09:15 09:20 09:25 09:30 09:35 09:40 09:45 09:50 09:55 10:0
Time [min]

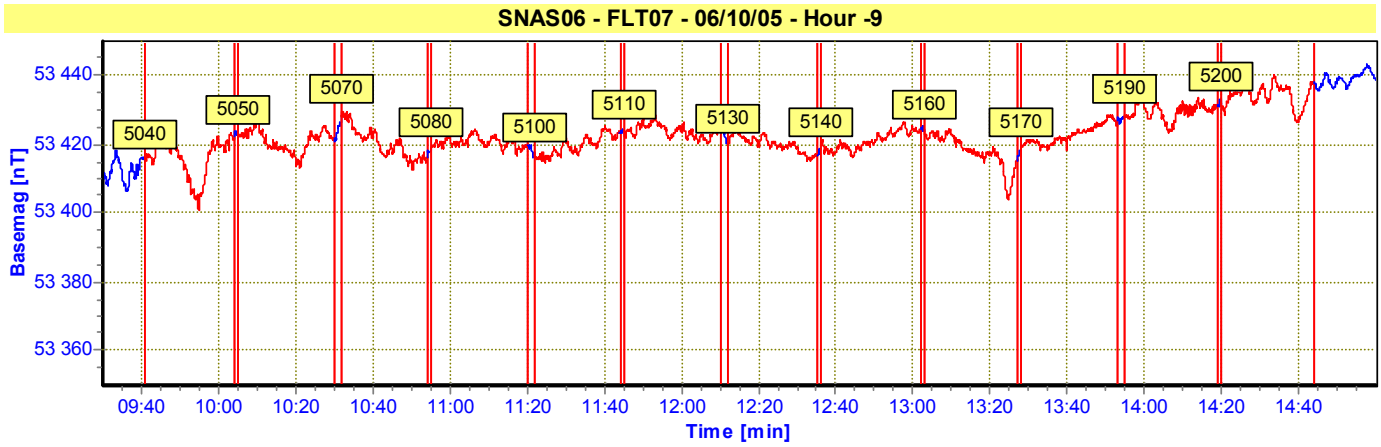

SNAS06 - FLT06 - 06/10/04 - Hour -10
Basemag [nT]
100
80
60
40
20
0
1280
1240
1200
1160
10:00 10:05 10:10 10:15 10:20 10:25 10:30 10:35 10:40 10:45 10:50 10:55 11:0
Time [min]

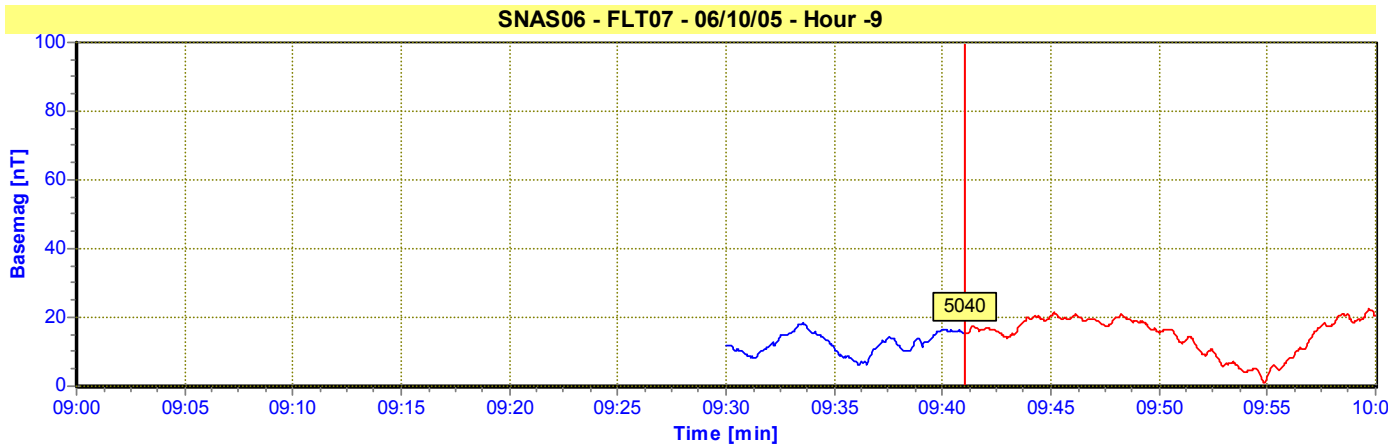

SNAS06 - FLT06 - 06/10/04 - Hour -11
Basemag [nT]
100
80
60
40
20
0
1120
1080
1040
1000
960
11:00 11:05 11:10 11:15 11:20 11:25 11:30 11:35 11:40 11:45 11:50 11:55 12:0
Time [min]

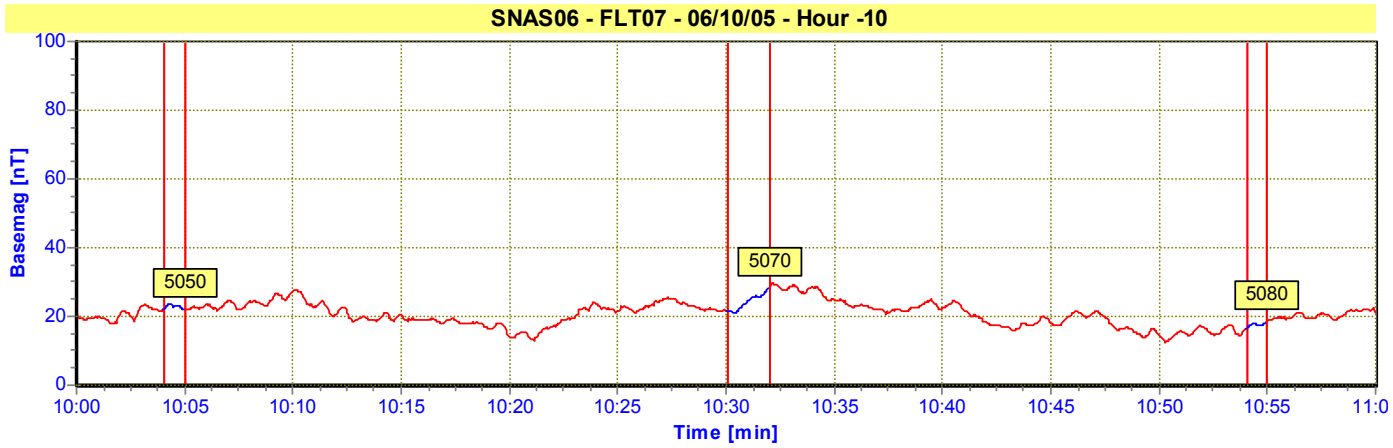

SNAS06 - FLT06 - 06/10/04 - Hour -12
Basemag [nT]
Time [min]
920
880
840
800

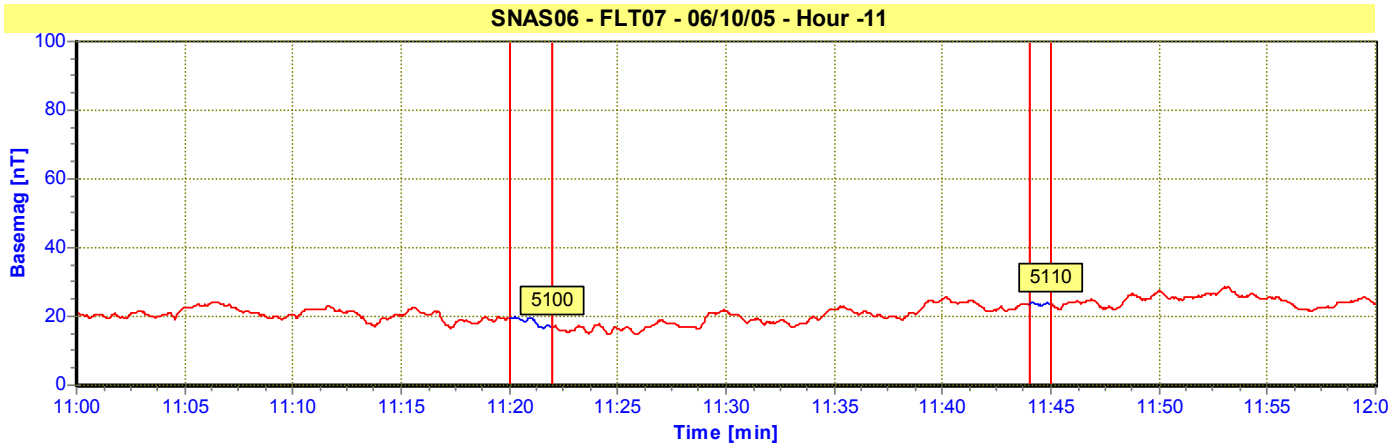

SNAS06 - FLT06 - 06/10/04 - Hour -13
Basemag [nT]
Time [min]
760
720
680
650


SNAS06 - FLT06 - 06/10/04 - Hour -14
Basemag [nT]
Time [min]
610
570


SNAS06 - FLT07 - 06/10/05 - Hour -9
Basemag [nT]
53 440
53 420
53 400
53 380
53 360
5040
5050
5070
5080
5100
5110
5130
5140
5160
5170
5190
5200
09:40
10:00
10:20
10:40
11:00
11:20
11:40
12:00
12:20
12:40
13:00
13:20
13:40
14:00
14:20
14:40
Time [min]


SNAS06 - FLT07 - 06/10/05 - Hour -9
Basemag [nT]
100
80
60
40
20
0
5040
09:00
09:05
09:10
09:15
09:20
09:25
09:30
09:35
09:40
09:45
09:50
09:55
10:0
Time [min]


SNAS06 - FLT07 - 06/10/05 - Hour -10
Basemag [nT]
100
80
60
40
20
0
5050
5070
5080
10:00
10:05
10:10
10:15
10:20
10:25
10:30
10:35
10:40
10:45
10:50
10:55
11:0
Time [min]


SNAS06 - FLT07 - 06/10/05 - Hour -11
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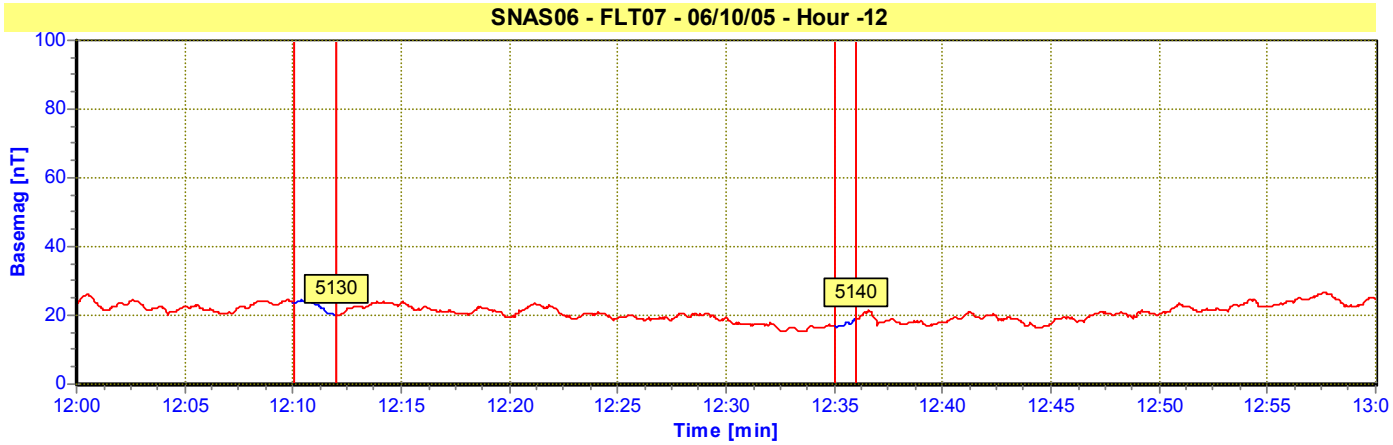
80
60
40
20
0
5100
5110
11:00
11:05
11:10
11:15
11:20
11:25
11:30
11:35
11:40
11:45
11:50
11:55
12:0
Time [min]


SNAS06 - FLT07 - 06/10/05 - Hour -12
Basemag [nT]
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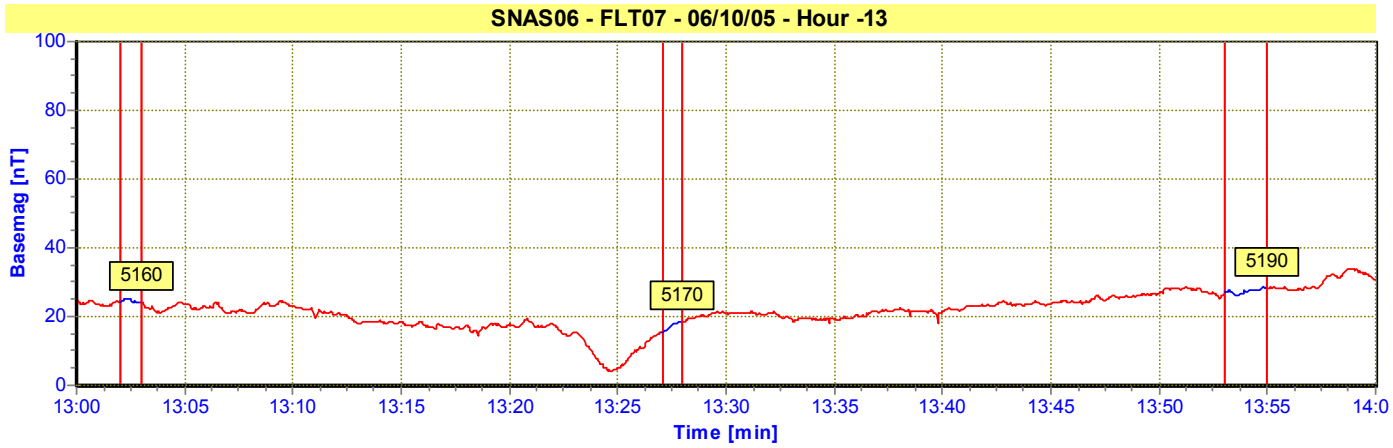
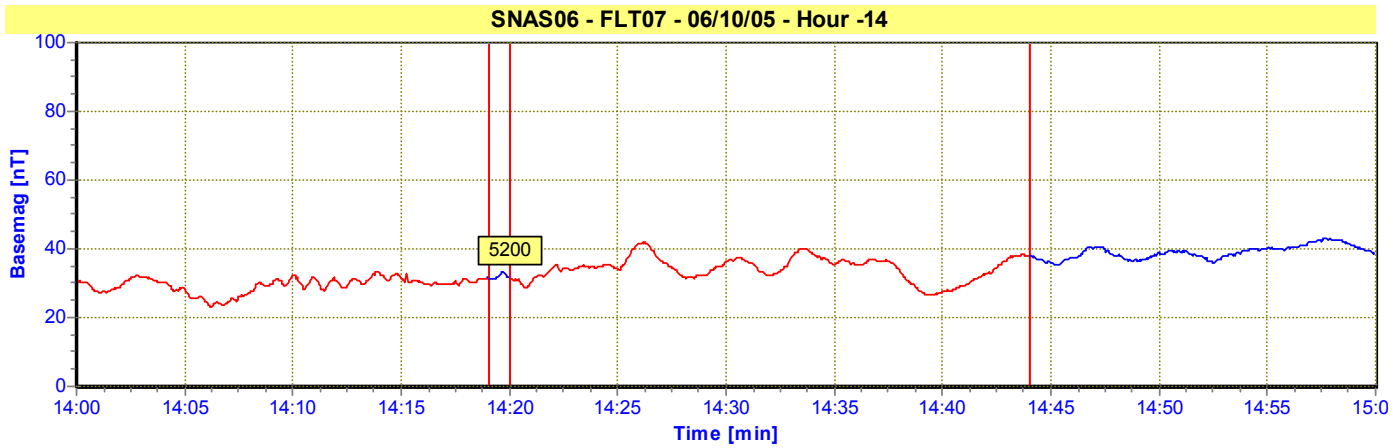
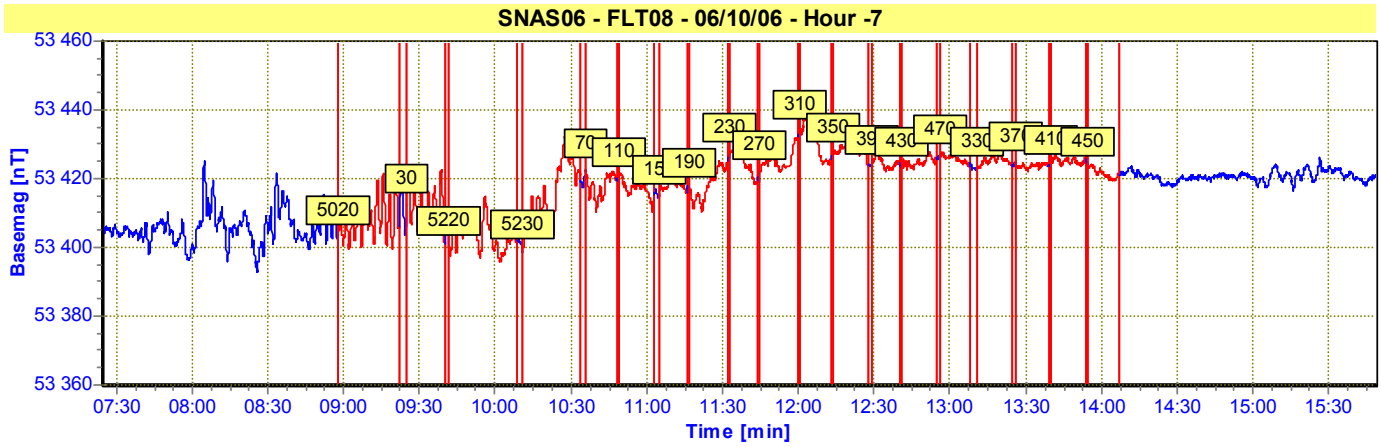
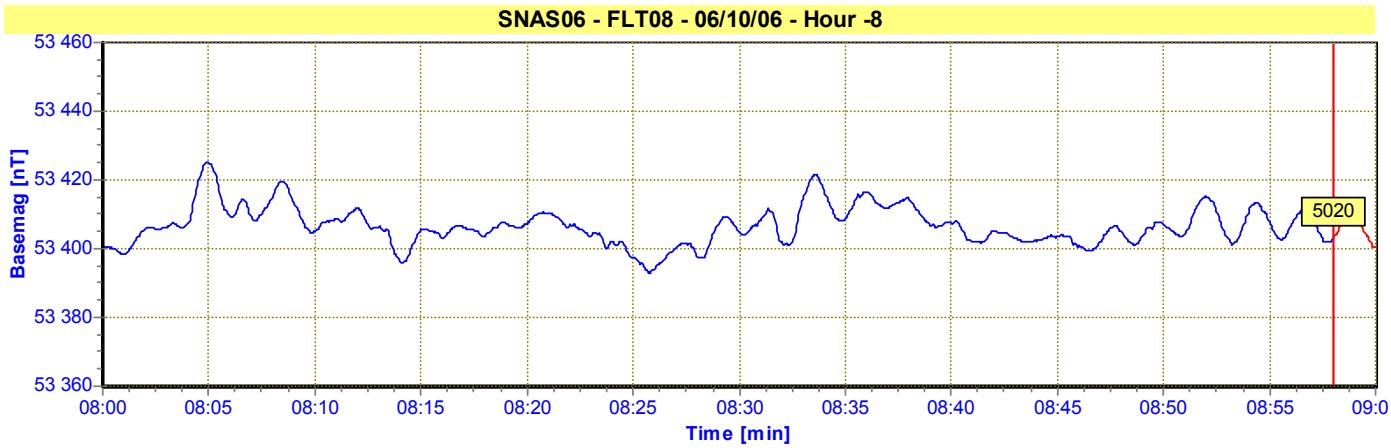
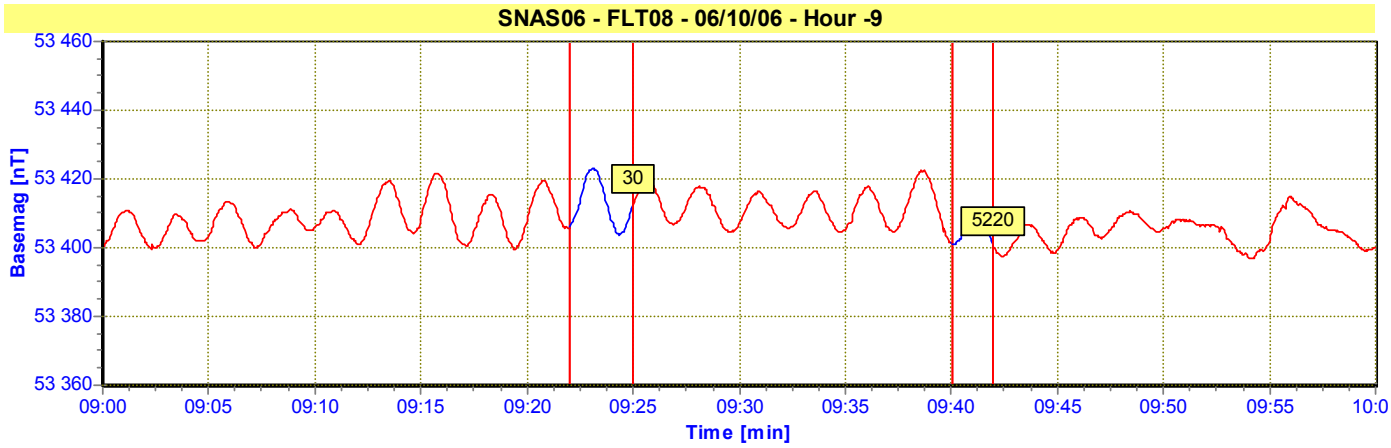
80
60
40
20
0
5130
5140
12:00
12:05
12:10
12:15
12:20
12:25
12:30
12:35
12:40
12:45
12:50
12:55
13:0
Time [min]

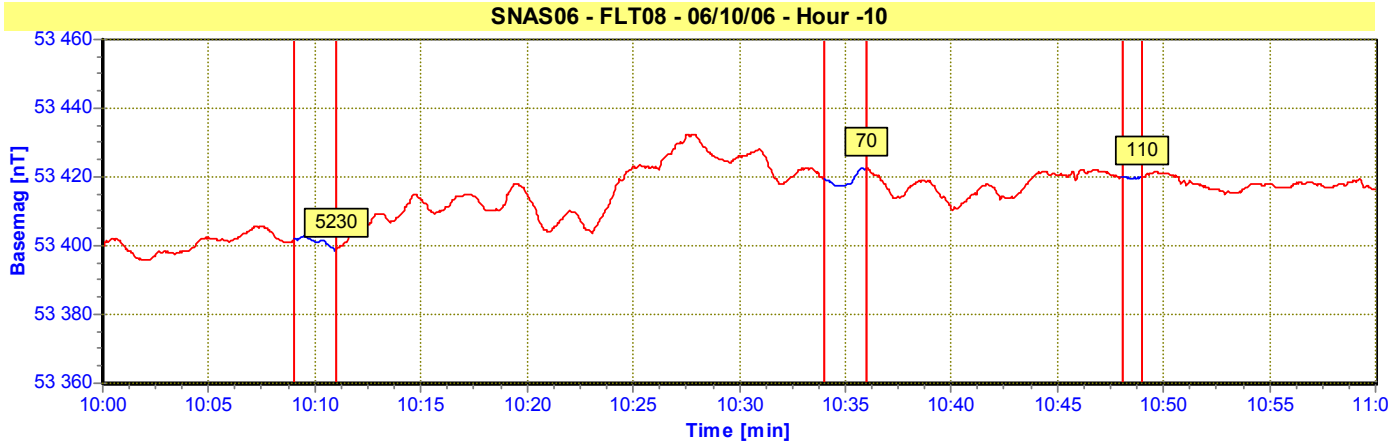

SNAS06 - FLT07 - 06/10/05 - Hour -13
Basemag [nT]
100
80
60
40
20
0
5160
5170
5190
13:00
13:05
13:10
13:15
13:20
13:25
13:30
13:35
13:40
13:45
13:50
13:55
14:0
Time [min]

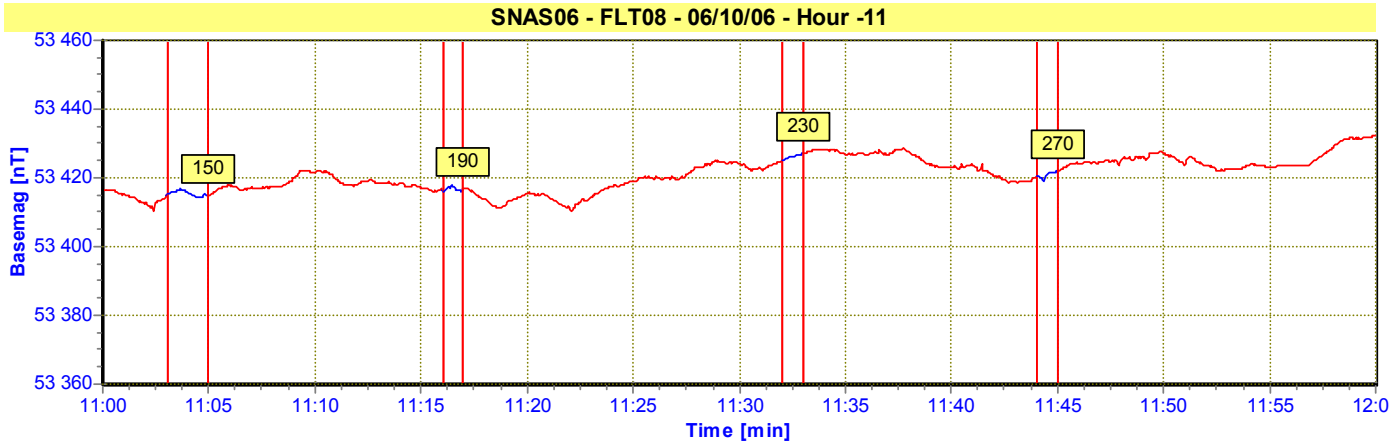

SNAS06 - FLT07 - 06/10/05 - Hour -14
Basemag [nT]
100
80
60
40
20
0
5200
14:00
14:05
14:10
14:15
14:20
14:25
14:30
14:35
14:40
14:45
14:50
14:55
15:0
Time [min]

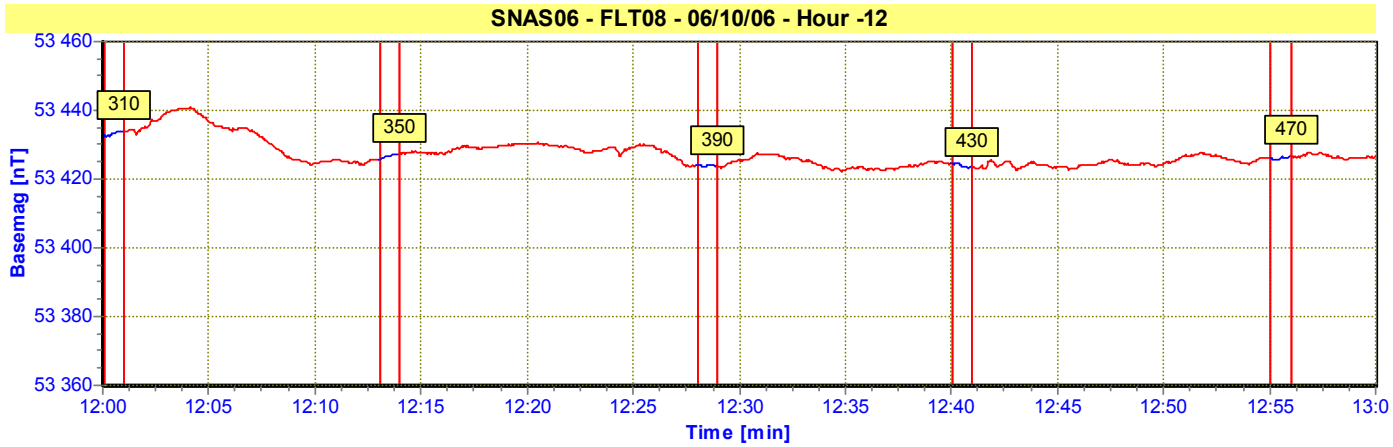

SNAS06 - FLT08 - 06/10/06 - Hour -7
Basemag [nT]
Time [min]
5020
30
5220
5230
70
110
190
230
270
310
350
450

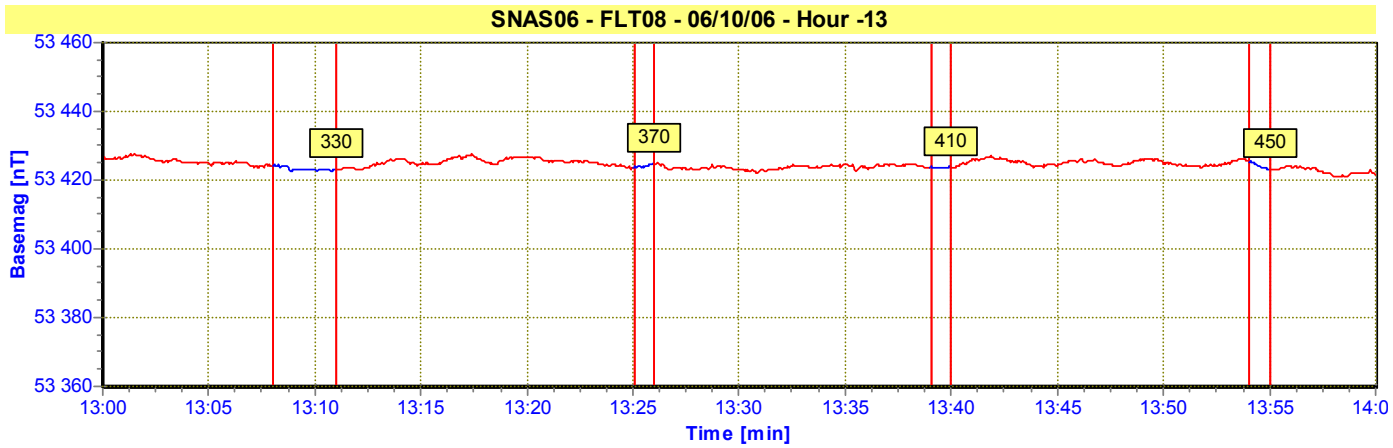

SNAS06 - FLT08 - 06/10/06 - Hour -8
Basemag [nT]
Time [min]
5020

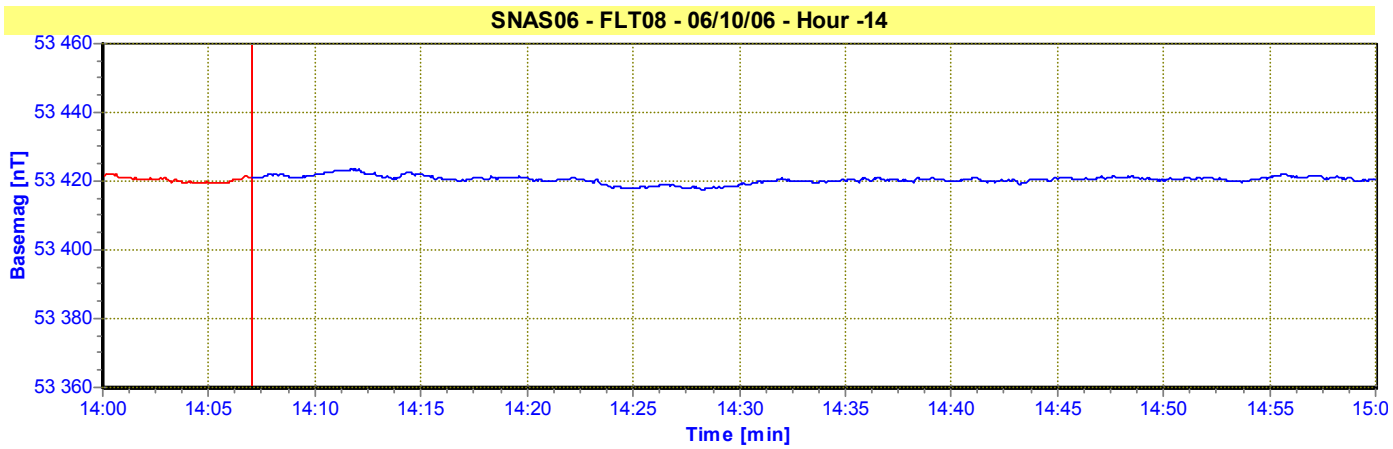

SNAS06 - FLT08 - 06/10/06 - Hour -9
Basemag [nT]
Time [min]
30
5220

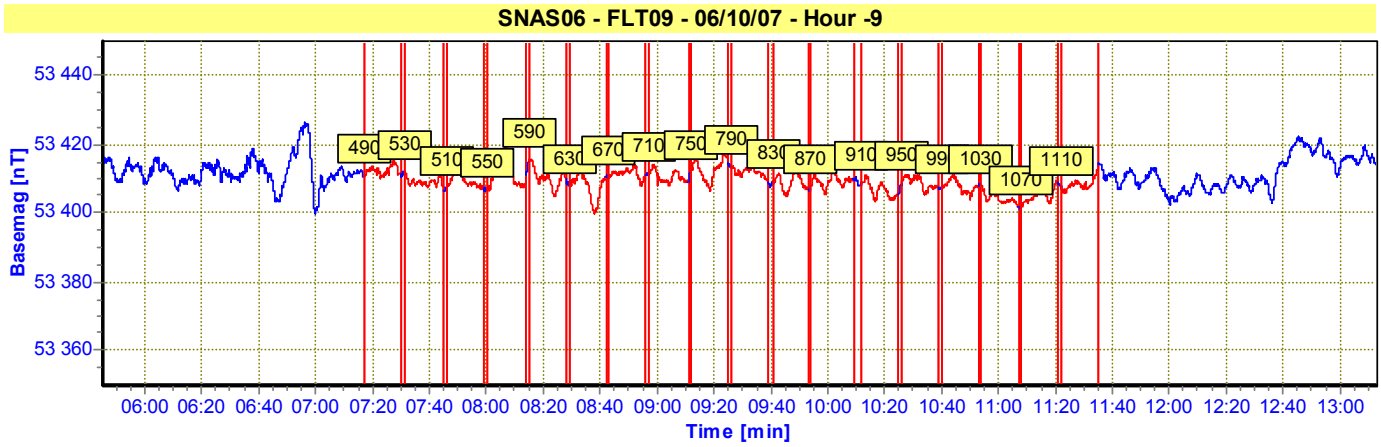

SNAS06 - FLT08 - 06/10/06 - Hour -10
Basemag [nT]
Time [min]
5230
70
110

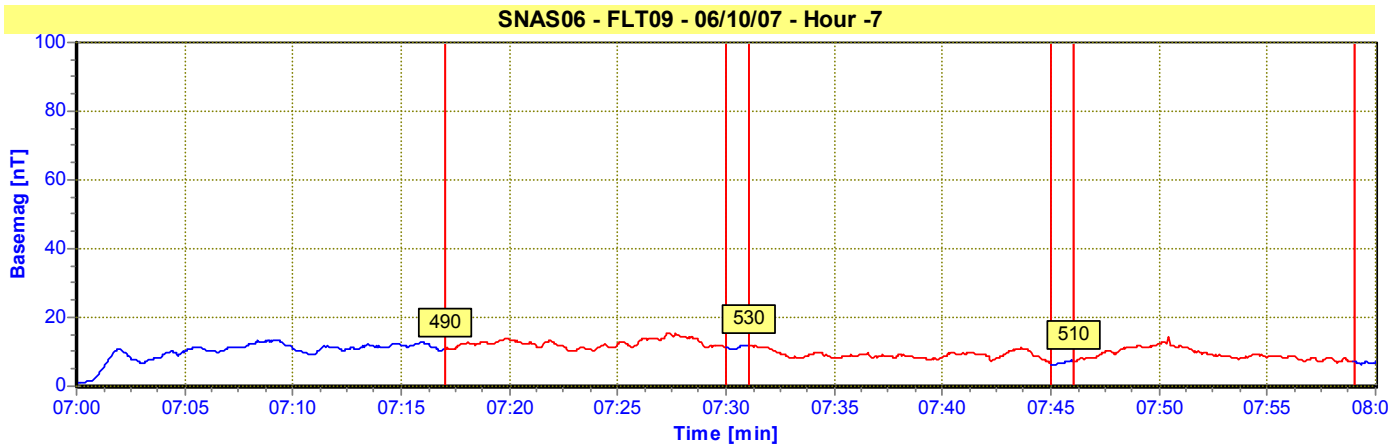

SNAS06 - FLT08 - 06/10/06 - Hour -11
Basemag [nT]
53 460
53 440
53 420
53 400
53 380
53 360
150
190
230
270
11:00
11:05
11:10
11:15
11:20
11:25
11:30
11:35
11:40
11:45
11:50
11:55
12:0
Time [min]

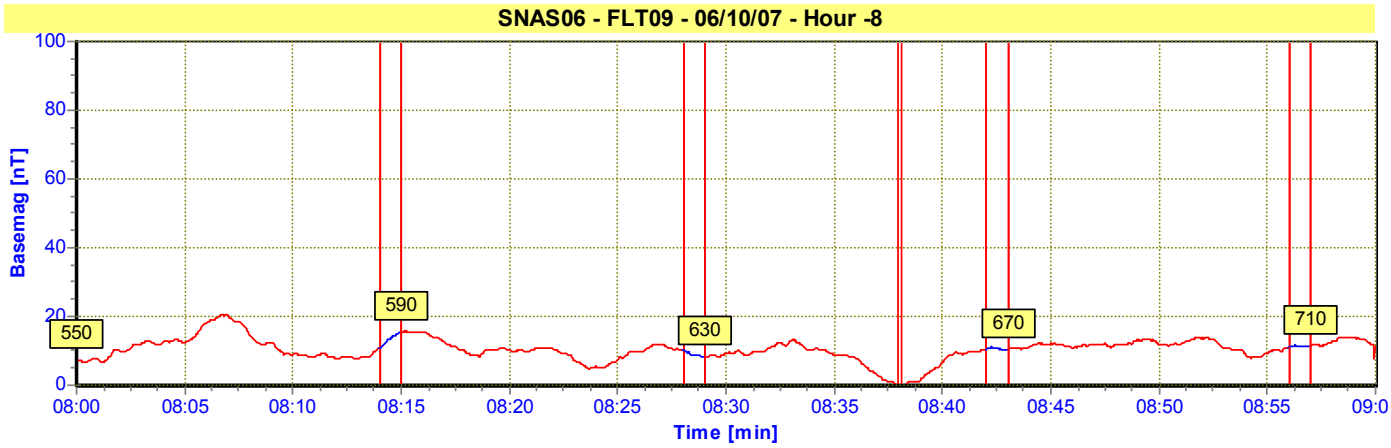

SNAS06 - FLT08 - 06/10/06 - Hour -12
Basemag [nT]
53 460
53 440
53 420
53 400
53 380
53 360
310
350
390
430
470
12:00
12:05
12:10
12:15
12:20
12:25
12:30
12:35
12:40
12:45
12:50
12:55
13:0
Time [min]

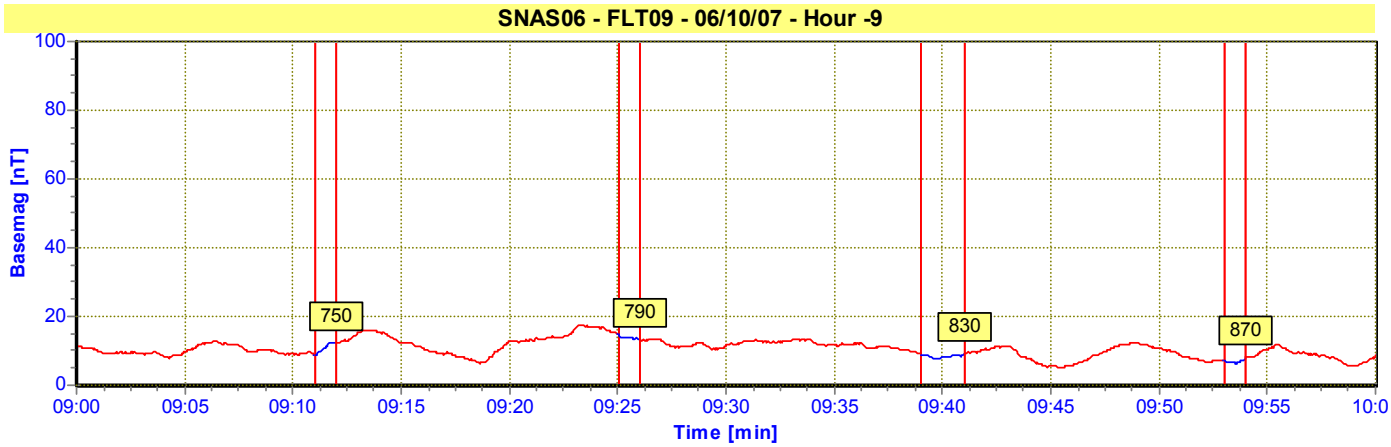

SNAS06 - FLT08 - 06/10/06 - Hour -13
Basemag [nT]
53 460
53 440
53 420
53 400
53 380
53 360
330
370
410
450
13:00
13:05
13:10
13:15
13:20
13:25
13:30
13:35
13:40
13:45
13:50
13:55
14:0
Time [min]


SNAS06 - FLT08 - 06/10/06 - Hour -14
Basemag [nT]
53 460
53 440
53 420
53 400
53 380
53 360
14:00
14:05
14:10
14:15
14:20
14:25
14:30
14:35
14:40
14:45
14:50
14:55
15:0
Time [min]


SNAS06 - FLT09 - 06/10/07 - Hour -9
Basemag [nT]
53 440
53 420
53 400
53 380
53 360
490
530
510
550
590
630
670
710
750
790
830
870
910
950
990
1030
1070
1110
06:00 06:20 06:40 07:00 07:20 07:40 08:00 08:20 08:40 09:00 09:20 09:40 10:00 10:20 10:40 11:00 11:20 11:40 12:00 12:20 12:40 13:00
Time [min]


SNAS06 - FLT09 - 06/10/07 - Hour -7
Basemag [nT]
100
80
60
40
20
0
490
530
510
07:00 07:05 07:10 07:15 07:20 07:25 07:30 07:35 07:40 07:45 07:50 07:55 08:0
Time [min]


SNAS06 - FLT09 - 06/10/07 - Hour -8
Basemag [nT]
100
80
60
40
20
0
550
590
630
670
710
08:00 08:05 08:10 08:15 08:20 08:25 08:30 08:35 08:40 08:45 08:50 08:55 09:0
Time [min]


SNAS06 - FLT09 - 06/10/07 - Hour -9
Basemag [nT]
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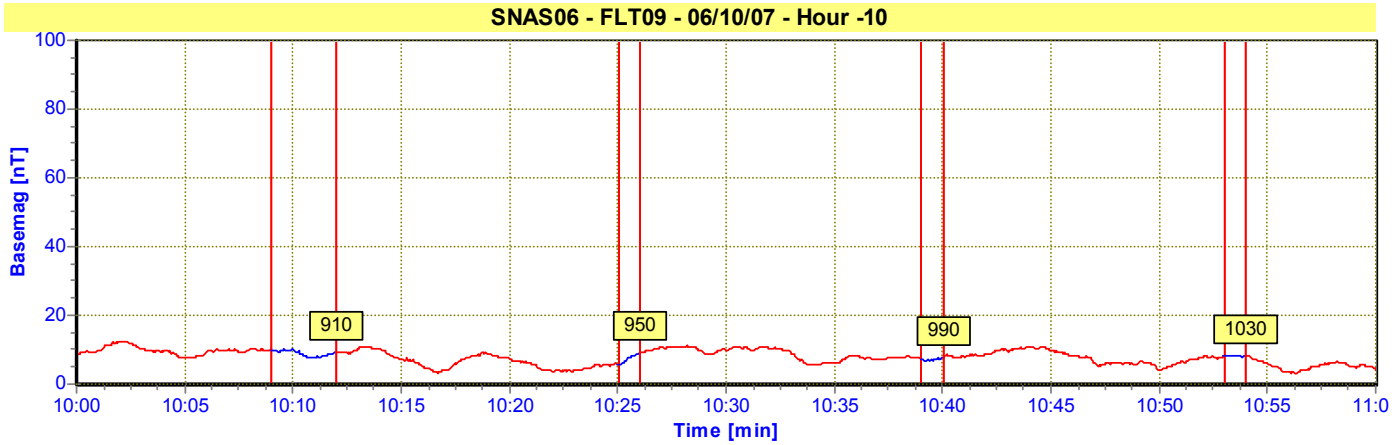
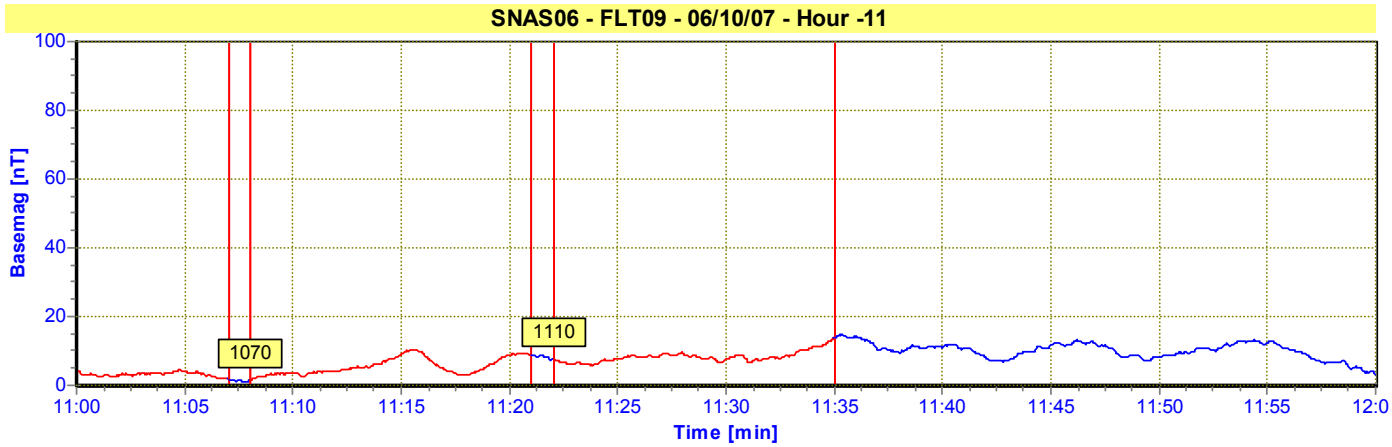
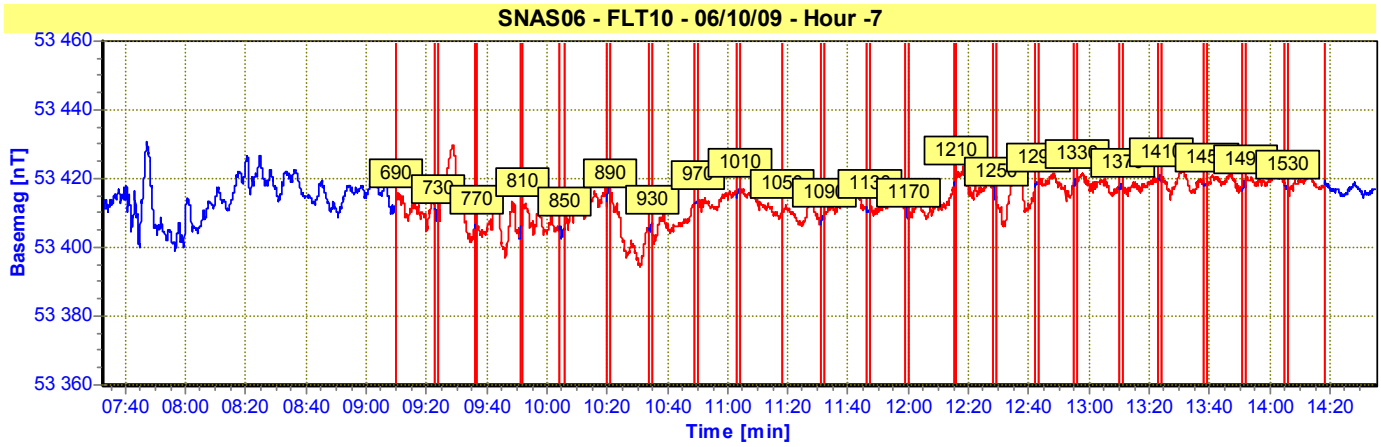
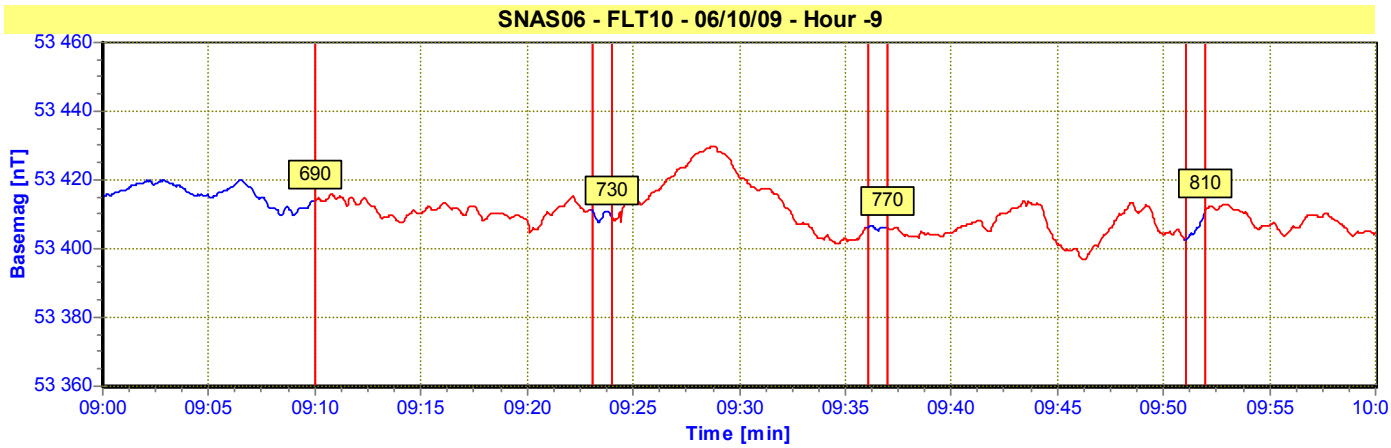
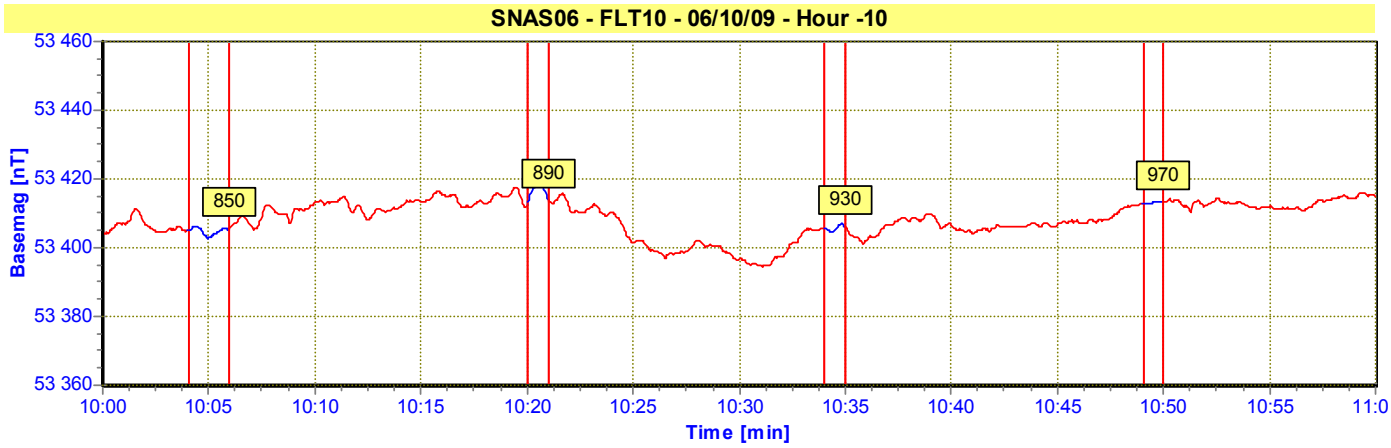
80
60
40
20
0
750
790
830
870
09:00 09:05 09:10 09:15 09:20 09:25 09:30 09:35 09:40 09:45 09:50 09:55 10:0
Time [min]

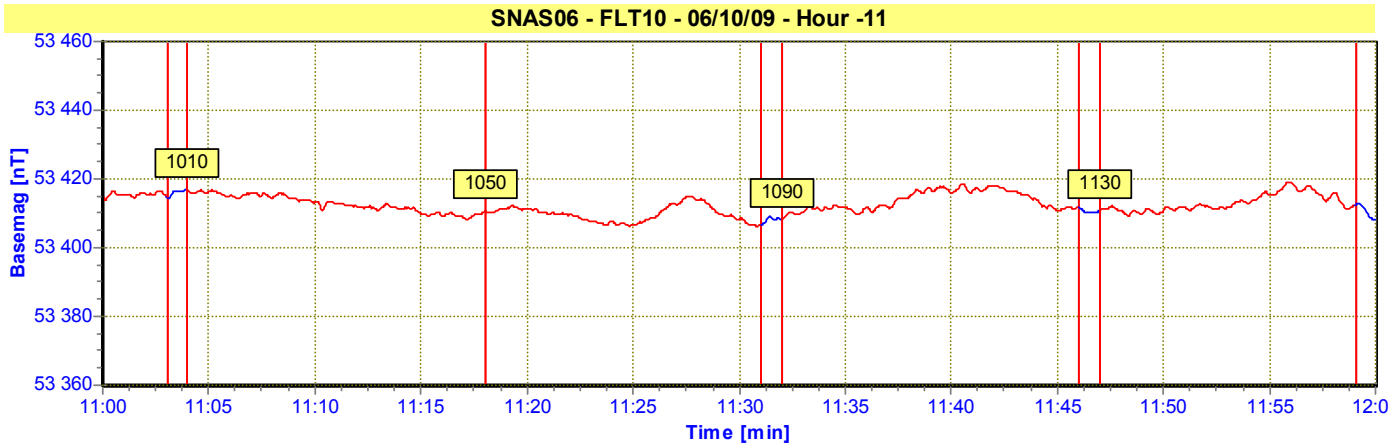

SNAS06 - FLT09 - 06/10/07 - Hour -10
Basemag [nT]
100
80
60
40
20
0
910
950
990
1030
10:00
10:05
10:10
10:15
10:20
10:25
10:30
10:35
10:40
10:45
10:50
10:55
11:0
Time [min]


SNAS06 - FLT09 - 06/10/07 - Hour -11
Basemag [nT]
100
80
60
40
20
0
1070
1110
11:00
11:05
11:10
11:15
11:20
11:25
11:30
11:35
11:40
11:45
11:50
11:55
12:0
Time [min]


SNAS06 - FLT10 - 06/10/09 - Hour -7
Basemag [nT]
53 460
53 440
53 420
53 400
53 380
53 360
690
730
770
810
850
890
930
1010
1170
1210
1530
07:40 08:00 08:20 08:40 09:00 09:20 09:40 10:00 10:20 10:40 11:00 11:20 11:40 12:00 12:20 12:40 13:00 13:20 13:40 14:00 14:20
Time [min]


SNAS06 - FLT10 - 06/10/09 - Hour -9
Basemag [nT]
53 460
53 440
53 420
53 400
53 380
53 360
690
730
770
810
09:00 09:05 09:10 09:15 09:20 09:25 09:30 09:35 09:40 09:45 09:50 09:55 10:0
Time [min]


SNAS06 - FLT10 - 06/10/09 - Hour -10
Basemag [nT]
53 460
53 440
53 420
53 400
53 380
53 360
850
890
930
970
10:00 10:05 10:10 10:15 10:20 10:25 10:30 10:35 10:40 10:45 10:50 10:55 11:0
Time [min]


SNAS06 - FLT10 - 06/10/09 - Hour -11
Basemag [nT]
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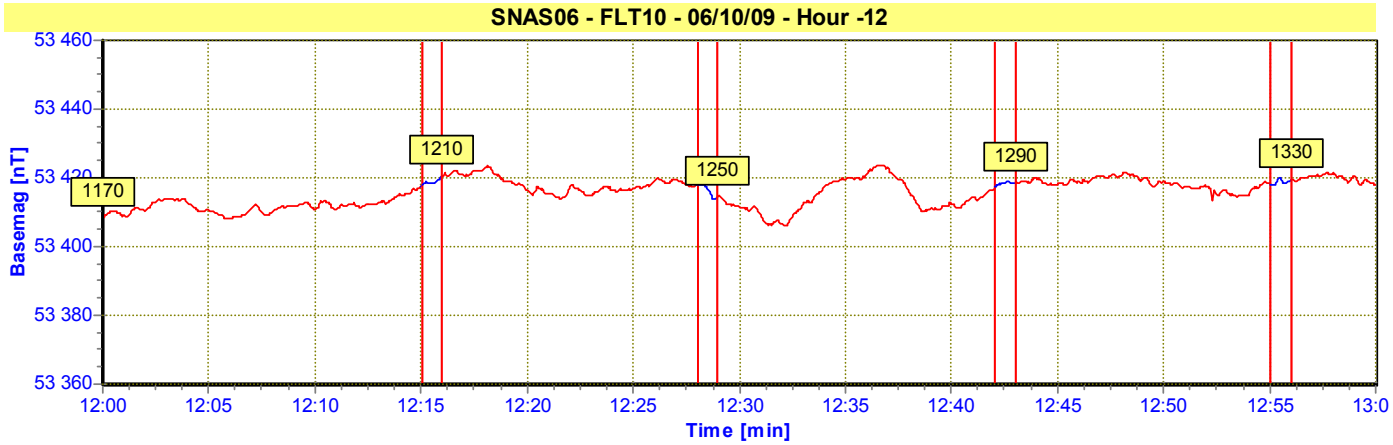
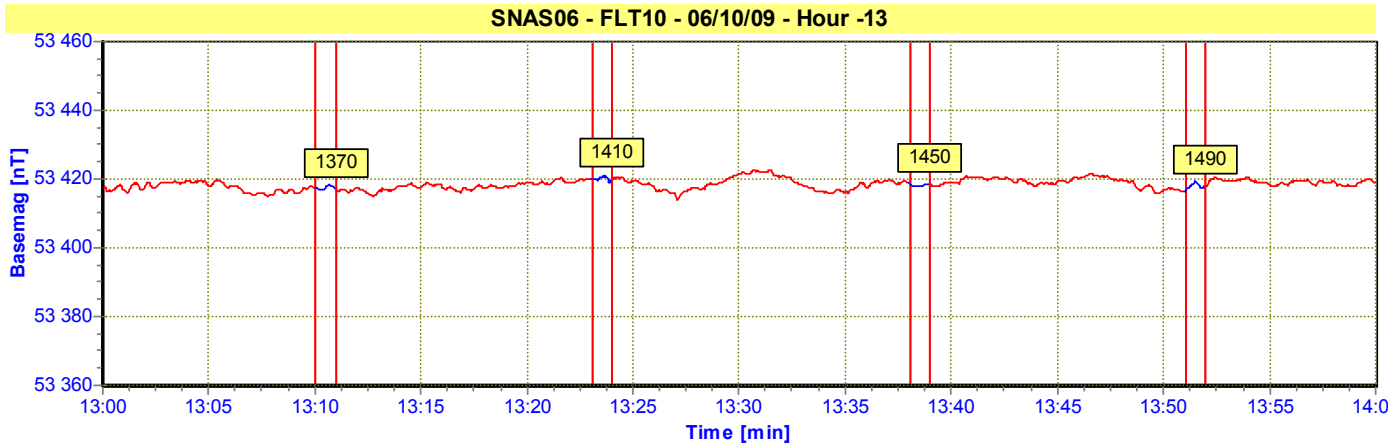
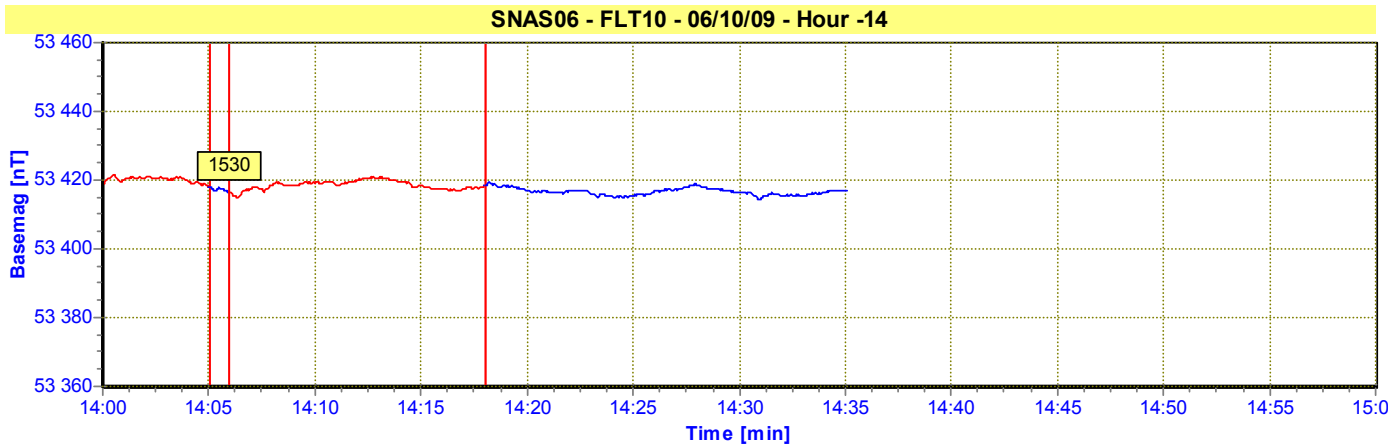
53 440
53 420
53 400
53 380
53 360
1010
1050
1090
1130
11:00 11:05 11:10 11:15 11:20 11:25 11:30 11:35 11:40 11:45 11:50 11:55 12:0
Time [min]


SNAS06 - FLT10 - 06/10/09 - Hour -12
Basemag [nT]
53 460
53 440
53 420
53 400
53 380
53 360
1170
1210
1250
1290
1330
12:00
12:05
12:10
12:15
12:20
12:25
12:30
12:35
12:40
12:45
12:50
12:55
13:0
Time [min]


SNAS06 - FLT10 - 06/10/09 - Hour -13
Basemag [nT]
53 460
53 440
53 420
53 400
53 380
53 360
1370
1410
1450
1490
13:00
13:05
13:10
13:15
13:20
13:25
13:30
13:35
13:40
13:45
13:50
13:55
14:0
Time [min]


SNAS06 - FLT10 - 06/10/09 - Hour -14
Basemag [nT]
53 460
53 440
53 420
53 400
53 380
53 360
1530
14:00
14:05
14:10
14:15
14:20
14:25
14:30
14:35
14:40
14:45
14:50
14:55
15:0
Time [min]

APPENDIX 2

ARCHIVE CD FOR THE SOUTHERN NORDKAPP BASIN AEROMAGNETIC SURVEY 2006 - SNAS-06 (NGU, 18.12.2006)

CONTENTS:

REPORTS (in word- and pdf-formats)

Report:
SNAS-06_Report_2006_089.doc
Report:
SNAS-06_Report_2006_089.pdf

MAPS in MAP- and JPG-formats:

1. MAP1_2006_089-01.map, MAP1_2006_089-01.jpg:

Total magnetic field. Referred to IGRF-2006. Statistical, median and micro levelling.
Upward continuation 200 m.

2. MAP2_2006_089-02.map, MAP2_2006_089-02.jpg:

Magnetic residual field. Referred to IGRF-2006. Statistical, median and micro levelling.
Upward continuation 200 m. High-pass Gaussian filter 20 km.

3. MAP3_2006_089-03.map, MAP3_2006_089-03.jpg:

Magnetic analytic signal (total gradient amplitude). Upward continuation 200 m.
High-pass Gaussian filter 20 km.

PROFILE-DATA (UTM zone 35, WGS84 datum), Geosoft _.gdb and _.XYZ-formats:

SNAS06_Merged.gdb and SNAS06_Merged.XYZ

FORMAT DESCRIPTION and COLOMN NAMES DEFINITION:

1. Time_h_m_s, TIME12,2	Time, (hour, minute, second)
2. UTME, F8,1	X koordinate, (m)
3. UTMN, F9,1	Y koordinate, (m)
4. Lat_d, F8,5	Longitude, (decimal degrees)
5. Long_d, F8,5	Latitude,(decimal degrees)
6. Distance, I5	Distance, (meter)
7. Alt_R_m, F7,2	Radar altitude, (meter)
8. M_base, F8,2	Base station magnetics, (nT)
9. M_IGRF06, F8,2	IGRF-2006 field values, (nT)
10. M_raw, F8,2	Raw magnetic data, (nT)
11. M_raw_sr_l, F8,2	Despiked raw magnetic data, (nT)
12. M_sr_l_anom, F6,2	Total magnetic field referred to IGRF-2006, (magnetic anomaly), (nT)
13. M_sr_l_anom_lag, F7,2	Lag corrected magnetic anomaly, (nT)
14. M_sr_l_anom_full, F7,2	Full levelled (Systematically corrected and Statistically levelled) magnetic anomaly, (nT)
15. M_l_anom_full_mic1, F6,2	Full and median levelled magnetic anomaly, (nT)
16. M_l_anom_full_mic1_mic2_map, F6,2	Full, median and micro levelled magnetic anomaly, (nT)
17. M_l_anom_full_mic1_mic2_u_200m, F6,2	Full, median and micro levelled magnetic anomaly, upward continuation 200 m, (nT)

18. M_l_anom_full_mic1_mic2_u_200m_res_20km,F6,3 Magnetic residual field referred to IGRF-2006. Statistical, median and micro levelling. Upward continuation 200 m. High-pass Gaussian filter 20 km.

19. M_l_anom_full_mic1_mic2_u_200m_res_20km_a, F7,5 Magnetic analytic signal (total gradient amplitude). Upward continuation 200 m. High-pass Gaussian filter 20 km.

Undefined values: *

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 11:19:47.00        *         *         *         *     *       * 53410.91        * 54171.88 54171.87
* -108.15  -90.54      *      *      *      *       *
 11:19:47.00        *         *         *         *     *       * 53410.90        * 54171.88 54171.87
* -108.15  -90.54      *      *      *      *       *
 11:19:48.00        *         *         *         *     *       * 53410.89        * 54171.88 54171.86
* -108.15  -90.53      *      *      *      *       *
 11:19:48.00        *         *         *         *     *       * 53410.89        * 54171.88 54171.86
* -108.15  -90.53      *      *      *      *       *
 11:19:48.00        *         *         *         *     *       * 53410.89        * 54171.87 54171.86
* -108.15  -90.53      *      *      *      *       *



 11:42:44.00        *         *         *         *     *       * 53408.46        * 54149.21 54149.21
*  -92.06  -74.44      *      *      *      *       *
 11:42:44.00        *         *         *         *     *       * 53408.46        * 54149.21 54149.20
*  -92.06  -74.44      *      *      *      *       *
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92.04  -92.05  -74.44 -74.26 -74.32 -73.63 -1.666 0.00088
 11:42:44.00 567147.8 8028265.5 72.34269 28.98370     9  300.67 53408.46 54241.24 54149.20 54149.20 -
92.04  -92.05  -74.43 -74.26 -74.32 -73.62 -1.665 0.00088
 11:42:45.00 567141.5 8028271.9 72.34275 28.98352    18  300.85 53408.45 54241.23 54149.19 54149.19 -
92.04  -92.05  -74.43 -74.25 -74.31 -73.62 -1.665 0.00088
 11:42:45.00 567132.2 8028281.6 72.34284 28.98325    31  301.14 53408.45 54241.22 54149.19 54149.19 -
92.03  -92.05  -74.43 -74.25 -74.31 -73.61 -1.664 0.00088
```

GRID-FILES (200x200m grid, UTM zone 35, WGS84 datum), Geosoft _.grd and _.XYZ-formats:

1.SNAS06_MedLev.grd, SNAS06_MedLev.XYZ

Full and median levelled magnetic anomaly

Grid-file format:

```
UTME,NORMAL,6,0
UTMN,NORMAL,7,0
M_l_anom_full_mic1,NORMAL,6,2


504800 7966800 -75.36
505000 7966800 -75.09
505200 7966800 -74.87
505400 7966800 -74.65
505600 7966800 -74.35
```

2. SNAS06_MedLevMicLev.grd, SNAS06_MedLevMicLev.XYZ

Full, median and micro levelled magnetic anomaly

Grid-file format:

```
UTME,NORMAL,6,0
UTMN,NORMAL,7,0
M_l_anom_full_mic1_mic2_map,NORMAL,6,2

504800 7966800 -75.47
505000 7966800 -75.22
505200 7966800 -75.00
505400 7966800 -74.81
505600 7966800 -74.55
```

3. SNAS06_MTot_lev_u_200.grd, SNAS06_MTot_lev_u_200.XYZ

Full, median and micro levelled magnetic anomaly, upward continuation 200 m

Grid-file format:

```
UTME,NORMAL,6,0
UTMN,NORMAL,7,0
```

M_l_anom_full_mic1_mic2_u_200m,NORMAL,6,2

504800 7966800 -76.86
505000 7966800 -76.60
505200 7966800 -76.35
505400 7966800 -76.12
505600 7966800 -75.87

4. SNAS06_Res_20km.grd, SNAS06_Res_20km.XYZ

Magnetic residual field. Referred to IGRF-2006. Statistical, median and micro levelling.
Upward continuation 200 m. High-pass Gaussian filter 20 km.

Grid-file format:

UTME,NORMAL,6,0
UTMN,NORMAL,7,0
M_l_anom_full_mic1_mic2_u_200m_res_20km,NORMAL,6,3

504800 7966800 5.637
505000 7966800 5.614
505200 7966800 5.583
505400 7966800 5.563
505600 7966800 5.580

5. SNAS06_Res20km_AnSig.grd, SNAS06_Res20km_AnSig.XYZ

Magnetic analytic signal (total gradient amplitude).
Upward continuation 200 m. High-pass Gaussian filter 20 km.

Grid-file format:

UTME,NORMAL,6,0
UTMN,NORMAL,7,0
M_l_anom_full_mic1_mic2_u_200m_res_20km_a,NORMAL,7,5

504800 7966800 0.00279
505000 7966800 0.00248
505200 7966800 0.00228
505400 7966800 0.00204
505600 7966800 0.00192