INTRODUCTION

This volume contains the results of geomagnetic measurements carried out at the Leirvogur Magnetic Observatory in Iceland during the year 2005. The observatory, which was established in 1957, is run by the Upper Atmosphere Section of the Science Institute, University of Iceland. A description of the observatory and its development up to 1968 may be found in a report published in 1969. More recent events are covered in the yearbooks.

The observatory is located on a river estuary, 5 m above mean sea level, 12 km ENE of Reykjavík (20 km by road). The geographic coordinates of the observatory's reference point are

$$64°10'.986 \text{ N}, \quad 21°41'.920 \text{ W} \ \ (\text{WGS84}).$$

The geomagnetic coordinates relative to a pole position of $79.°4$ N, $71.°7$ W are $69.°4$ N, $71.°8$ E. The McIlwain L-parameter of the observatory in 2005 was approximately 5.5 earth-radii, the corresponding corrected geomagnetic latitude being $64.°9$. The geomagnetic conjugate point at 100 km altitude was at $69.°1$ S, $30.°8$ E geographic, about 3ZZ km from the Japanese Antarctic station Syowa.

PERSONNEL

In 2005, the upper Atmosphere Section had a staff of three: Þorsteinn Sæmundsson, director, Jón Sveinsson, electronics technician, and Pálmi Ingólfsson, research assistant. Jón worked part time for health reasons. On March 31, Þorsteinn retired from his position after 48 years of work at observatory, most of that time as director. He was succeeded, from April 1, by Gunnlaugur Björnsson, formerly of the Physics Division of the Science Institute.

Marteinn Sverrisson of the Physics Division continued to maintain and update the Linux operating system used for handling the 10-second data at Leirvogur.

Selma Bjarnadóttir at the nearby farm Leirvogstunga contributed to the security of the observatory by watching out for uninvited visitors.

DEVELOPMENTS

The staff made 84 trips to the observatory in 2005. A Skoda Fabia belonging to the Upper Atmosphere Section was used for transportation to and from Leirvogur.

The environment

Weather was mild most of the year with only slight snow that did not cause any problems. The lowest temperature was $-11°$C in January, and the highest was $+24°$C in June, July and August.

The electrical supply was uninterrupted throughout the year.

The land around the observatory has long been defined as a recreational area by planning authorities. The owners of the nearby farm Leirvogstunga have decided to convert some of their land to a housing project with about 400 houses and apartments. If accepted by planning authorites this may have copnsequences for the observatory, in particular with increased traffic and possible intrusion. Possible counter-measures are being investigated.

In August, several horses from a nearby fence manged to get through the fences around the observatory. When discovered, they had apparently been there for a few days. They had clearly rubbed themselfs both against Flosabær and Vesturbær and also the glass secondary pillar that collapsed.

On the weekend of August 27-28, a series of football matches was held on the sports field, attended by large crowds of people. A watch was kept to ensure cars were not parked too close to the observatory and to ward off inquisitive spectators. Matches like these have become an annual event.

Digital fluxgate systems I and II

On October 31, the charger for system I failed, with the continuous proton magentometer Móði also failing. Both were connected to the system II charger while a replacement charger was accquired. The records from system II were used for backup for a total of 7.4 hours.

On November 30, the data logger on system II showed a 'disk error'. On December 1, the computer failed. When this was being fixed, system I also failed as they are not fully independent. When system I was restarted the system clock was wrong and was not corrected in the appropriate way. Thus, about 46 minutes of data was lost. Rebooting system II computer fixed the disk errors reported.

On April 27, the thermostat in the variometer house Flosabær, were system II (Emil) is located, was adjusted from winter level ($13°$C) to summer level ($20°$C). Readjustment to winter level took place on October 26.

The thermostat in Vesturbær which houses system I (Óli) was adjusted from winter level ($13°$C) to summer level ($21°$C) on May 18. Readjustment took place on November 2.

Móði

The magnetizing unit of the continuous proton magnetometer Móði was renewed in January. The signal was lost on October 31 when charger to system I failed. This is because the elctronics of Móði shares the same power supply as system I.

Geó

The conventional proton magnetometer Geó (G856-AX) was used in the absolute measurements. Obtaining a satisfactory functioning with the 50 m cable to Nýbær proved problematic, but was finally solved in February.

On November 25, a metal rack holding Geó and a few other insturments was removed to free up space. Thereafter Geó began to show signs of a weak signal from Miðbær. An interference with chargers and other equipment in Nýbær was suspected as measurments with the instrument placed near Miðbær never showed such symptoms and no systematic weak signal pattern was evident. The cause of the weak signal has not yet been identified.

Backup computer

The PC-computer "Muninn", which has been used at the Science Institute for receiving and storing 10-second data from Leirvogur, worked without problems except for power failures that happended YY times during the year.

Real-time displays on the Web

The real-time display of the Leirvogur recordings on the World Wide Web was interrupted xx times during the year, YY times because of power outage, and ZZ times because of corrupt data files. Transmissions at hourly intervals for display at the World Data Centre in Kyoto were also affected.

Time control

A quartz clock of the type Omegaface is used for timing the data. Two clocks are maintained, a main clock and a backup unit. These are corrected by means of GPS signals once a week. This is generally sufficient for keeping the timings correct to within 1 second. The clocks are also compared with time signals from Rugby on 60 kHz.

The old crystal clock, which served as the main observatory clock from 1963 to 1988 was kept running. It is believed to be the oldest Icelandic-built electronic device still working.

ADSL conncetion

As a first step in replacing the old BBC data loggers with new computers, an ADSL-connection was installed in October. The laptop PC-computer storing 10-second data at Leirvogur was thus accessible via the internet. The dial-in connection was kept as a backup but has not been used since. As the new data-loggers come on line, the internal network at Leirvogur will be accessible from the outside (from designated computers only), enabling a routine check on all devices and regular data delivery to the Science Institute.

General maintenance and modifications

Trees and hedges were pruned and fertilizer applied. Because of the warm weather, tree growth was rather rapid.

Wooden parts of the toolshed Suðurbær was painted in April as well as the doors to Móðabær and Flosabær.

During the summer and autumn, the grass around the observatory was cut from time to time with a lawnmower and a brush cutter.

MAGNETOMETERS

The observatory possesses the following instruments:

1. A triaxial fluxgate variometer, “Óli” (Óli II), of the type FGE, version E, from the Dansih Meteorological Institute, with suspended sensors and a digital data logger designed and built at the Science Institute. This is the primary recording instrument at Lerivogur. The sensor elements are oriented in the approximate directions of Z (vertical), H (magnetic north) and D (magnetic east). The logger uses an Acorn BBC B+ microcomputer with two floppy drives, each able to store 12 days of data. The records contain 1-minute means of the elements and show the extreme departures from the mean during each minute. Hourly means are both stored and printed out. Momentary values at 10-second intervals are recorded by a PC laptop computer linked to BBC monitoring and disply computers. The 10-second values are also transmitted by UHF radio to the Science Institute in Reykjavík and stored there on a PC computer.

2. A triaxial fluxgate variometer, “Emil”, of the type FG84C with a BBC+ data logger identical to that of Óli. This serves as a backup for Óli. All the 1-minute data from this instrument are fully processed.

3. A triaxial fluxgate variometer, Óli I, of the same type as Emil, superseded by Óli II in October 1998.

4. A Sigurgeirsson proton magnetometer (“Móði”) producing an uninterrupted record of the total force F. The precession cycles are counted and 1-minute averages recorded using the data loggers serving the fluxgate variometers Óli and Emil. Hourly means are also printed out. 10-second averages are recorded on a PC computer at Leirvogur and transmitted by radio to a backup computer and a display in Reykjavík.

5. A Geometrics G856-AX proton magnetometer (“Geó II”).

6. A Declination-Inclination fluxgate magnetometer (DI-flux, “Stefnir”) based on a Zess Jena Theo 010 B theodolite, with electronics from the Auroral Observatory, Tromsø.

7. A second, identical DI-flux instrument, “Stefnir-II”, also with electronics from Tromsø.

8. A portable fluxgate magnetometer (“Ferðaflosi”) made by Fjarskiptatækni for diverse applications.

In addition, the observatory has an astatic magnetometer and access to two portable proton magnetometers, a Barringer GM-122 (“Barri”) and a Geometrics G856-AX (“Geó”). These three instruments belong to Dr. Leó Kristjánsson of the Geophysics Division of the Science Institute.

The above list includes only those instruments that are in active use or are kept in reserve.

TIME CONTROL

The digital fluxgate loggers are controlled by a quartz crystal clock which is adjusted using a signal from the Global Positioning System (GPS). The aim has been to keep the timing correct to within one second. This limit was exceeded five times in 2005.

ABSOLUTE MEASUREMENTS

To determine the base-line values for the triaxial fluxgates Óli and Emil, absolute measurements were carried out by means of the proton magnetometers Geó and Móði and the DI-fluxgate magnetometer Stefnir. Traditionally, these measurements have been made once a week, on Wednesday afternoons, irrespective of the magnetic conditions.

The magnetometer Geó was used for measuring the total intensity (F) on the absolute pier. The crystal oscillator correction for Geó was checked regularly in 2005 and found quite stable, about -0.3 nT.

While measurements with Stefnir are in progress, the proton magnetometer probe must be removed from the absolute pier. Simultaneous measurements of the total field can be made, however, feeding the electronics with the signal from Móði. As the probe of Móði is situated some 15 meters from the absolute pier, a site correction must be applied. This correction is subject to changes whenever magnetic parts of the Móði system are moved or modified. Its value is checked by comparison measurements once a week. In 2005, the correction varied between -4.5 nT and -3.5 nT.

Stefnir measures the declination (D) and the inclination (I) of the geomagnetic field. The theory of the DI-fluxgate has been treated by Kring Lauridsen (Danish Meteorological Institute Geophysical Papers, R-71, 1985). For measurements of declination, the standard measuring scheme at Leirvogur involves four readings with the telescope facing west and four readings with the telescope facing east. For every reading with the telescope in an upright position (with the fluxgate sensor on top) there is a corresponding reading in an inverted position. From such a set of measurements the declination can be derived, along with the collimation angles of the sensor and the zero correction of the sensor output.

For measurements of inclination, the adopted measuring scheme consists of eight measurements with the telescope oriented in the magnetic meridian and tilted at right angles to the total field vector. Four measurements are made with the telescope pointing south and four with the telescope pointing north. All readings are made with the telescope in the same (upright) position. In each case the total field is measured simultaneously and the total intensity, both the vertical and horizontal intensities can be calculated.

BASE LINES

Digital Fluxgate I (Óli)

The base-line values derived from the absolute measurements are shown in graphic form on pages XX-YY. Individual measurements are indicated by squares. The solid lines which shift in steps are the adopted base-line values Z_0, H_0 and D_0, the definition of which will be given below.

The method used to derive Z, H, and D from the observed fluxgate readings will now be described. The first step occurs in the logging program where the raw values are multiplied by 0.15 to make the output unit correspond to 1 nT. Fixed constants are then added to give suitable base levels. For the electronics installed in 2002, these constants are 47802 for Z, 10164 nT for H and 2199 nT for D (see yearbook 2002, p. 14). The resulting outputs are the "observed" readings Z_1, H_1 and D_1. These readings are then corrected as follows (in units of nanotesla):

$$\begin{pmatrix} Z_2 \\ H_2 \\ D_2 \end{pmatrix} = \begin{pmatrix} 138 \\ 38 \\ -200 \end{pmatrix} + \begin{pmatrix} 1-3\epsilon & \epsilon & 0.0 \\ 0.0 & 1-3\epsilon & -\epsilon \\ 0.0 & 0.0 & 1-3\epsilon \end{pmatrix} \begin{pmatrix} Z_1 \\ H_1 \\ D_1 \end{pmatrix},$$

where $\epsilon = 0.001$. These corrections allow for the sensor' departure from orthogonality, found by rotating the instrument under controlled conditions. The fact that the scale values depart slightly from unity is also allowed for. The additive constants are adjusted to make the horizontal component similar to that in the absolute hut, Miðbær, both in size and direction.

The formulae giving the field in the absolute hut are then

$$\begin{aligned} Z &= Z_0 + Z_2 \\ H &= H_0 + \sqrt{H_2^2 + D_2^2} \\ D &= D_0 + \arctan(D_2/H_2) \end{aligned} \quad ,$$

where Z_0, H_0, and D_0 are the base-line values. The adopted base-line values for 2005 were as follows:

Vertical intensity (Z_0):

		nT
Jan 1	– Feb 28	0.0
Mar 1	– May 18 (15:54)	-0.5
May 18	– May 18 (17:58)	0.0
May 18	– May 18 (20:00)	0.5
May 18	– Nov 2 (17:20)	1.0
Nov 2	– Nov 2 (20:50)	0.5
Nov 2	– Nov 2 (23:20)	0.0
Nov 2	– Dec 31	-0.5

Horizontal intensity (H_0):

		nT
Jan 1	– May 18 (14:52)	-3.5
May 18	– May 18 (15:54)	-3.0
May 18	– May 18 (16:56)	-2.5
May 18	– May 18 (17:58)	-2.0
May 18	– May 18 (19:00)	-1.5
May 18	– May 18 (20:00)	-1.0
May 18	– Sep 10	-0.5
Sep 11	– Sep 30	-1.0
Oct 1	– Nov 2 (16:10)	-0.5
Nov 2	– Nov 2 (17:20)	-1.0
Nov 2	– Nov 2 (18:50)	-1.5
Nov 2	– Nov 2 (19:44)	-2.0
Nov 2	– Nov 2 (20:50)	-2.5
Nov 2	– Nov 2 (22:06)	-3.0
Nov 2	– Nov 2 (23:20)	-3.5
Nov 2	– Dec 31	-4.0

Declination ($D_0$0):

Jan 01	– Jan 08	$344^\circ\ 04'.8$
Jan 09	– Jan 23	$344^\circ\ 04'.9$
Jan 24	– Feb 05	$344^\circ\ 05'.0$
Feb 06	– May 18 (15:54)	$344^\circ\ 04'.9$
May 18	– May 18 (17:58)	$344^\circ\ 04'.8$
May 18	– May 18 (20:00)	$344^\circ\ 04'.7$
May 18	– May 31	$344^\circ\ 04'.6$
Jun 01	– Jun 30	$344^\circ\ 04'.4$
Jul 01	– Aug 31	$344^\circ\ 04'.5$
Sep 01	– Sep 30	$344^\circ\ 04'.4$
Oct 01	– Oct 15	$344^\circ\ 04'.3$
Oct 16	– Nov 02 (17:20)	$344^\circ\ 04'.4$
Nov 02	– Nov 02 (18:50)	$344^\circ\ 04'.5$
Nov 02	– Nov 02 (20:50)	$344^\circ\ 04'.6$
Nov 02	– Nov 02 (23:20)	$344^\circ\ 04'.7$
Nov 02	– Dec 31	$344^\circ\ 04'.8$

The changes in base lines in May 18 and November 2 were caused by adjustments of the thermostat in the variometer building Vesturbær. The temperature coefficient is about 0.25 nT/°C for Z and 0.4 nT/°C for H and D.

Scale values. The scale values of Óli are close to unity (1 nT/unit). This was confirmed by indirect tests in 1998 (see yearbook p. 18). The tests have not been repeated since a new electronic unit was installed in October 2002. The intrinsic sensitivity of the instrument is actually higher by a factor of 6.25 but is reduced by inserting a suitable term in the program of the logging computer as explained above.

Digitial fluxgate II (Emil)

The base-line values derived from the absolute measurements are shown graphically on pages xx-yy. The data are handled in the same way as the data for system I (Óli), except that the observed values Z_1, H_1 and D_1 represent the raw data and are not altered by the logging program. The corrections to the observed values were determined by a Helmholtz coil. In 2005 the following formulae were used:

$$\begin{pmatrix} dZ \\ dH \\ dD \end{pmatrix} = \begin{pmatrix} 70 \\ 50 \\ -178 \end{pmatrix} + \begin{pmatrix} -\epsilon & -3\epsilon & 2\epsilon \\ 0.0 & 0.0 & -9\epsilon \\ -2\epsilon & 3\epsilon & -\epsilon \end{pmatrix} \begin{pmatrix} Z_1 \\ H_1 \\ D_1 \end{pmatrix},$$

where $\epsilon = 0.001$. The adopted base-line values for 2005 were as follows:

Vertical intensity (Z_0):

		nT
Jan 01	– Feb 03	7.5
Feb 04	– Feb 08	7.0
Feb 09	– Feb 12	6.5
Feb 13	– Feb 15	7.0
Feb 16	– Feb 18	6.5
Feb 19	– Feb 28	7.0
Mar 01	– Mar 01	6.5
Mar 02	– Mar 15	6.0
Mar 16	– Mar 23	6.5

		nT
Mar 24	– Mar 28	6.0
Mar 29	– Apr 12	5.0
Apr 13	– Apr 18	4.0
Apr 19	– Apr 27 (16:57)	3.5
Apr 27	– Apr 27	-10.0
Apr 28	– May 03	-8.5
May 04	– May 07	-8.0
May 08	– May 15	-7.5
May 16	– May 28	-6.0
May 29	– May 31	-5.5
Jun 01	– Jul 18	-5.0
Jul 19	– Jul 27 (10:50)	-6.0
Jul 27	– Jul 27 (13:20)	-5.0
Jul 27	– Jul 27 (21:57)	-4.0
Jul 27	– Jul 27 (23:20)	-5.0
Jul 27	– Jul 31	-6.0
Aug 01	– Aug 03	-6.5
Aug 04	– Aug 14	-7.0
Aug 15	– Aug 22	-7.5
Aug 23	– Aug 27	-8.0
Aug 28	– Sep 22	-7.5
Sep 23	– Sep 28	-6.5
Sep 29	– Oct 10	-5.5
Oct 11	– Oct 13	-5.0
Oct 14	– Oct 26	-4.0
Oct 27	– Dec 17	7.5
Dec 18	– Dec 31	6.5

Horizontal intensity (H_0):

		nT
Jan 01	– Jan 16	4.0
Jan 17	– Feb 12	4.5
Feb 13	– Mar 01	4.0
Mar 02	– Mar 09	4.5
Mar 10	– Apr 26	4.0
Apr 27	– Apr 27 (16:57)	3.0
Apr 27	– May 03	-0.3

		nT
May 04	– May 15	0.0
May 16	– May 31	0.5
Jun 01	– Jul 31	1.0
Aug 01	– Sep 28	0.5
Sep 29	– Oct 26	1.0
Oct 27	– Dec 31	5.5

Declination (D_0):

Jan 01	– Jan 16	$344° \ 16.'4$
Jan 17	– Jan 31	$344° \ 16.'2$
Feb 01	– Feb 06	$344° \ 16.'3$
Feb 07	– Feb 17	$344° \ 16.'5$
Feb 18	– Feb 28	$344° \ 16.'2$
Mar 01	– Mar 31	$344° \ 16.'1$
Apr 01	– Apr 27 (16:57)	$344° \ 16.'9$
Apr 27	– May 07	$344° \ 16.'5$
May 08	– May 15	$344° \ 16.'3$
May 16	– May 28	$344° \ 16.'4$
May 29	– Jul 18	$344° \ 16.'3$
Jul 19	– Aug 27	$344° \ 16.'2$
Aug 28	– Sep 13	$344° \ 16.'3$
Sep 14	– Sep 28	$344° \ 16.'6$
Sep 29	– Oct 26	$344° \ 16.'5$
Oct 27	– Dec 17	$344° \ 16.'7$
Dec 18	– Dec 31	$344° \ 16.'9$

The steps in the base lines on April 27 and October 26 were caused by adjustments of the thermostat in the variometer house. A change in $1°$C at the sensors of Emil alters the Z base line by $\sim$1.4 nT, the H base line by $\sim$0.6 nT and the D base line by $\sim$ 0.3 nT. Occaisionally, weather conditions caused the temperature to rise above the intended value. This happened on July 27.

Scale values. The scale values of Emil implicit in the formulae for dZ, dH and dD are based on an evaluation of measurements carried out with a Helmholtz coil in 1988 and 2001. The values are close to unity (1 nT/unit) for all sensors.

D-correction. Because of zero-point anomaly in the A-D converters (see yearbook for 1988), readings below 125 nT from the D sensor were given a correction amounting to $+1$ to $+6$ nT. Such a correction is not needed for the primary system (Óli) where the readings are actually offset far from the zero point and then brought back towards zero by a compensating term in the logging program.

ONE-MINUTE MEANS

Calculations of 1-minute means of Z, H, and D are based on measurements with the triaxial fluxgate variometers, chiefly system I (Óli). The magnetometers measure at 1-second intervals at, $02^{\mathrm{s}} - 09^{\mathrm{s}}$, $12^{\mathrm{s}} - 19^{\mathrm{s}}$, $22^{\mathrm{s}} - 29^{\mathrm{s}}$, $32^{\mathrm{s}} - 39^{\mathrm{s}}$, $42^{\mathrm{s}} - 49^{\mathrm{s}}$and $52^{\mathrm{s}} - 59^{\mathrm{s}}$ past each minute mark, giving a total of 48 measurements per minute. An exception occurs during the first minute of each quarter-hour, when measurements from 02^{s} to 07^{s} past the minute are left out, resulting in 42 measurements per minute. During the first minute of each day, measurements at $12^{\mathrm{s}} - 17^{\mathrm{s}}$ are left out as well.

The 10-second momentary recordings, which are made at 08^{s}, 18^{s}, 28^{s}, 38^{s}, 48^{s} and 58^{s}, are used to compenstae for the gaps at the quarter-hours and the larger gap at the beginning of each day.

The 1-minute means of F are calculated from the number of proton precession cycles of the continuous proton magnetometer Móði. From the number, N, of precession cycles per minute, the mean value of F is found:

$$F = 0.3914534 \cdot N + \delta F \quad (\mathrm{in\ \ nT}).$$

The numerical constant corresponds to $(2\pi/\gamma_{\mathrm{p}})/60$, where γ_{p} is the proton gyromagnetic ratio and δF is the sum of a site reduction and a clock correction. A site reduction is needed because the probe of Móði is some distance away from the observatory reference pier as mentioned earlier. A clock correction arises if the Móði reference clock runs too slowly or tooo fast; this correction is generally small (< 0.1 nT). The value of δF is found by comparing the signal from Móði with that from the proton magnetometer Geó, the probe of which is situated on the pier. This comparison is made once a week.

The adopted values of δF in 2005 were as follows:

		δF (nT)
Jan 01	– Jan 26 (14:00)	-3.7
Jan 26	– Feb 05	-4.0
Feb 06	– Mar 13	-4.1
Mar 14	– Apr 09	-4.0
Apr 10	– Jun 30	-4.1
Jul 01	– Jul 31	-4.2
Aug 01	– Aug 23	-4.1
Aug 24	– Sep 22	-4.3
Sep 23	– Oct 26	-4.2
Oct 27	– Dec 31	-4.4

On occaisons when Móði was not functioning, F was calculated from the fluxgate components to fill the gaps in the records.

All 1-minute data were checked visually in graphic form on a computer screen. The 1-minute values of Z and H were also checked by comparing them with the 1-minute values of F. The expression

$$M = \sqrt{Z^2 + H^2} - F,$$

was evaluated for this purpose. The mean value of M over the year was -0.0x nT. Most of the valus (xx.x%) were in the range -1 to +1 nT, y.yy% reached ± 2 nT and there were ZZ cases of higher values.

Non-zero values of M may be explained by a combination of several factors. To begin with, the field values of Z and H are only recorded to the nearest nanotesla. The base-line values are rounded to the nearest 0,5 nT. Finally, the fluxgate sensors are sampled at discrete intervals which are not spaced evenly within the minute. All these factors can cause M to depart from zero, especially during magnetic storms.

In 2005, 46 minutes of data were lost on December 1 as explained above. In addition, gaps occurred in the 1-minute values from the proton magnetometer Móði in January when the magnetizing unit was replaced. Gaps and errors from Móði numbered XXXX or y% of the total time.

HOURLY MEANS

The hourly mean values of the magnetic elements Z, H, D and F were found by averaging the 1-minute means from the fluxgate variometers and the proton magnetometer Móði.

The hourly means of Z and H were checked by comparing the with the hourly means of F and tabulating the difference M (see p.X̃). In 2005, individual roundd values of the difference rarely exceeded 1 nT.

K-INDICES

K-indices were derived from thedigital 1-minute values by a straightforward measurement of the 3-hour ranges of H and D, as explained in the yearbook for 1993.

MAGNETIC ACTIVITY

As measured by Ak, the magnetic activity in 2005 was below average and very similar to the year before. The most significant disturbances occurred on the following days:

Date	*K-sum*	*C9*	*L9*
Jan 2-3	(43,36)	(6,5)	(7,6)
Jan 7-8	(23,33)	(6,6)	(4,5)
Jan 12	(40)	(6)	(6)
Jan 17-19	(46,56,47)	(7,7,7)	(7,8,7)
Jan 21	(41)	(7)	(6)
Feb 7	(25)	(6)	(5)
Mar 6-9	(43,41,40,28)	(6,6,6,4)	(6,7,7,6)
Apr 4-5	(33,43)	(6,7)	(4,7)
Apr 30-May 1	(39,40)	(6,5)	(6,6)
May 8	(47)	(8)	(8)
May 15-17	(51,47,37)	(7,7,4)	(7,7,6)
May 21	(43)	(5)	(6)
May 30-31	(51,34)	(7,4)	(7,5)
Jun 12-13	(36,37)	(7,6)	(5,6)
Jun 23	(44)	(7)	(6)
Jul 9-12	(34,46,37,42)	(6,7,5,6)	(4,7,5,6)
Jul 17-18	(32,36)	(5,6)	(3,6)
Aug 24-25	(49,37)	(8,5)	(7,6)
Aug 31-Sep 1	(38,27)	(7,4)	(5,4)
Sep 10-13	(43,57,49,44)	(4,6,8,7)	(6,9,8,6)

These and other disturbances are displayed in the graphical records on pages xx-yy. The index L9 was explained in the yearbook for 1998.

K reached the extreme value 9 eight times in 2005. The quietest time of the year was on X YYY when the field kept steady to the nearest nanaotesla in alla elements for ZZZ consecutive 10-second reading (x minutes).

COMPUTER PROGRAMS

Approximately 100 programs are used for data handling and processing. Most are in Comal, nine in Fortran, four in Turbo-Pascal, four in BBC-Basic with 6502 assembly language, on in C and then in GNU-awk and Linux command scripts.

DATA DISTRIBUTION

Magnetic results from Leirvogur are sent to two data centers: WDC-C2 in Kyoto and WDC-A in Boulder. The data are transmitted over the Internet. Preliminary 10-second data are sent daily to Kyoto where they are displayed graphically on the World Wide Web. The address is:
http://swdcdb.kugi.kyoto-u.ac.jp/magqldir/q/LRVryestd.html
Final 10-second values are sent to Kyoto after the end of each month along with the 1-minute means, hourly means, monthly means and K-indices. The 1-minute means and hourly means are converted from a special Leirvogur format to WDC format before transmission. Monthly transmissions to Boulder are restricted to 1-minute means and hourly means.

Prelimnary values of Z, H and D are sent every hour to Kyoto, to be displayed graphically on the World Wide Web at
http://swdcwww.kugi.kyoto-u.ac.jp/magqldir/q/LRVrtoday.html
The same preliminary data are also placed in graphical form on the Leirvogur website:
http://www.raunvis.hi.is/ halo/leirvogur.html
The data on this site cover the last 24 hours and are renewed every 10 minutes.

Both preliminary and final data are available over the Internet by ftp-transfer. The address is *ftp.raunvis.hi.is* logging in as “anonymous”. The files are kept in the directory “pub/lrv”. The annual means are sent to WDC-C2 in Kyoto, WDC-C1 in Edinburgh and the Analytical Centre on Secular Variations in Troitsk (IZMIRAN). The annual means are accesible by FTP at the above address under the file name ANNMEANS.LRV. Also kept in the same location is the file ADQMEANS.LRV which contains an extended list of annual means, including disturbed-day and quiet-day means.

FIELD STATION OBSERVATIONS

In 2005, observations were made at one field station, Guðnastaðir at $63°34.'728$ N, $20°09.'567$ V, 101 km from Leirvogur. The above coordinates were measured with a GPS receiver and refer to WGS84. The observations were made on August 11 under magnetically quiet conditions. The DI-flux instument Stefnir II and the proton magnetometer Barri were used to measure the magnetic field components. Three series of measurements were made with Stefnir II, and four with Barri. The results were as follows:

Guðnastaðir minus Leirvogur

	dF	dZ	dH	dD
2005	+661	+489	+755	-45′.9
2004	+658	+482	+755	-44′.4

The units of F, Z and H are nanoteslas. As can be seen from the graphs on the following pages, the results are in conformity with a previosuly established trend. Note that in the yearbook of 2004 there was a sign error in the quoted difference in D. It has been corrected above.

October 2006

Gunnlaugur Björnsson

EXPLANATION OF TABLES

Monthly and annual means

In the table of mnothly means on the follwoing page, the declination is reckoned towards the east from 0 to 360 degress. Thus $344°$ corresponds to $16°$ W. The letters Q and D mark the international quiet and disturbed days, respectively. The days were selected according to circulars from the International Service of Geomagnetic Indices in Potsdam.

Annual means (all days) since 1958 are given on pages xxx-yyy.

Diurnal variations

The tables on pages xx-yy show the mean diurnal inequalities of the magnetic elements Z, H, D and F at Leirvogur in 2005. The units are nanoteslas (for Z, H and F) or tenths of a minute (for D). The top row in each group of four gives the mean of all months of the year, whie the other rows show the mean for the winter months (W = January, February, November, December), the equinotical months (E = March, April, September, and October) and summer months (S = May, June, July and August).

The averages for the international quiet and disturbed days are shown separatelyand are identified by Q or D as a second letter.

The last three columns give the positions of the minimum and the maximum values in each row, and the range. In cases where there are two or more extreme values of equal size, the number 99 is printed.

K-indices

The three-hourly K-indices, based on the components H and D, are shown in tabular from on page ZZ. The daily K-sums are shown on page ZZ in runs of 27 days. Thetable on page XX shows the distribution of K-indices for each month of the year. The columns give the number of cases when $K = 0$, $K = 1$ etc.The column marked “-” shows how many indices are missing owing to breaks in the record. The final columns give the average values of K and the equivalent amplitudes Ak. A summary for all years since 1958 is given on pages XX-yYY.

EXPLANATION OF DAILY GRAPHS

The graphs on pahges xx-yy show the 1-minute means of the magnetic elements Z, H, and D at Leirvogur in 2005. Vertical divisions are spaced at intervals of 500 nT in Z and H and $2°31$ in D. The last figure is equvalent ot 500 nT in the direction of magnetic east for average values of H at Leirvogur.

Levels marked with asteriks (*) are as follows:
Z: 50000 nT
H: 12000 nT
D: 343° E