

NATIONAL ANTARCTIC RESEARCH PROGRAM

Terra Nova Bay, Antarctica Geomagnetic Observatory

Magnetic Observation Results

2003-2004

2004-2005

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Geomagnetic Observation Results 2003-2004 Terra Nova Bay - Antarctica

Introduction

This report deals with activities undertaken at the Antarctic Italian Geomagnetic Observatory during the austral summer 2003-2004.

The coordinates of the Observatory at OASI are the following:

Geographic latitude:	74.6936°S
Geographic longitude:	164.0975°E
Corrected Geomagnetic latitude (IGRF00):	80.00°S
Corrected Geomagnetic longitude (IGRF00):	306.94°E
Magnetic local time midnight:	08:11 UT

This report describes the activities performed from November 9, 2003 to December 3, 2004.

For the present work H, D and Z INTERMAGNET formatted data from the fluxgate magnetometer have been used.

The proton precession magnetometers used to record F total values were Overhauser type; for a description of instruments we refer to geomagnetism text books, for example Parkinson (1983) and Wienert (1970).

Since the total intensity F time variations, at polar latitudes, where values of inclination is almost 90°, are very close to the vertical component Z time variations, the plots of total intensity time variations are not shown. They can however be obtained from the well known equation:

$$F^2 = H^2 + Z^2$$

Absolute measurements

For the normal absolute measurements-taking at the Observatory, a standard fluxgate magnetometer theodolite for the determination of D, I angles has been used.

At OASI three different azimuth marks are available, for the computation of the Declination (please refer to the 2001/2002 report for details). The coordinates of geodetic points (mark piers and measuring location) were established on the basis of GPS measurements. From these coordinates the azimuth values 152° 44' 04'', 60° 13' 36'' and 338° 07' 59'' were found.

The proton magnetometer recordings, continuously undertaken during the execution of the DI measurements, have allowed the calculation of the absolute intensive elements.

Table 1 shows absolute measurement values for each element; the values of the intensive components H and Z (rounded off to the nT) were computed using the relations:

$$H = F \cdot \cos I$$
$$Z = F \cdot \sin I$$

H₀ and D₀ reference values computation

Since the fluxgate was magnetically oriented in the horizontal plane, as in the previous installations, it was necessary to compute H₀ and D₀ reference values, comparing absolute and relative measurements, at the same time. For the Z component, once the vertical levelling of the sensor was assured, it was assumed that the variations measured by fluxgate were actually the vertical component of the geomagnetic field variations.

In the description the mathematical procedure used for computation of H₀ and D₀, the following symbols are used:

H ₀ , D ₀	Reference values
H _{abs} , D _{abs}	Values of absolute measurements at time t
x,y	Instantaneous variations recorded by fluxgate system at time t

For each absolute measurement, the reference values were computed as:

$$H_0 = H_{abs} \cos(\varphi) - x$$

$$D_0 = D_{abs} - \varphi$$

where

$$\varphi = \arcsin(y/H_{abs})$$

In order to reduce this dispersion in the set, the Chauvenet criterion was used. The method, based on the hypothesis of a Gauss probability distribution for the data, consists in the elimination of measurements whose difference from the average is greater than a multiple of the standard deviation fixed by the sample dimension (in this case a value 2.4 σ , corresponding to a sample of 33 data elements, was used).

This method, however, cannot be applied more than once, since an iterative procedure could exclude most of the values up to the complete elimination of the data (Worthing and Jeffner, 1943). The average values of H₀ and D₀ are:

$$H_0 = (7856 \pm 8) \text{ nT}$$

$$D_0 = (138.20 \pm 0.07) \text{ deg}$$

These values are considerably different from those reported in the previous yearbooks because a different instrument was used for the measurements of the instantaneous variations (please refer to the Introduction for more details).

Daily base lines computation

After H₀ and D₀ reference values are found, the computation of the base lines in relation to absolute measurements and then the computation of the daily base lines for all days, can follow. The available data are the H, D and Z magnetic element variations recorded by fluxgate system (sampling rate 1 minute) and the absolute measurements recorded from Nov 9, 2003, to Dec 3, 2003.

The base lines computation was undertaken by two different procedures. In the case of Z, assuming that the fluxgate recordings show the variations of the vertical components, the base line (B_Z) was computed as the difference between the absolute measurements (Z_{abs}) and the fluxgate measurements (z). On the other hand, in the case of H and D, the magnetic orientation of the fluxgate system axes was taken into account. Using H_0 and D_0 reference values, the H and D base lines were computed for each absolute measurement as:

$$B_H = H_{abs} - [(H_0+x)^2 + y^2]^{1/2}$$
$$B_D = D_{abs} - D_0 - \arctg[y/(x+H_0)]$$

Mean daily values of the base lines were obtained for those days in which more than one absolute measurement was available.

In order to have a daily base line for each magnetic element, a linear regression analysis using the least squares method has been undertaken. The results are shown in Fig. 1, where the experimental data, as well as the best fit lines are reported.

Using the daily base lines, one minute values for the three field elements H, D and Z were computed as:

$$H = [(H_0+x)^2 + y^2]^{1/2} + B_H$$
$$D = D_0 + \arctg[y/(x+H_0)] + B_D$$
$$Z = z + B_Z$$

Following the Observatory move in 2001/2002 to the new site at OASI, the measurements are reduced to the old site subtracting the following gradient:

$$\Delta H = -1.5 \text{ nT}$$
$$\Delta D = 13.0'$$
$$\Delta Z = 0.7 \text{ nT}$$

In Tables 2, 3, 4 all the hourly and daily averages and the total mean values for the H, D and Z elements on the entire measuring period (from Nov 9, 2003 to Dec 3, 2004) are reported; the relative plots are shown in Fig. 2. The plots of the one minute data follow in succession.

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Table captions

Table 1: Absolute measurement values 2003/2004

Table 2: Horizontal intensity hourly and daily means
(from Nov 9, 2003 to Dec 3, 2004)

Table 3: Declination hourly and daily means
(from Nov 9, 2003 to Dec 3, 2004)

Table 4: Vertical intensity hourly and daily means
(from Nov 9, 2003 to Dec 3, 2004)

Table 1**Terra Nova Bay, Geomagnetic Observatory****Absolute measurements 2003/2004**

date julian day	D		(+)	I		(-)	(+)	(+)	(-)
	beg (UT)	end (UT)	D (deg min)	beg (UT)	end (UT)	I (deg min)	F (nT)	H (nT)	Z (nT)
313	06:30	6:36	136 06.2	6:42	6:46	82 49.3	64240	8027	63737
313	06:52	6:56	136 17.1	7:00	7:04	82 50.0	64246	8014	63744
314	05:57	6:00	136 28.5	6:02	6:06	82 46.0	64280	8094	63768
314	06:09	6:12	136 25.7	6:14	6:17	82 48.5	64282	8046	63776
315	05:06	5:10	137 11.3	5:14	5:17	82 36.6	64294	8269	63760
315	05:18	5:23	137 20.7	5:26	5:30	82 39.5	64277	8214	63750
317	05:53	5:55	136 05.5	5:58	6:01	82 49.5	64256	8025	63753
317	06:06	6:09	136 14.2	6:12	6:15	82 49.1	64269	8034	63765
318	06:03	6:06	136 23.4	6:09	6:13	82 45.5	64343	8110	63829
318	06:15	6:18	136 10.7	6:21	6:24	82 44.8	64427	8134	63911
319	06:08	6:10	135 46.8	6:12	6:16	82 39.3	64257	8216	63729
322	05:09	5:12	135 54.3	5:14	5:18	82 49.8	64226	8016	63723
322	05:23	5:26	136 11.6	5:28	5:31	82 47.8	64253	8057	63746
324	05:27	5:30	137 09.0	5:33	5:36	82 46.0	64225	8086	63714
324	05:38	5:40	137 05.5	5:42	5:45	82 46.1	64225	8085	63714
326	05:51	5:54	135 48.7	5:56	5:59	82 49.1	64174	8023	63671
326	06:04	6:07	135 39.3	6:12	6:15	82 47.6	64167	8050	63660
327	05:39	5:42	136 34.7	5:44	5:47	82 41.2	64173	8169	63651
327	05:48	5:51	136 37.1	5:53	5:57	82 39.9	64197	8196	63671
328	04:40	4:43	135 40.5	4:45	5:48	82 50.5	64201	8000	63700
328	04:52	4:55	135 28.2	4:57	5:00	82 52.9	64141	7948	63646
331	05:53	5:56	135 55.1	5:59	6:02	82 49.5	64200	8019	63697
331	06:04	6:06	135 53.2	6:08	6:11	82 49.5	64207	8020	63704
332	04:44	4:48	136 14.0	4:50	4:54	82 50.2	64116	7995	63616
332	04:56	4:58	136 22.3	5:01	5:04	82 50.2	64137	7998	63636
333	06:35	6:37	135 45.5	6:41	6:44	82 50.9	64180	7990	63680
333	06:52	6:56	135 43.2	6:52	6:56	82 49.1	64208	8026	63704
337	07:00	7:04	135 46.5	7:07	7:09	82 52.5	64173	7959	63677
337	07:11	7:15	135 34.8	7:18	7:20	82 51.4	64177	7980	63679

Table 2

Terra Nova Bay Antarctica, Italian Geomagnetic Observatory

Hourly H values (nT) from Nov 9,2003 to Dec 3,2003

UT	0	1	2	3	4	5	6	7	8	9	10	11	DAILY MEAN
	12	13	14	15	16	17	18	19	20	21	22	23	
julian day													
313	7889	7923	8004	8039	8074	8101	8024	7995	8023	7989	7937	7963	
	7875	7896	7848	7814	7851	7776	7689	7647	7652	7766	7671	7692	7881
314	7827	7925	7984	8083	8184	8206	8086	8062	8070	8067	7990	7894	
	7848	7805	7825	7791	7714	7786	7744	7834	7687	7779	9999	9999	7918
315	7932	8015	7946	7975	8064	8157	8152	8103	8040	7965	7997	7939	
	7938	7899	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	8009
316	9999	9999	9999	9999	9999	7894	7888	7841	7779	7704	7736	7678	
	7677	7636	7624	7596	7512	7521	7484	7529	7498	7579	7570	7610	7650
317	7944	7996	7979	8092	8127	8103	8089	8054	8069	8018	7978	7897	
	7923	7858	7857	7868	7863	7871	7754	7729	7730	7807	7809	7865	7928
318	7896	7927	8028	8090	8095	8049	8219	8124	8079	8063	7920	7915	
	7904	7837	7825	7797	7768	7718	7788	7856	7841	7835	7876	7767	7926
319	7916	7905	7962	8126	8094	8008	8060	8102	8117	8039	7979	7924	
	7838	7882	7829	7767	7781	7791	7772	7793	7767	7739	7771	7869	7910
320	7879	7957	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	
	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	7918
321	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	
	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	7842	7818	7830
322	7936	8004	7985	7975	8040	8040	8060	8048	8058	7995	7983	7940	
	7881	7862	7863	7845	7842	7825	7849	7830	7818	7883	7812	7827	7925
323	7864	7945	7954	7987	8021	8028	8062	8075	8018	7961	7960	7911	
	7912	7913	7894	7874	7859	7858	7873	7870	7907	7887	7895	7917	7935
324	7892	7928	7955	8012	8017	8057	8084	8099	8189	8235	8063	7889	
	7913	7791	7800	7594	7546	7386	7414	7477	7606	7668	7736	7750	7837
325	7983	8103	7819	7991	8070	8117	8261	8148	8058	8057	8005	7940	
	7957	7929	7918	7914	7864	7844	7881	7838	7869	7831	7951	7948	7971
326	7917	7858	8004	8003	8050	8062	8020	8014	7981	7952	7955	7948	
	7890	7923	7901	7805	7746	7709	7679	7703	7714	7732	7772	7805	7881
327	7862	7972	8045	8112	8138	8161	8189	8110	8050	7970	7898	7893	
	7931	7908	7844	7860	7863	7868	7888	7893	7778	7919	7896	7978	7959
328	8023	8009	7993	8020	7994	8016	8016	8025	8021	7990	7947	7923	
	7924	7943	7843	7846	7893	7920	7940	7889	7795	7786	7892	7929	7941
329	8008	7975	7998	7992	8092	8067	7999	8017	8030	7980	7946	7984	
	7915	7918	7924	7869	7849	7824	7918	7926	7978	7980	7905	8004	7962
330	8036	8070	8067	8060	8018	8076	9999	7993	7972	7960	7950	7939	
	7977	7922	7906	7885	7871	7913	7961	7954	7952	7938	7914	7979	7970
331	7950	7973	8012	7997	8025	8026	8027	8029	7990	7957	7974	7969	
	7948	7931	7917	7893	7922	7924	7939	7910	7951	7930	7894	7913	7958
332	7949	7959	8027	8015	8029	8009	8013	8022	7986	7993	8004	8008	
	7948	7890	7922	7944	7948	7970	7984	8015	7983	7971	7942	7941	7978
333	7988	8019	8029	8061	8011	7999	8001	8044	8016	8010	7982	7956	
	7956	7904	7883	7893	7916	7964	7971	7915	7895	7811	7899	7939	7961
334	7994	8011	8030	8034	8015	8052	8039	8000	7956	7921	7944	7981	
	7976	7920	7904	7836	7834	7809	7800	7778	7788	7835	7856	7913	7926
335	7980	7990	8088	8109	8101	8119	8083	8024	8051	8016	7985	7974	
	7951	7932	7944	7957	7927	7932	7912	7910	7912	7907	7849	7861	7980
336	7873	7897	8016	8040	8059	8100	8057	7992	7998	8039	7980	7932	
	7909	7948	7928	7930	7959	7983	8009	8023	8015	7992	7902	7892	7978
337	7931	8006	7996	8018	8048	8073	7999	7988	7982	8016	7962	7927	
	7910	7931	7980	7981	7938	7902	7920	7899	7915	7866	7882	7938	7959

TOTAL MEAN = 7929 nT

Table 3

Terra Nova Bay Antarctica, Italian Geomagnetic Observatory

*Hourly D values from Nov 9,2003 to Dec 3,2003
(deg:first three digit, minutes: second two digits)*

UT	0	1	2	3	4	5	6	7	8	9	10	11	DAILY MEAN
	12	13	14	15	16	17	18	19	20	21	22	23	
julian day													
313	13704	13654	13701	13612	13622	13616	13557	13551	13516	13504	13520	13506	
	13530	13458	13513	13543	13557	13608	13538	13638	13731	13703	13746	13807	13611
314	13802	13753	13633	13627	13616	13643	13615	13541	13504	13451	13511	13432	
	13435	13453	13515	13514	13521	13552	13553	13641	13640	13715	99999	99999	13558
315	13701	13809	13713	13629	13555	13601	13619	13605	13535	13458	13505	13534	
	13536	13538	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	13607
316	99999	99999	99999	99999	99999	13712	13731	13716	13646	13609	13616	13645	
	13647	13649	13637	13636	13656	13640	13652	13733	13819	13854	13819	13805	13711
317	13724	13734	13645	13648	13628	13627	13551	13516	13528	13516	13514	13460	
	13453	13510	13544	13547	13544	13543	13535	13607	13636	13656	13657	13653	13604
318	13653	13653	13708	13707	13620	13554	13542	13604	13452	13504	13523	13459	
	13504	13504	13531	13514	13524	13524	13633	13557	13554	13624	13648	13756	13559
319	13704	13644	13711	13729	13641	13559	13535	13460	13521	13544	13506	13510	
	13524	13440	13515	13538	13545	13530	13610	13707	13708	13631	13640	13724	13606
320	13738	13707	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	
	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	13722
321	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	
	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	13635	13656	13645
322	13647	13733	13717	13631	13610	13531	13520	13534	13531	13446	13438	13506	
	13458	13503	13526	13545	13520	13541	13531	13619	13611	13628	13638	13641	13552
323	13642	13629	13625	13621	13633	13619	13542	13537	13529	13528	13508	13511	
	13516	13522	13536	13529	13532	13535	13554	13556	13613	13629	13616	13609	13553
324	13637	13627	13612	13637	13649	13645	13606	13552	13435	13422	13534	13533	
	13239	13318	13427	13350	13422	13535	13714	13714	13801	13835	13835	13814	13559
325	13810	13559	13559	13701	13724	13602	13545	13556	13530	13522	13536	13536	
	13527	13530	13532	13513	13524	13522	13508	13457	13503	13510	13432	13453	13541
326	13539	13708	13654	13520	13506	13516	13519	13508	13458	13527	13533	13533	
	13531	13534	13518	13520	13505	13533	13521	13558	13614	13633	13638	13701	13544
327	13552	13528	13650	13622	13606	13607	13547	13511	13455	13505	13536	13533	
	13527	13506	13508	13523	13537	13522	13516	13513	13538	13534	13605	13529	13535
328	13520	13523	13544	13521	13524	13508	13442	13459	13504	13501	13514	13530	
	13526	13513	13510	13518	13452	13454	13429	13430	13517	13556	13552	13549	13514
329	13560	13609	13611	13541	13545	13546	13601	13552	13544	13546	13528	13521	
	13514	13515	13509	13524	13553	13556	13606	13620	13549	13433	13447	13513	13538
330	13540	13602	13539	13545	13554	13546	99999	13530	13540	13542	13546	13541	
	13528	13519	13516	13522	13605	13531	13447	13520	13445	13449	13446	13448	13527
331	13531	13546	13600	13601	13560	13539	13535	13527	13540	13541	13529	13528	
	13532	13530	13534	13557	13535	13544	13531	13455	13456	13536	13612	13600	13538
332	13545	13612	13556	13555	13556	13549	13543	13528	13516	13518	13511	13520	
	13513	13511	13514	13532	13518	13514	13540	13533	13614	13528	13456	13550	13533
333	13528	13608	13637	13553	13529	13519	13530	13535	13550	13548	13547	13543	
	13543	13549	13560	13605	13549	13519	13450	13628	13633	13628	13630	13607	13552
334	13430	13457	13453	13523	13510	13511	13437	13439	13518	13527	13535	13522	
	13517	13511	13517	13503	13504	13524	13530	13549	13602	13553	13600	13610	13519
335	13621	13614	13610	13616	13602	13537	13518	13503	13452	13455	13510	13523	
	13525	13536	13537	13521	13533	13519	13538	13556	13557	13553	13603	13604	13539
336	13634	13613	13619	13602	13555	13545	13521	13522	13534	13521	13534	13546	
	13535	13521	13522	13512	13460	13445	13444	13425	13407	13359	13634	13611	13528
337	13603	13522	13535	13531	13524	13523	13530	13523	13508	13519	13537	13550	
	13556	13554	13526	13506	13504	13443	13451	13451	13437	13523	13508	13533	13521

TOTAL MEAN = 135° 48' nT

Table 4

Terra Nova Bay Antarctica, Italian Geomagnetic Observatory

Hourly Z values (nT) from Nov 9,2003 to Dec 3,2003 (values must be considered negative)

UT	0	1	2	3	4	5	6	7	8	9	10	11	DAILY MEAN
	12	13	14	15	16	17	18	19	20	21	22	23	
julian day													
313	63686	63709	63693	63709	63726	63749	63737	63747	63774	63796	63798	63818	
	63792	63835	63808	63770	63800	63886	63918	63990	63958	63886	63742	63753	63795
314	63769	63791	63770	63729	63738	63797	63762	63784	63981	63995	63959	63894	
	63914	63943	63946	63915	63965	63886	63845	63857	63774	63842	99999	99999	63857
315	63690	63696	63690	63716	63738	63792	63845	63814	63804	63827	63913	63857	
	63834	63804	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	63787
316	99999	99999	99999	99999	99999	99999	63830	63883	63851	63841	63864	63949	63894
	63871	63840	63829	63832	63803	63839	63818	63728	63863	63841	63790	99999	63843
317	63735	63723	63729	63755	63729	63722	63757	63794	63800	63823	63834	63845	
	63851	63828	63793	63803	63828	63769	63811	63801	63842	63833	63775	63786	63790
318	63722	63732	63740	63707	63724	63725	63851	63810	63841	63840	63837	63839	
	63839	63839	63859	63919	63881	63866	63949	63772	63652	63613	63550	63586	63779
319	63593	63595	63695	63713	63746	63745	63763	63797	63944	63897	63857	63811	
	63796	63842	63807	63817	63906	63893	63875	63870	63789	63729	63828	63723	63793
320	63694	63667	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	
	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	63680
321	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	
	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	99999	63728
322	63699	63621	63654	63693	63711	63740	63743	63747	63750	63766	63788	63771	
	63778	63801	63812	63760	63780	63724	63652	63713	63695	63762	63650	63651	63728
323	63642	63633	63637	63662	63672	63696	63752	63755	63757	63769	63766	63780	
	63812	63838	63784	63771	63746	63766	63702	63710	63696	63695	63693	63664	63725
324	63688	63712	63709	63688	63699	63718	63728	63737	63836	63918	63905	64015	
	64088	64154	63971	63888	63862	63846	63820	63841	63773	63740	63698	63646	63820
325	63649	63643	63807	63821	63795	63814	63869	63824	63803	63818	63791	63802	
	63809	63788	63783	63809	63785	63767	63719	63687	63611	63582	63476	63584	63743
326	63469	63540	63598	63628	63646	63662	63668	63711	63704	63725	63765	63797	
	63758	63777	63818	63791	63811	63780	63784	63775	63720	63690	63581	63554	63698
327	63648	63608	63532	63619	63628	63642	63687	63713	63728	63711	63716	63749	
	63757	63738	63720	63700	63633	63657	63678	63637	63619	63615	63538	63604	63661
328	63561	63542	63571	63606	63631	63708	63688	63705	63740	63733	63737	63766	
	63745	63747	63741	63719	63707	63667	63630	63563	63494	63542	63656	63715	63663
329	63511	63595	63592	63632	63630	63646	63679	63716	63734	63733	63758	63766	
	63769	63782	63777	63750	63758	63795	63680	63730	63765	63739	63498	63438	63686
330	63483	63531	63584	63629	63653	63669	99999	63712	63725	63734	63759	63763	
	63762	63745	63764	63792	63784	63728	63716	63667	63648	63643	63441	63435	63668
331	63592	63605	63577	63624	63666	63696	63706	63713	63715	63734	63734	63722	
	63730	63744	63758	63756	63759	63727	63743	63697	63629	63709	63709	63680	63697
332	63652	63652	63609	63630	63626	63661	63694	63703	63707	63706	63730	63748	
	63755	63766	63776	63747	63754	63721	63678	63759	63760	63805	63700	63760	63712
333	63617	63538	63563	63589	63592	63637	63687	63683	63702	63740	63771	63792	
	63807	63805	63793	63787	63739	63772	63723	63664	63687	63724	63706	63696	63701
334	63722	63530	63601	63591	63603	63668	63690	63722	63693	63720	63726	63739	
	63728	63713	63710	63714	63750	63735	63690	63646	63620	63573	63595	63542	63667
335	63501	63543	63555	63585	63626	63651	63661	63669	63691	63719	63734	63742	
	63736	63729	63740	63718	63696	63750	63749	63692	63677	63689	63617	63542	63667
336	63634	63615	63613	63605	63634	63644	63675	63673	63694	63732	63736	63756	
	63726	63743	63732	63718	63711	63727	63718	63739	63699	63634	63739	63735	63693
337	63655	63590	63620	63647	63637	63637	63660	63689	63687	63682	63712	63748	
	63747	63736	63761	63726	63689	63689	63690	63666	63646	63606	63473	63461	63661

TOTAL MEAN = 63729 nT

Figure Captions

Fig 1: Scatter plot and linear regression for daily H, D and Z¹ base lines.

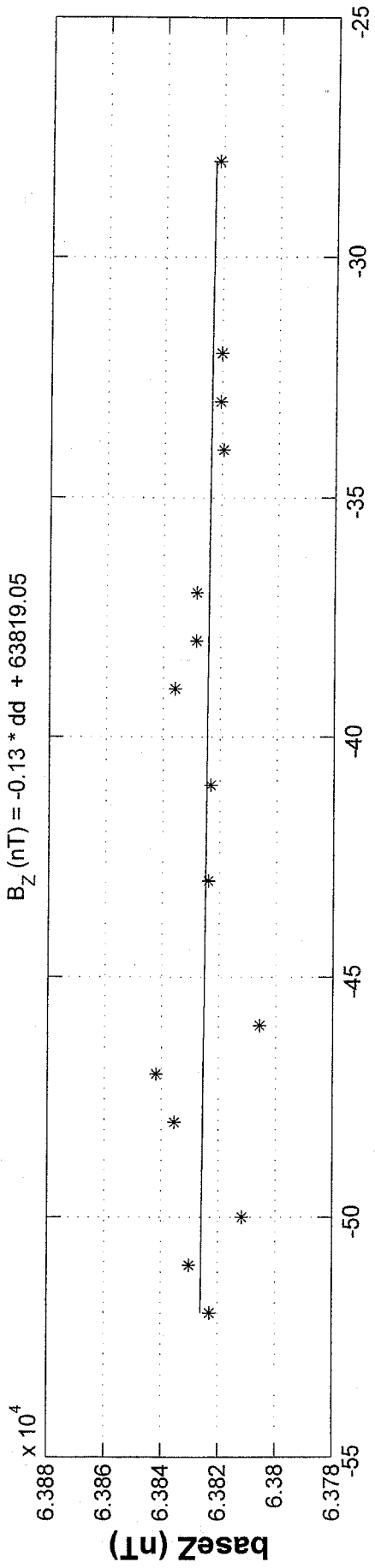
Fig 2: Hourly means of the H, D and Z¹ elements during the whole campaign.

Fig. 3 – 25: Daily plots of the one minute values of the H, D and Z¹ elements.

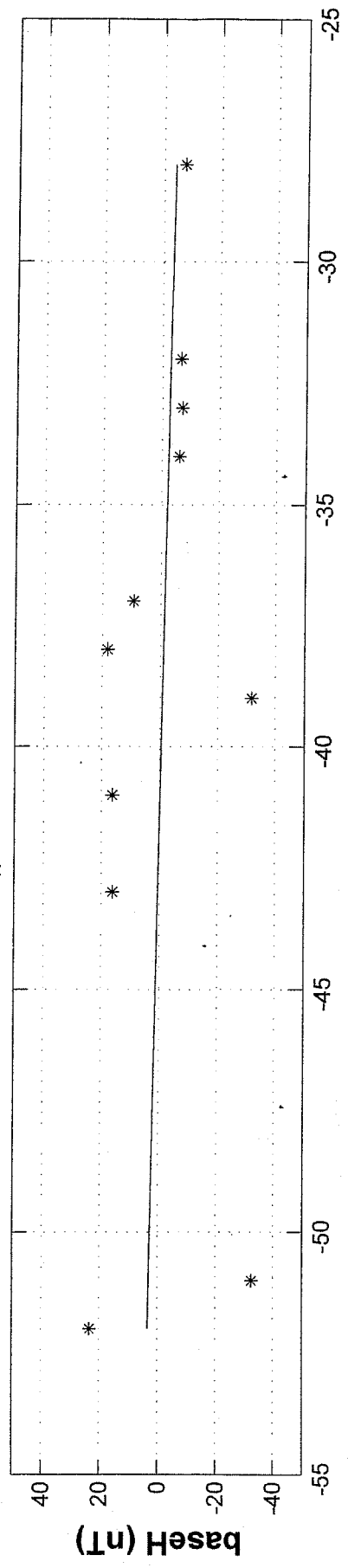
¹ Z values must be considered negative

TNB Z, H and D base lines 2003/2004

$$B_Z (\text{nT}) = -0.13 * \text{dd} + 63819.05$$



$$B_H (\text{nT}) = -0.31 * \text{dd} - 12.86$$



$$B_D (\text{deg}) = 0.0006 * \text{dd} - 0.0011$$

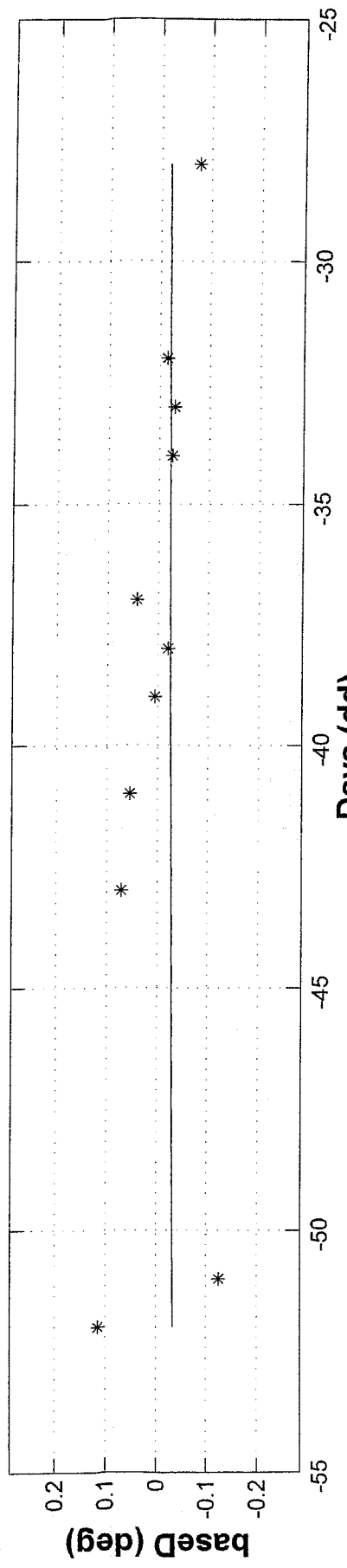
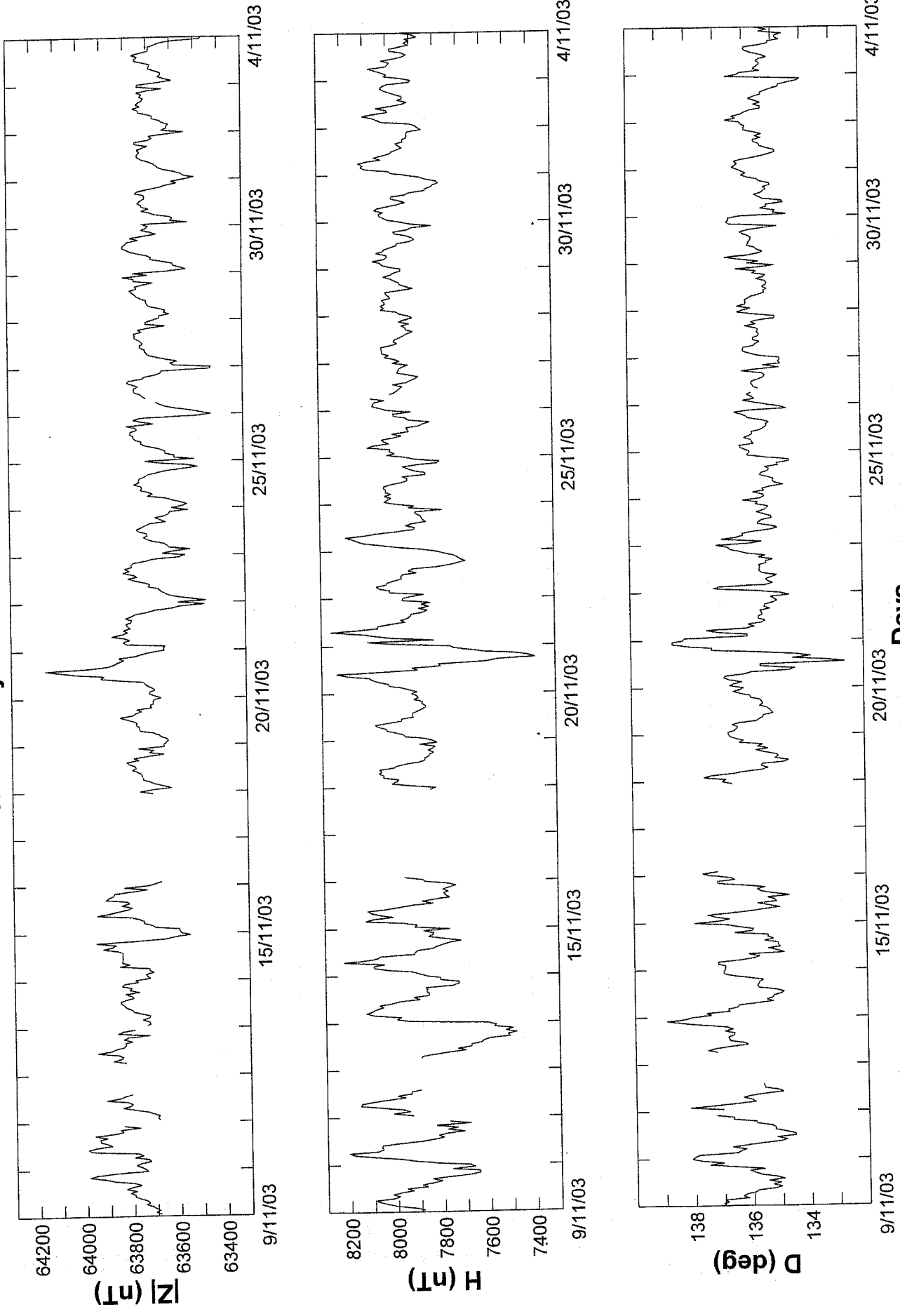
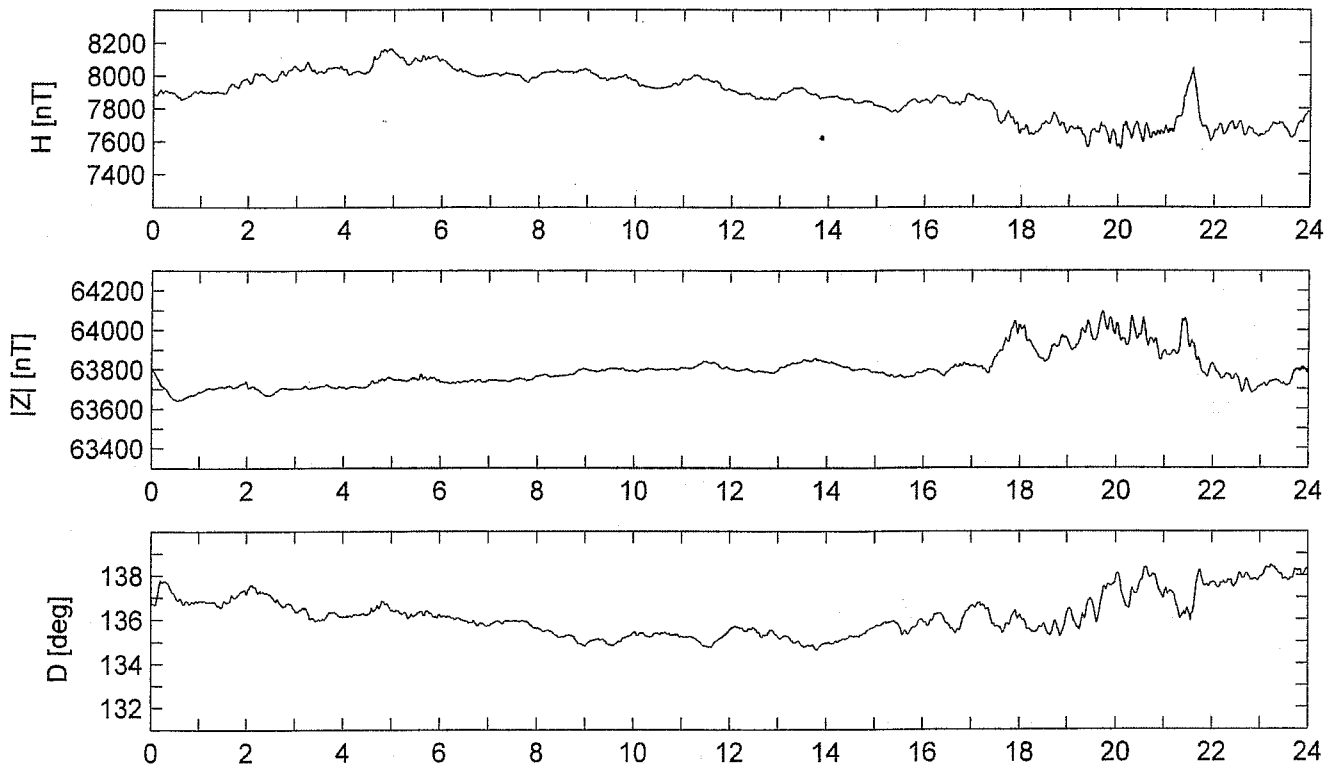


Fig.1

TNB hourly means 2003/2004

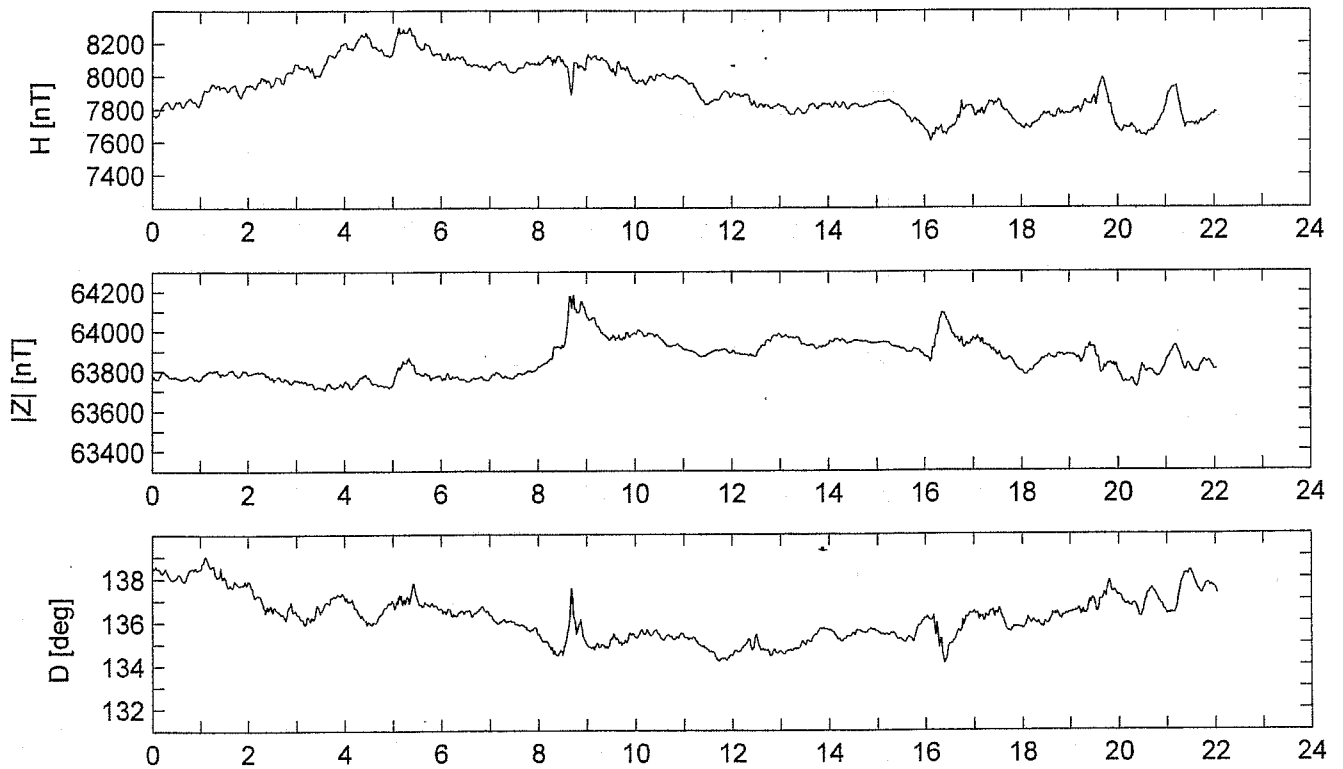


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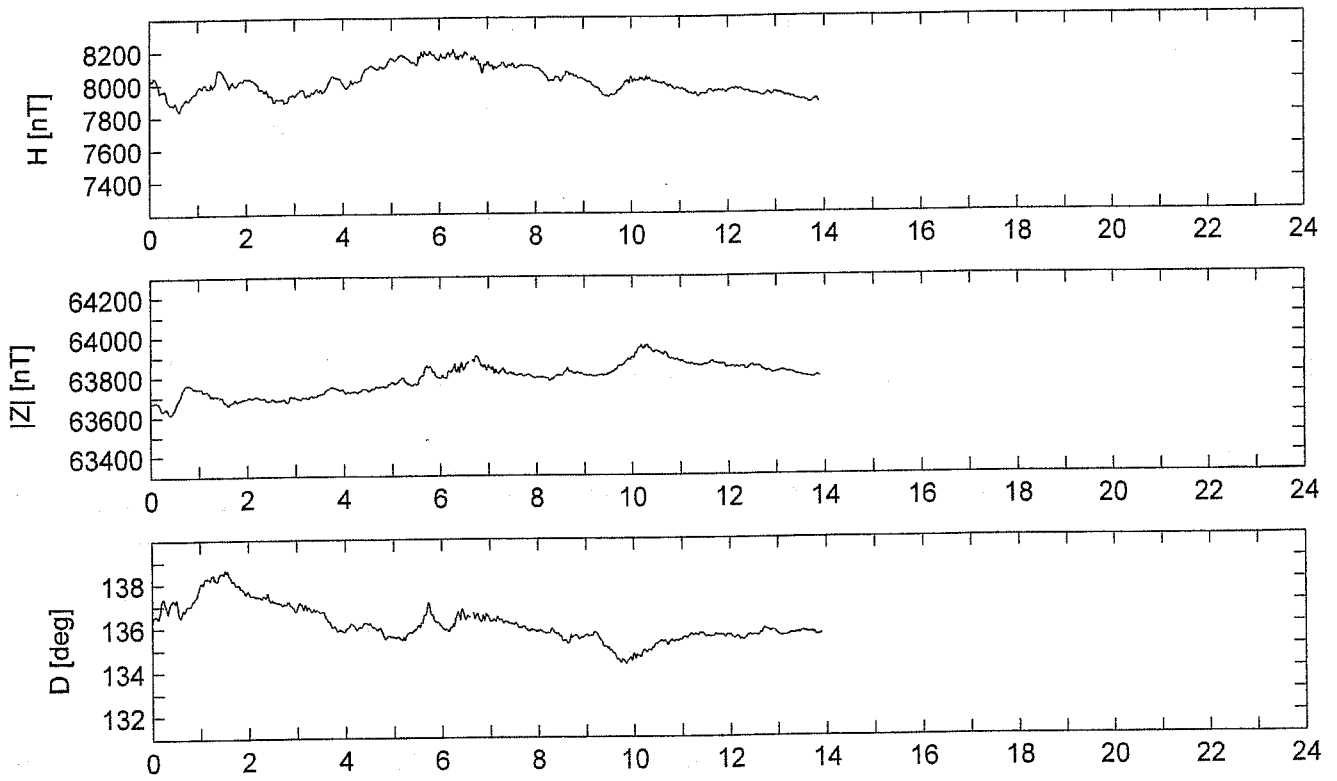
Hours [UT], nov 9 2003

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



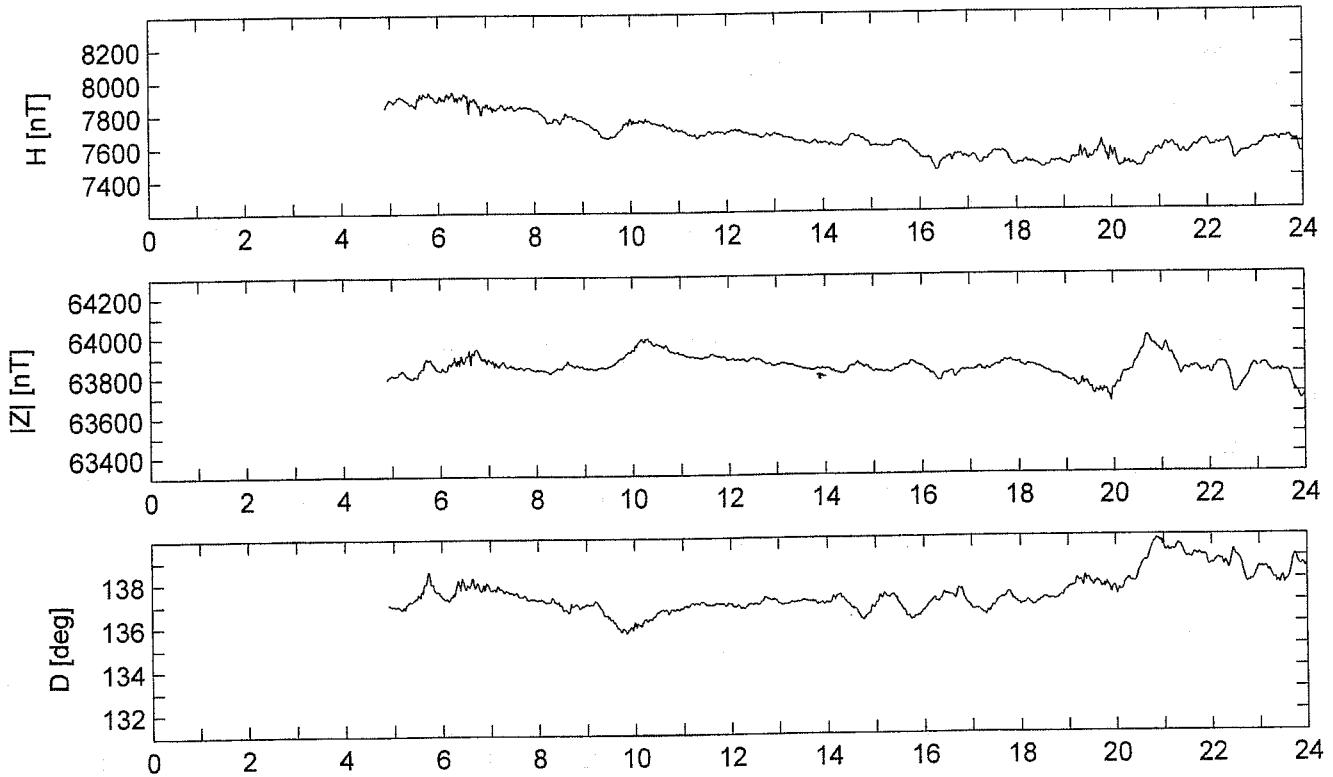
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



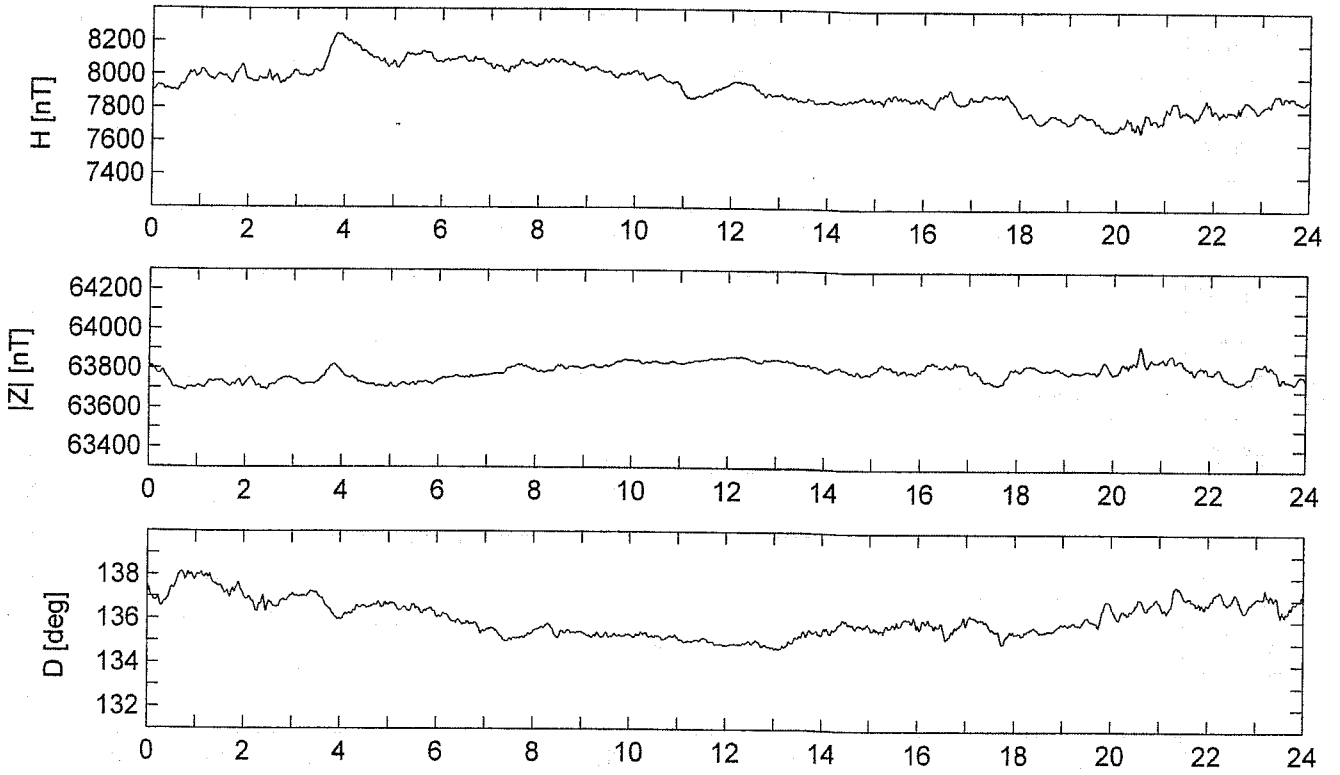
Hours [UT], nov 11 2003

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



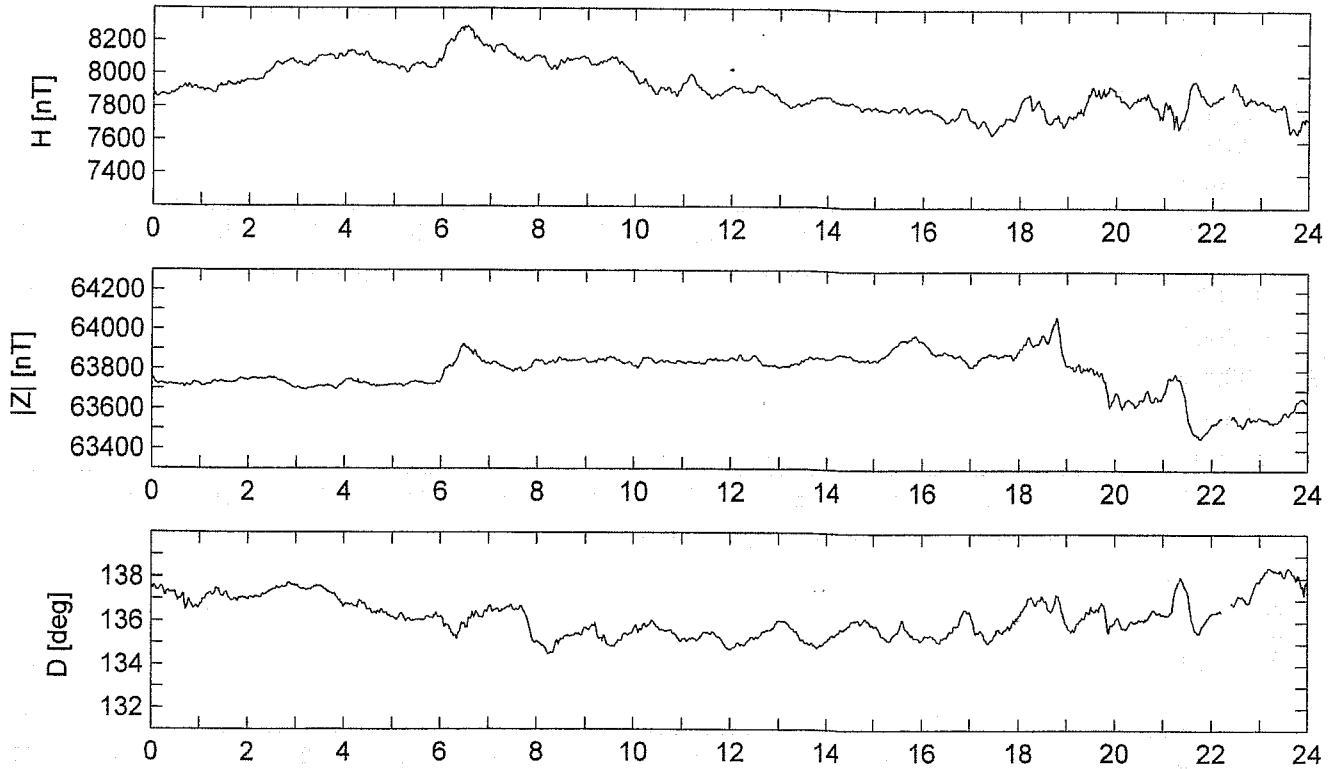
Hours [UT], nov 12 2003

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



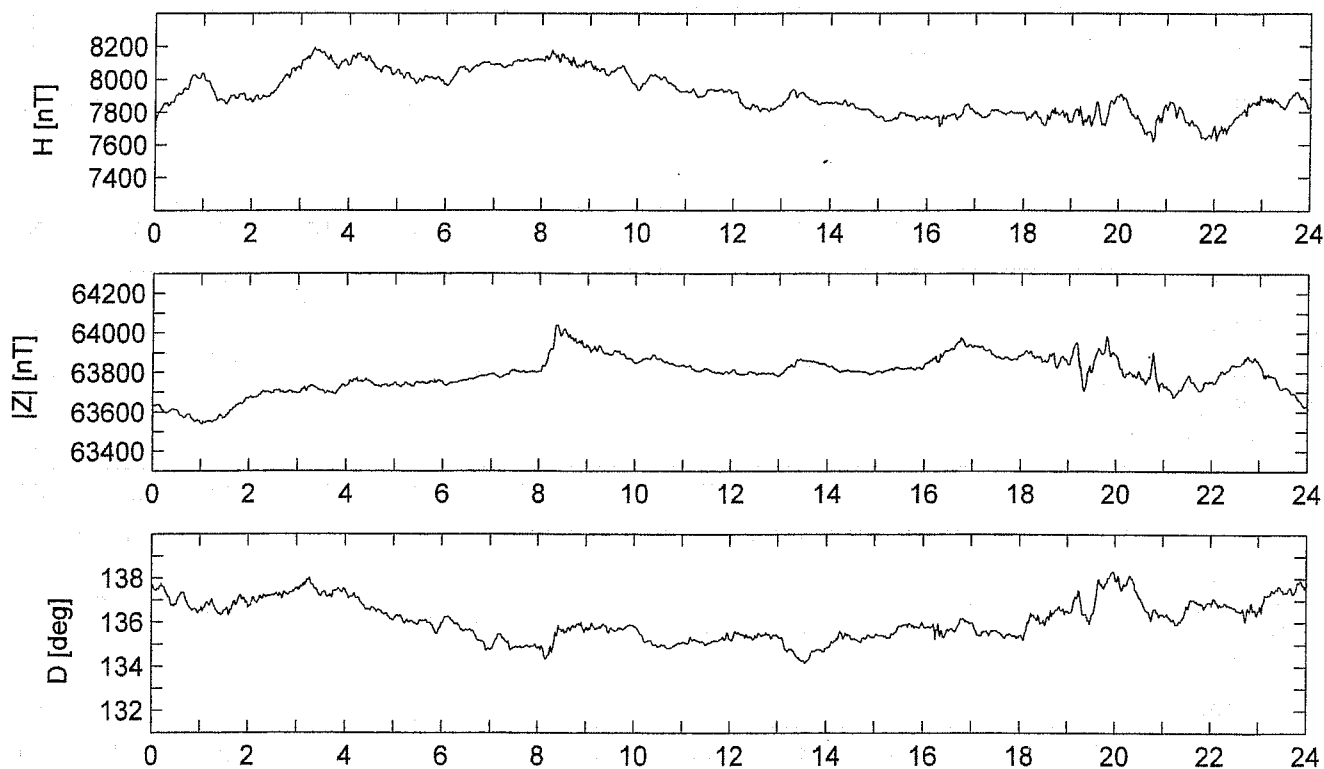
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



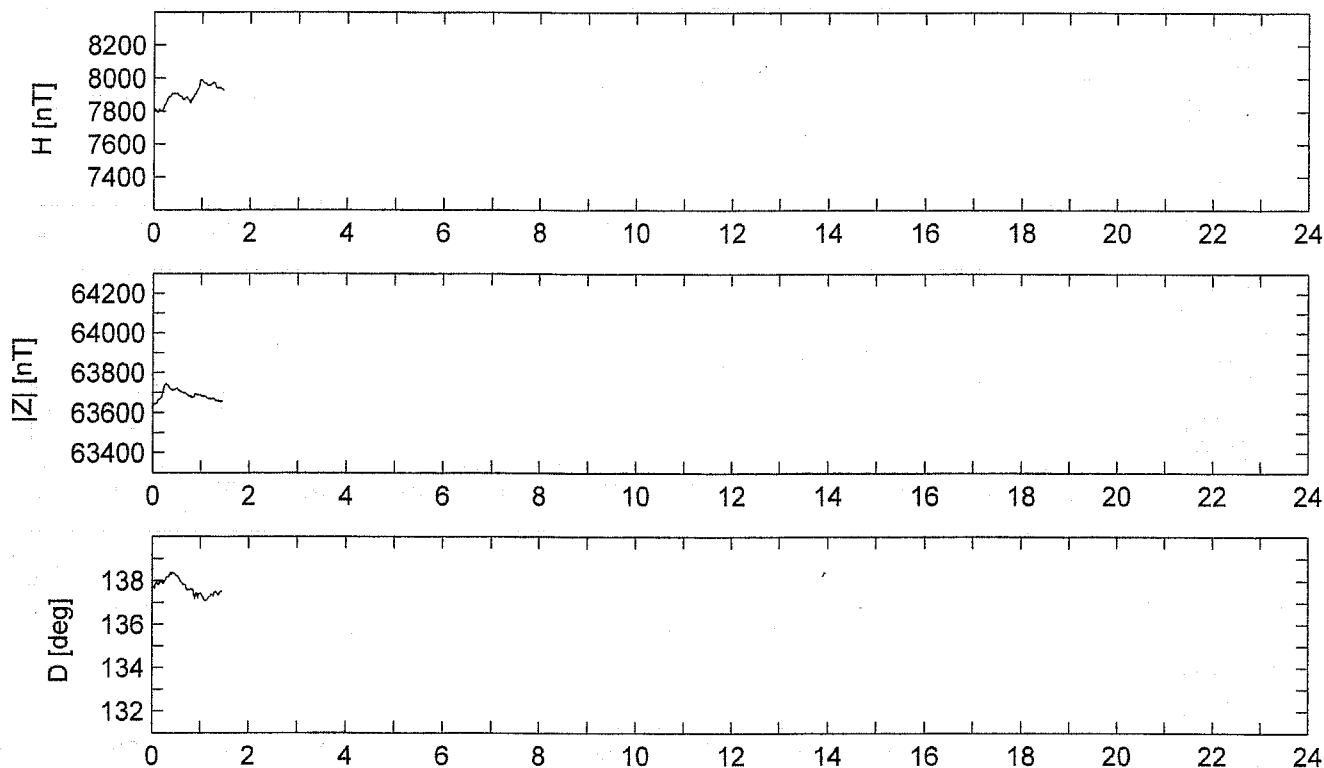
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



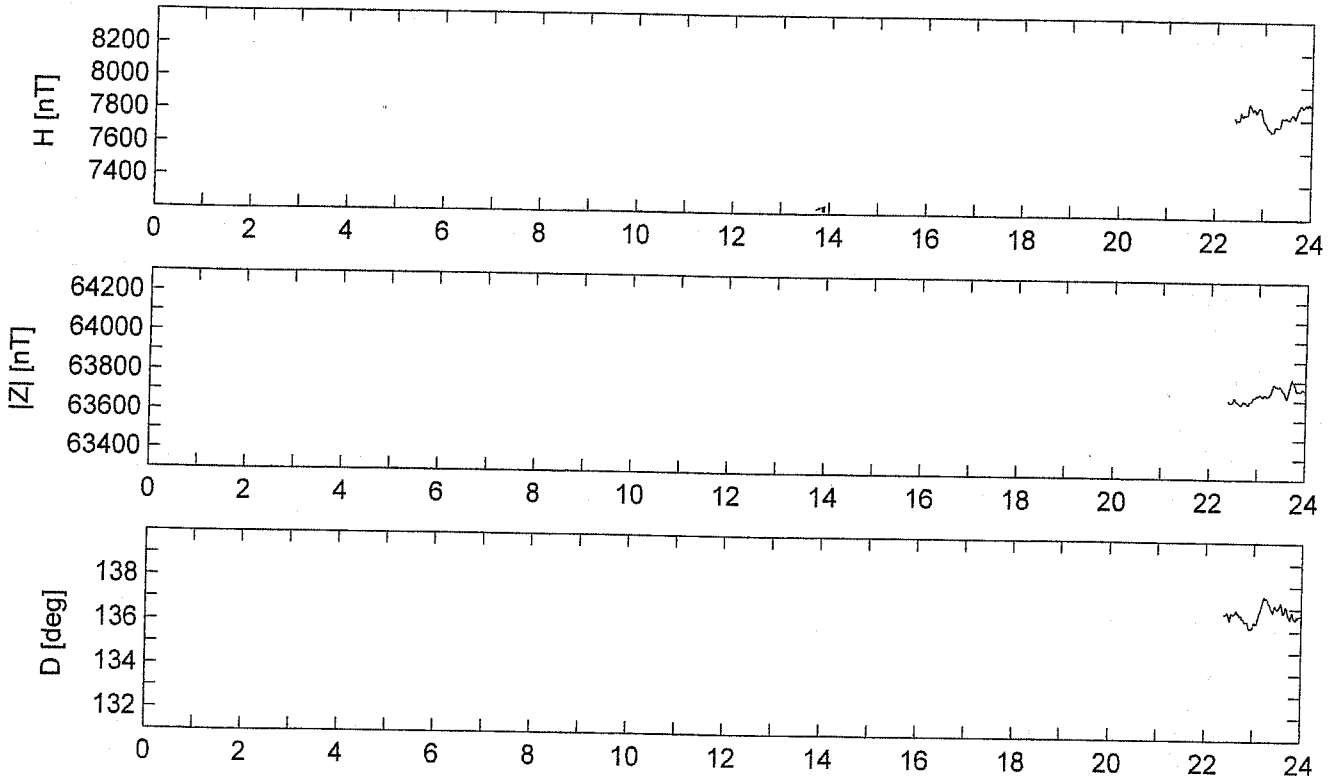
Hours [UT], nov 15 2003

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



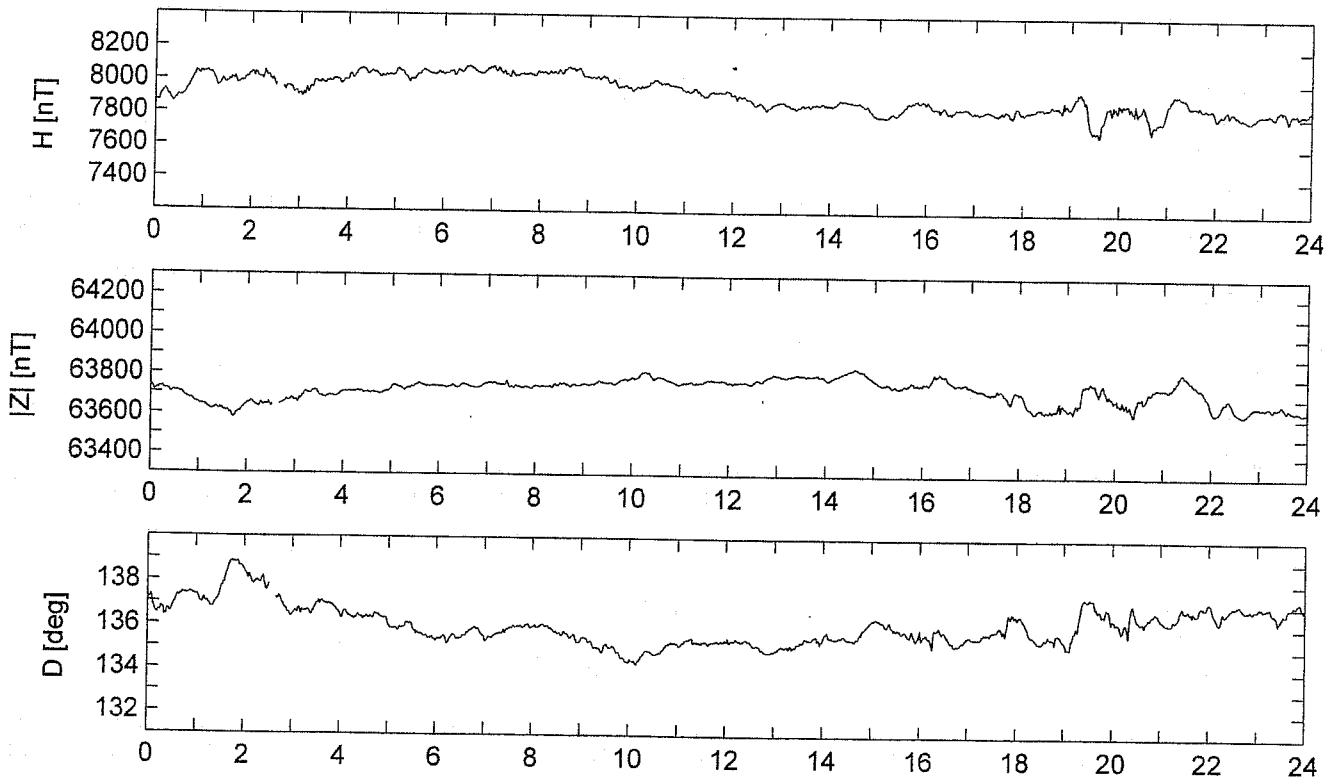
Hours [UT], nov 16 2003

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



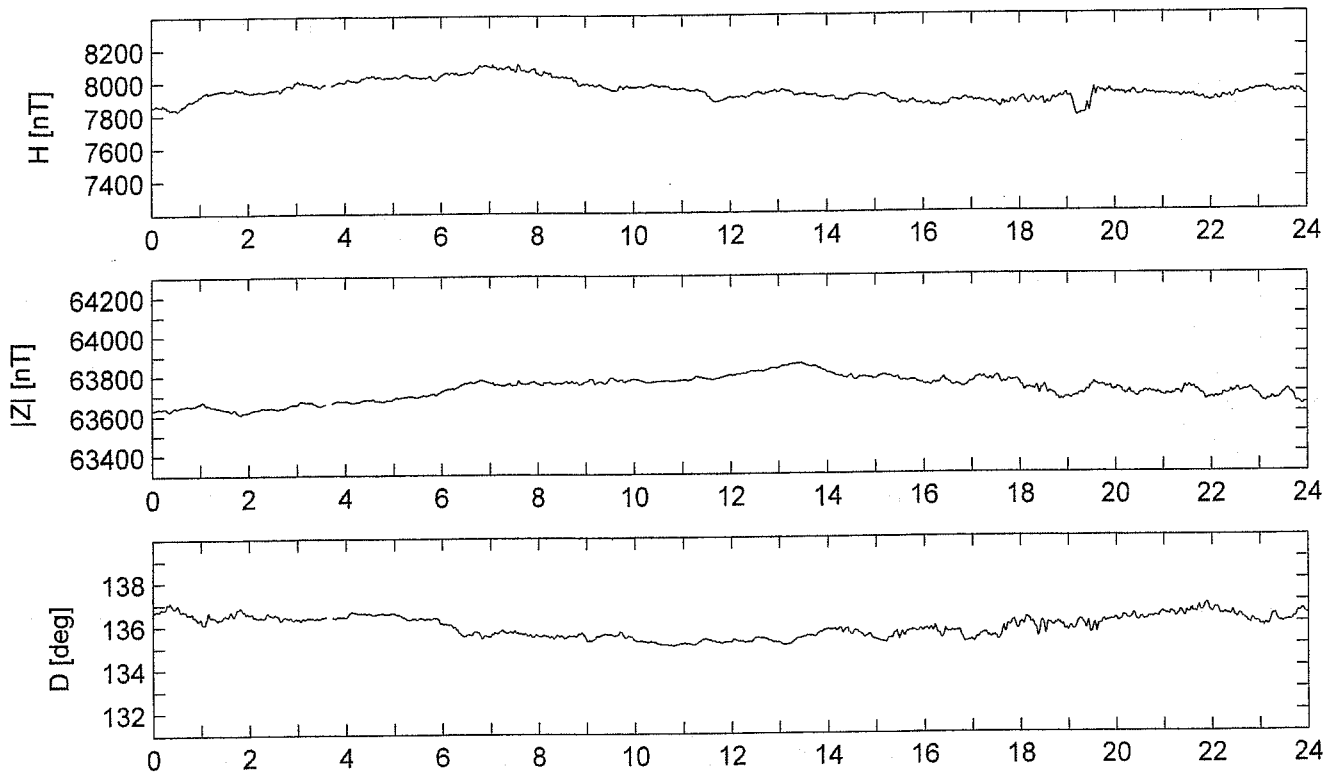
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



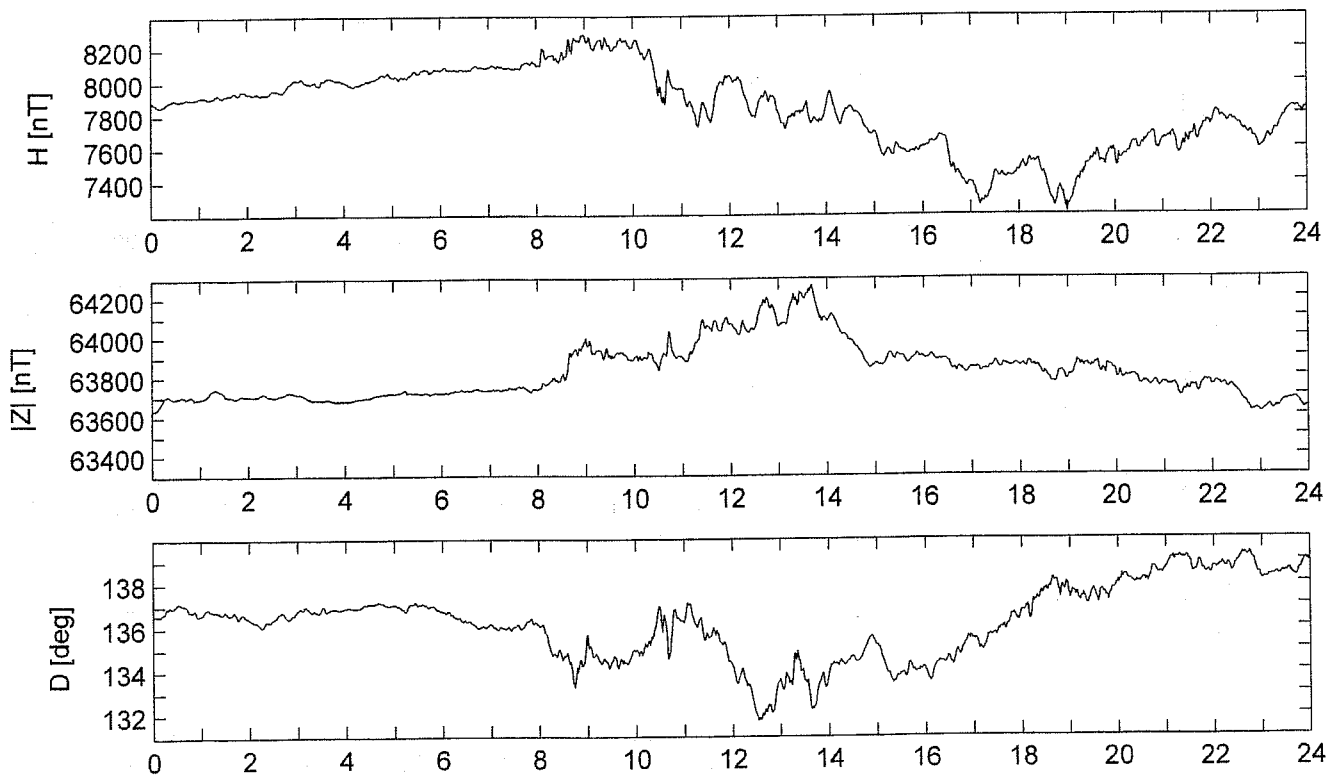
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



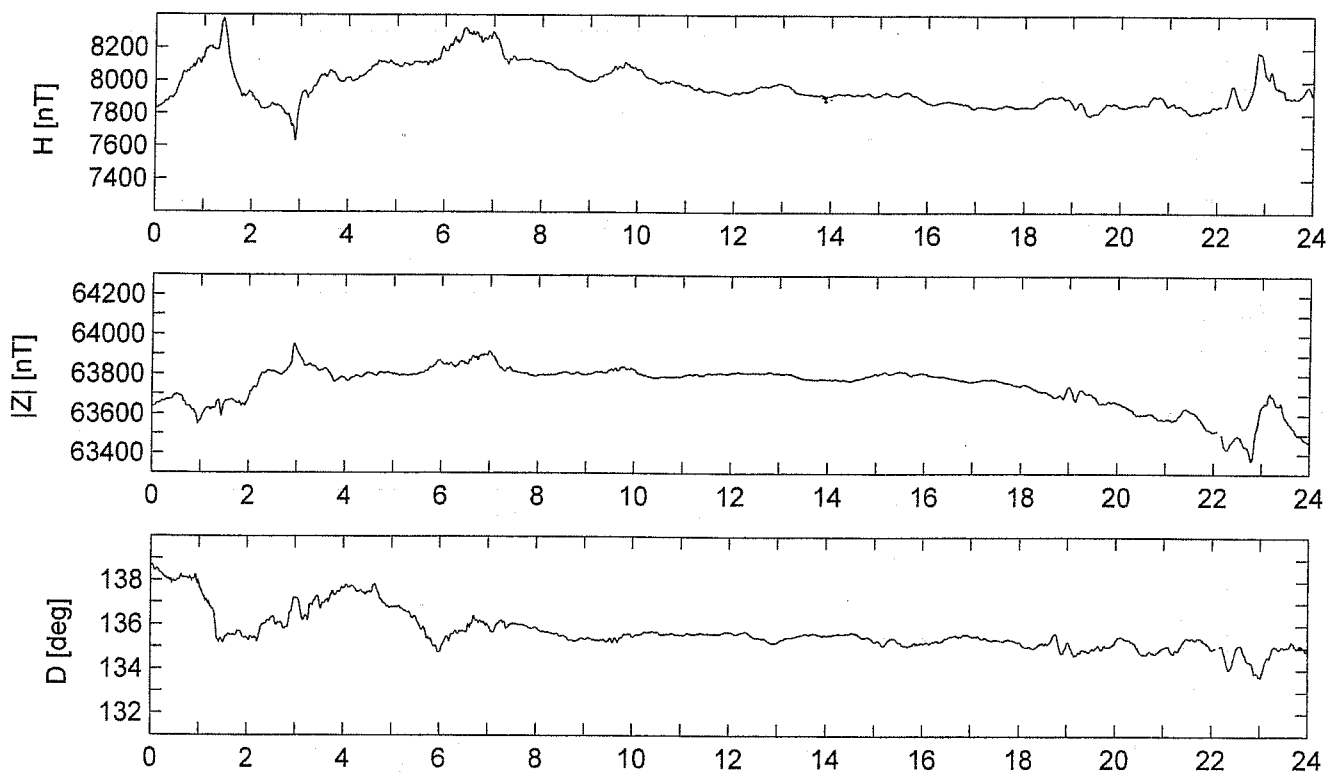
Hours [UT], nov 19 2003

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



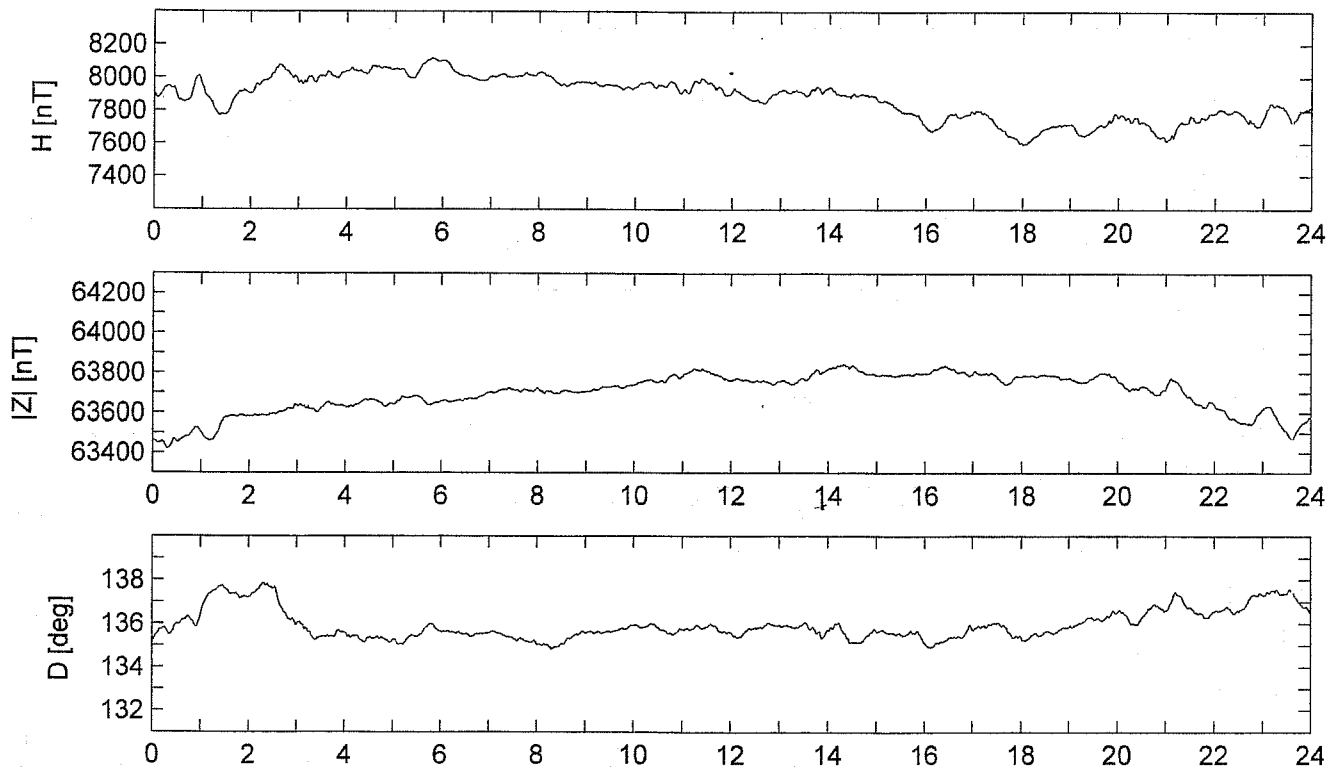
Hours [UT], nov 20 2003

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



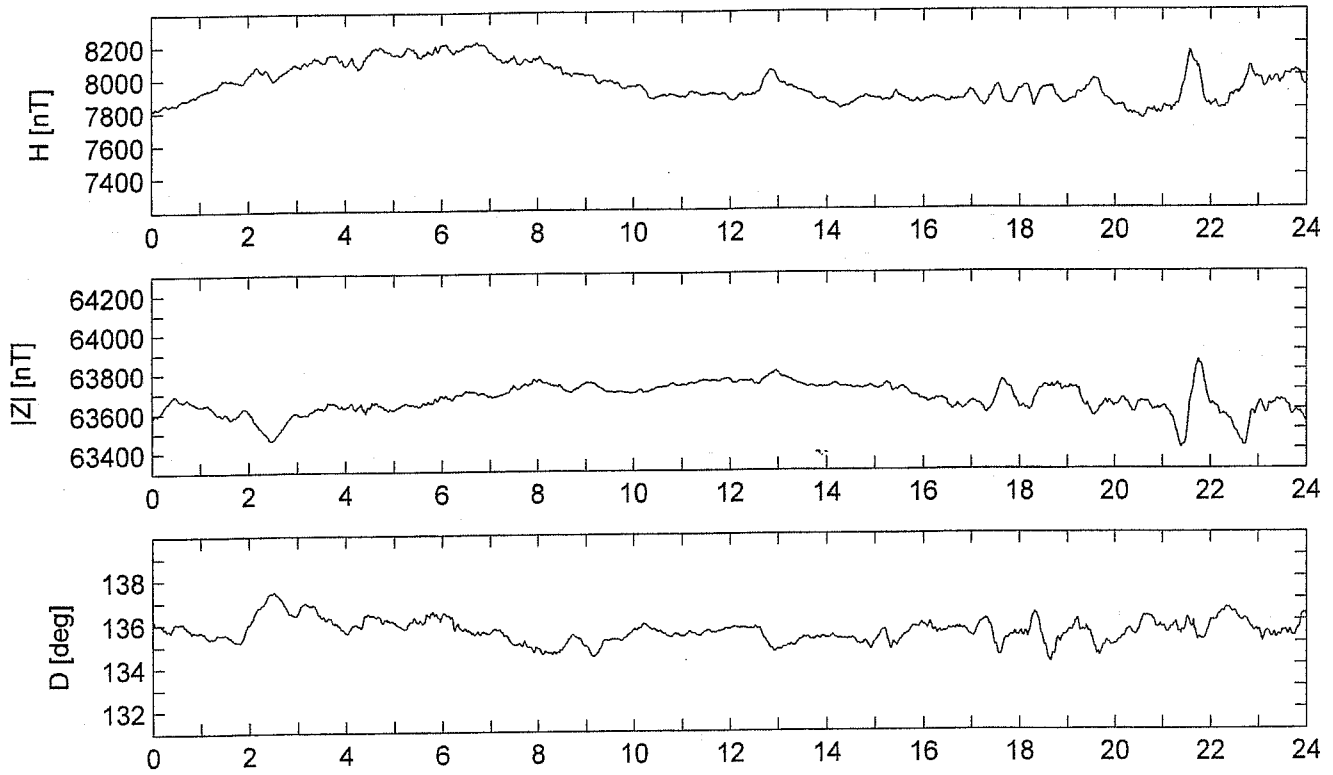
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



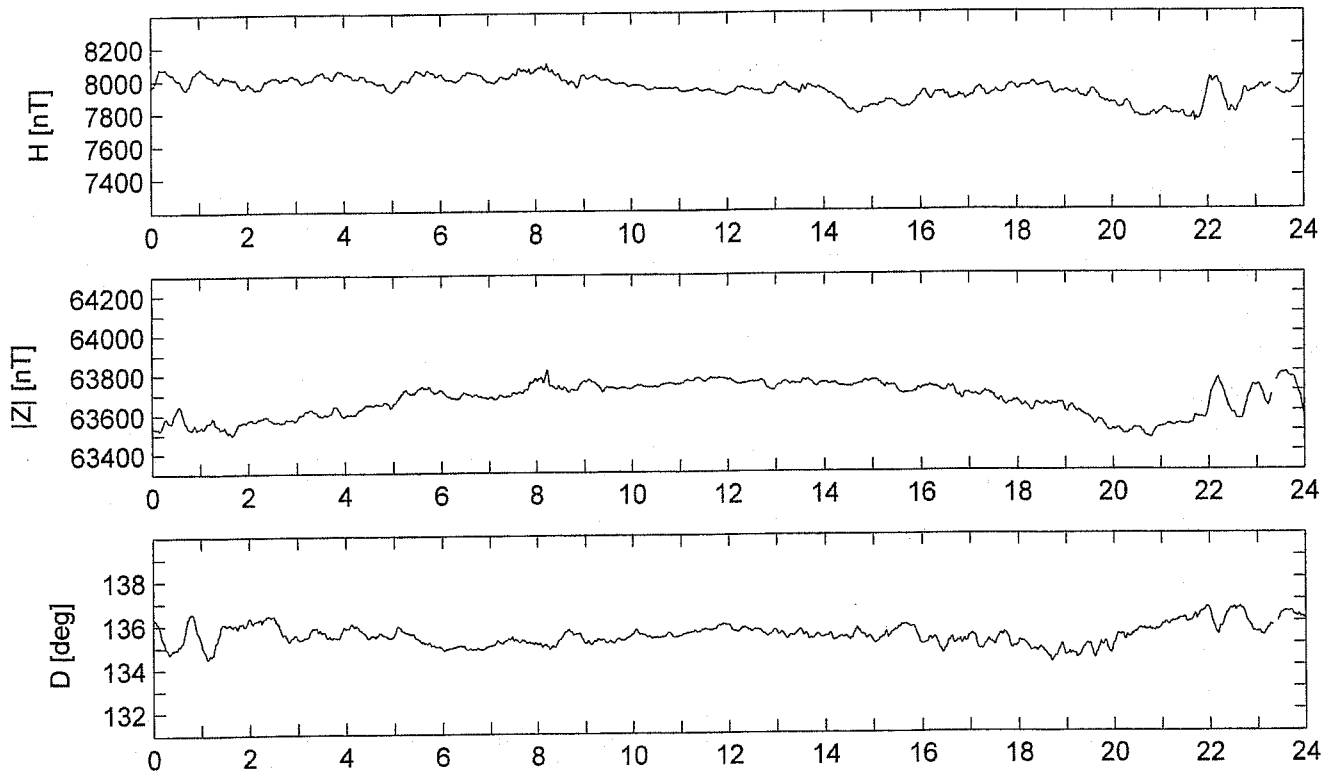
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



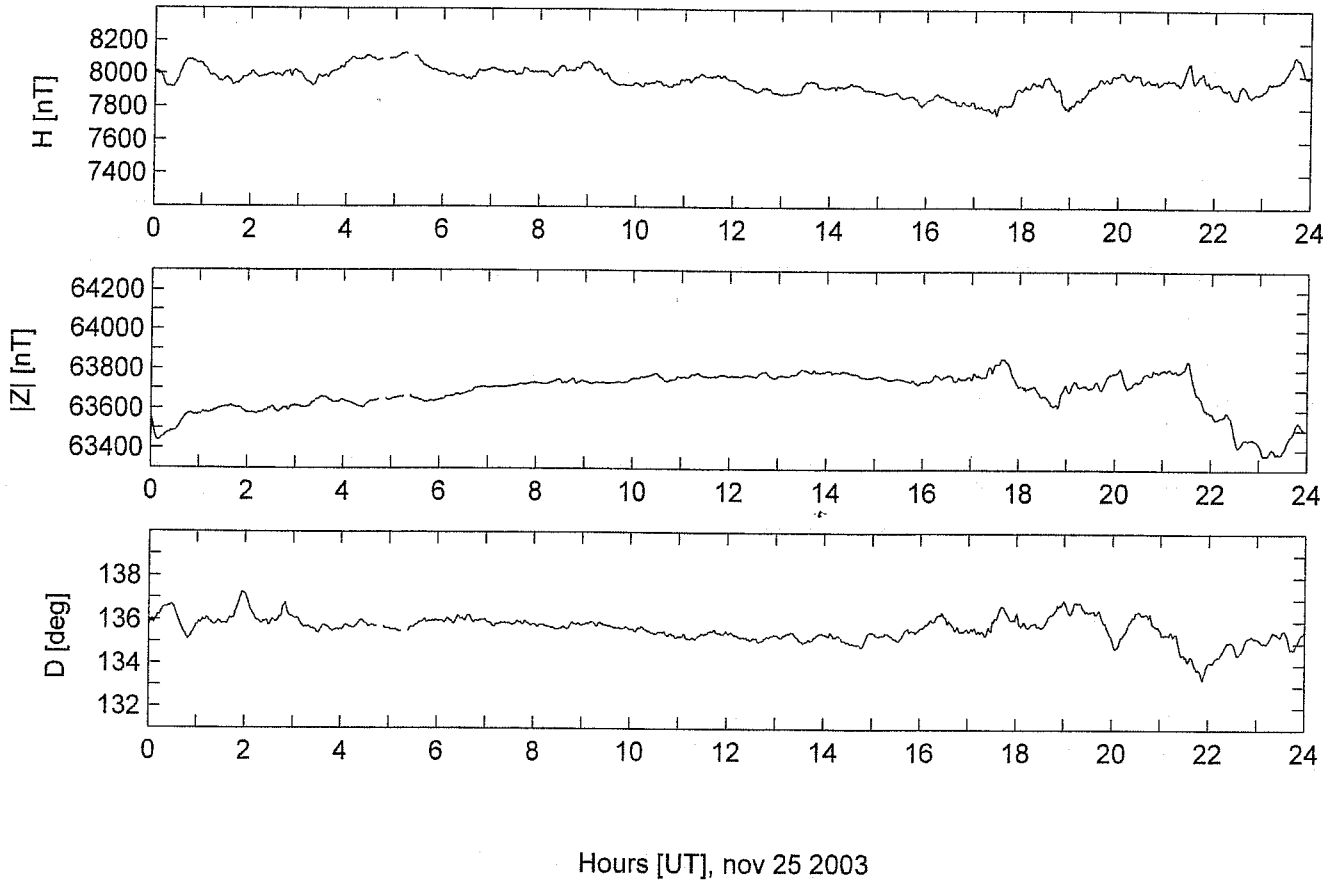
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica

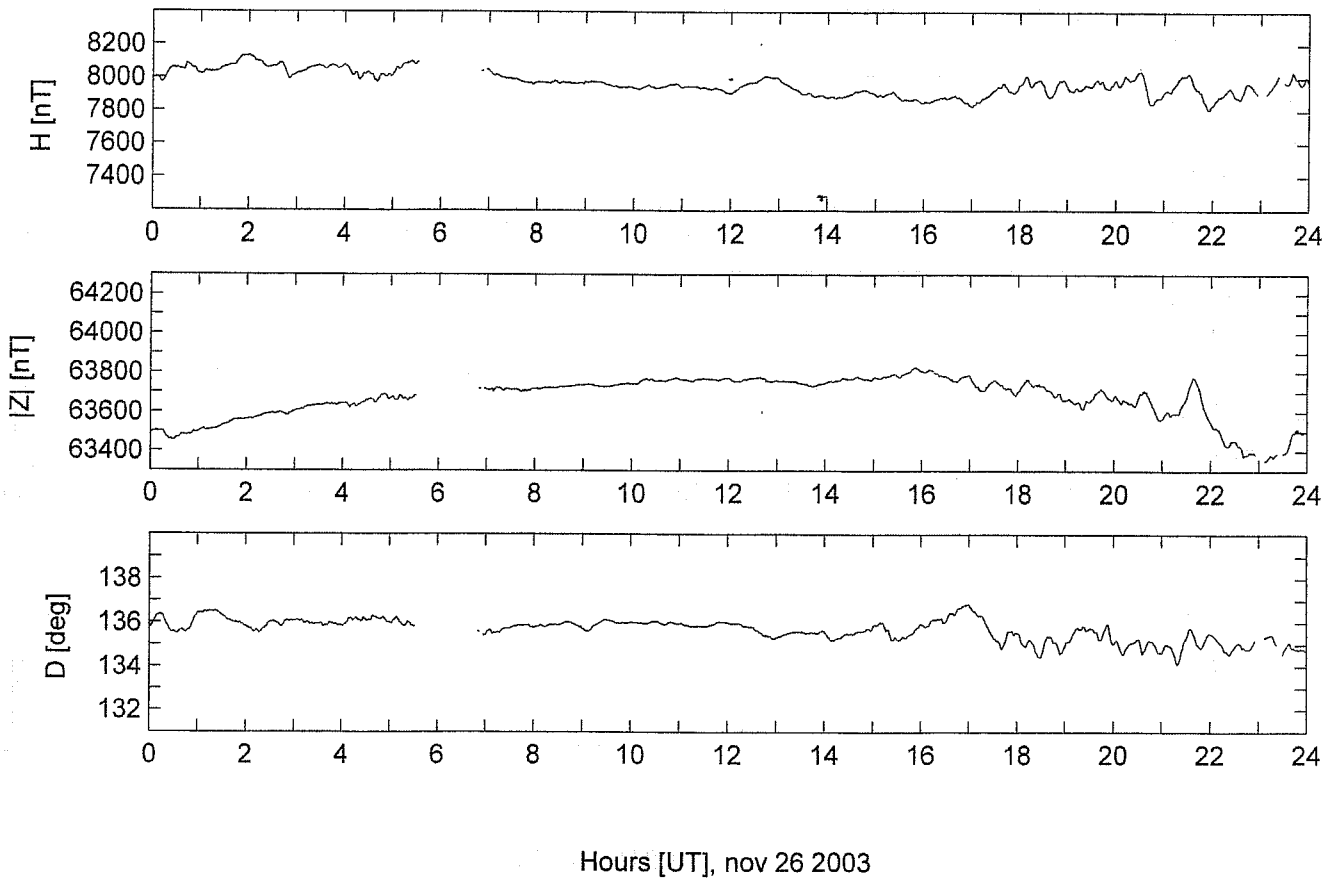


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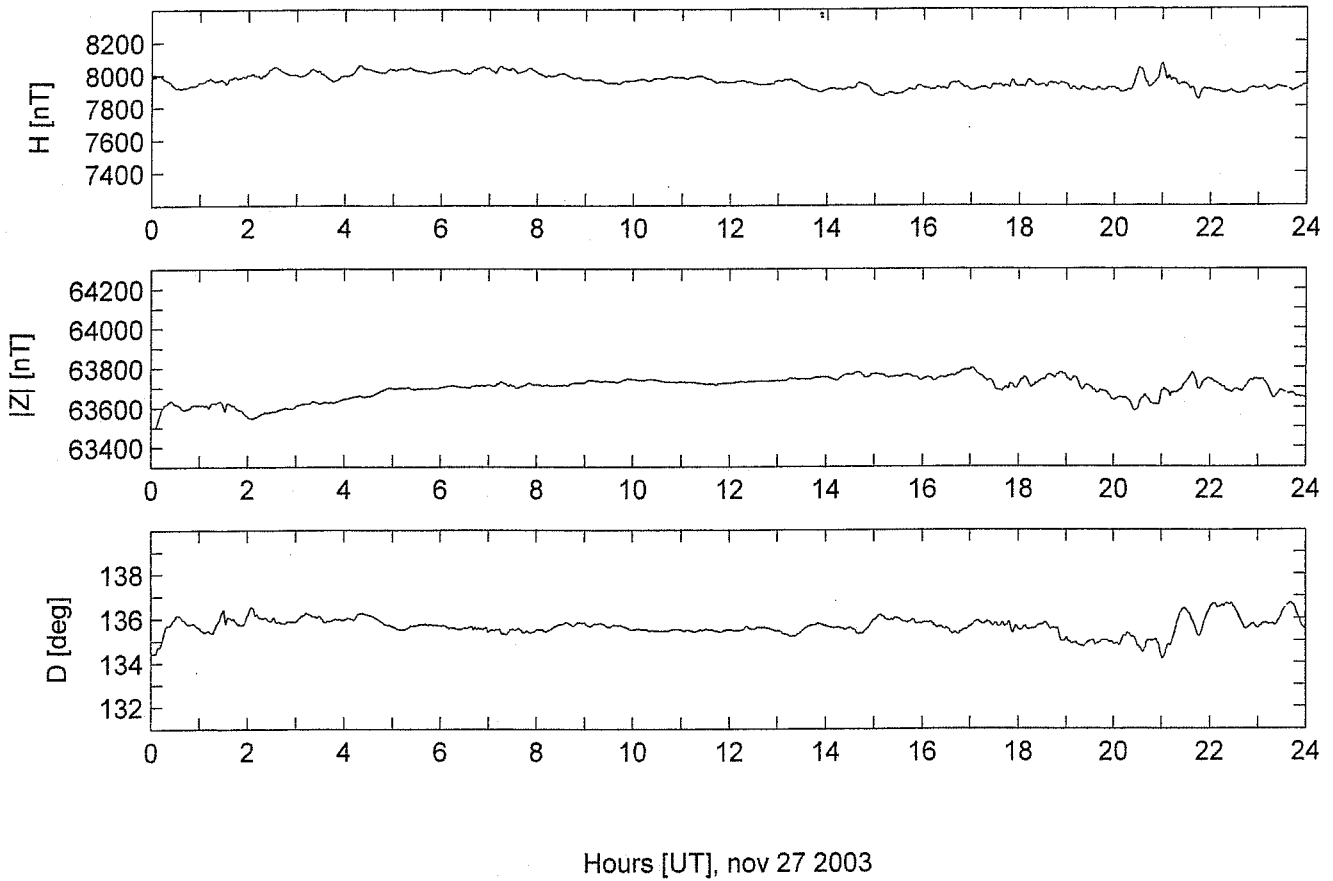
Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



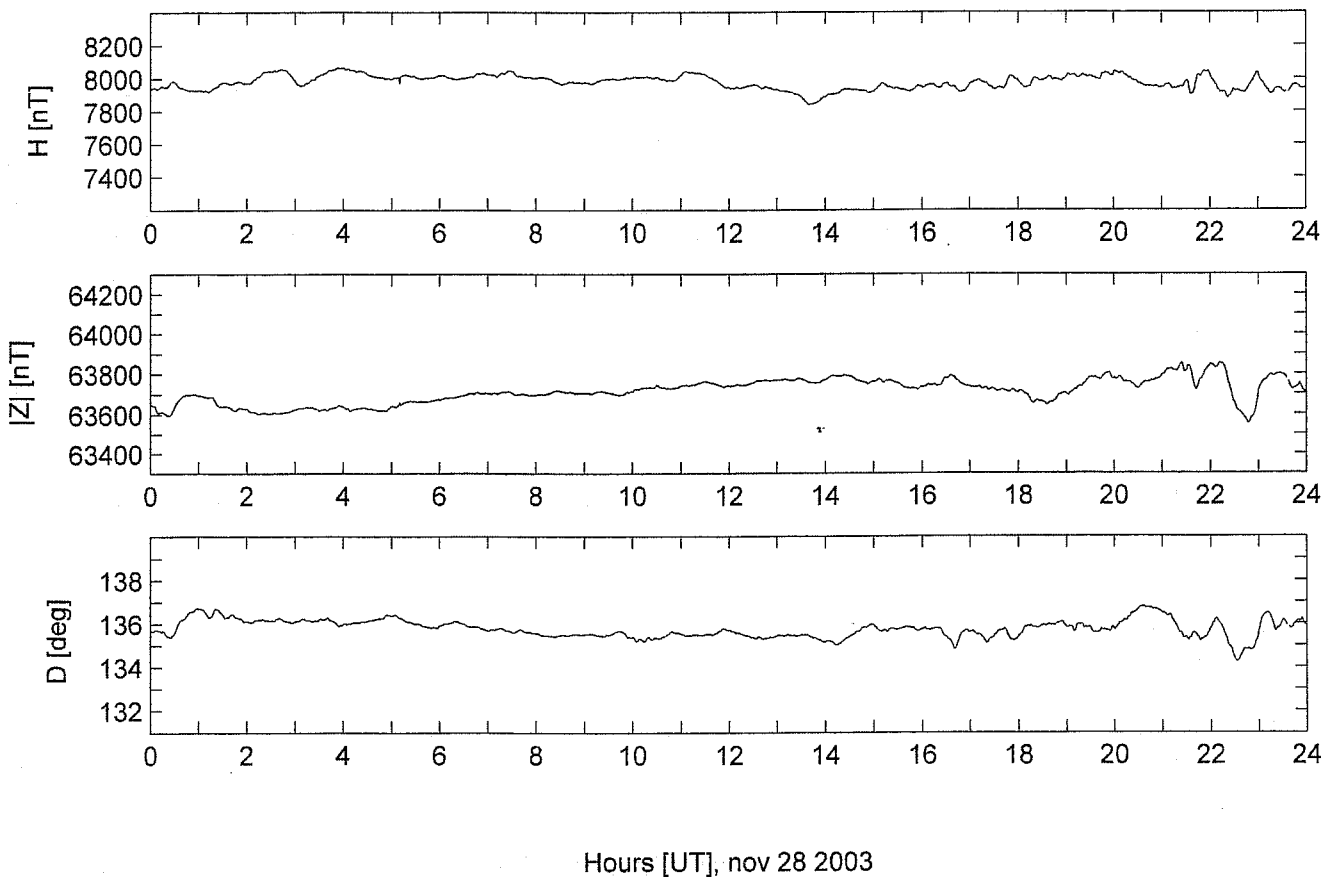
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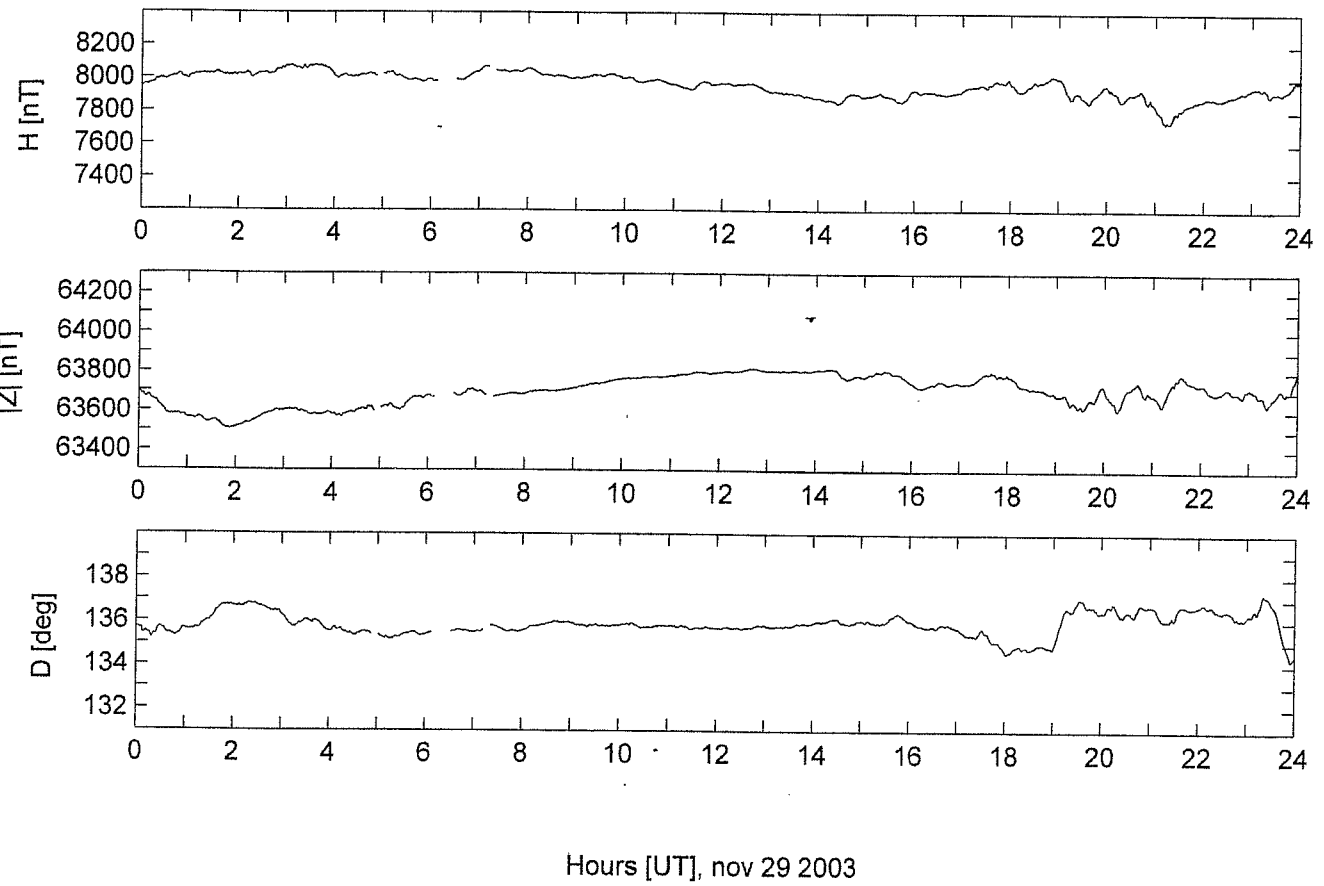
Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



Terra Nova Bay Italian Geomagnetic Observatory, Antarctica

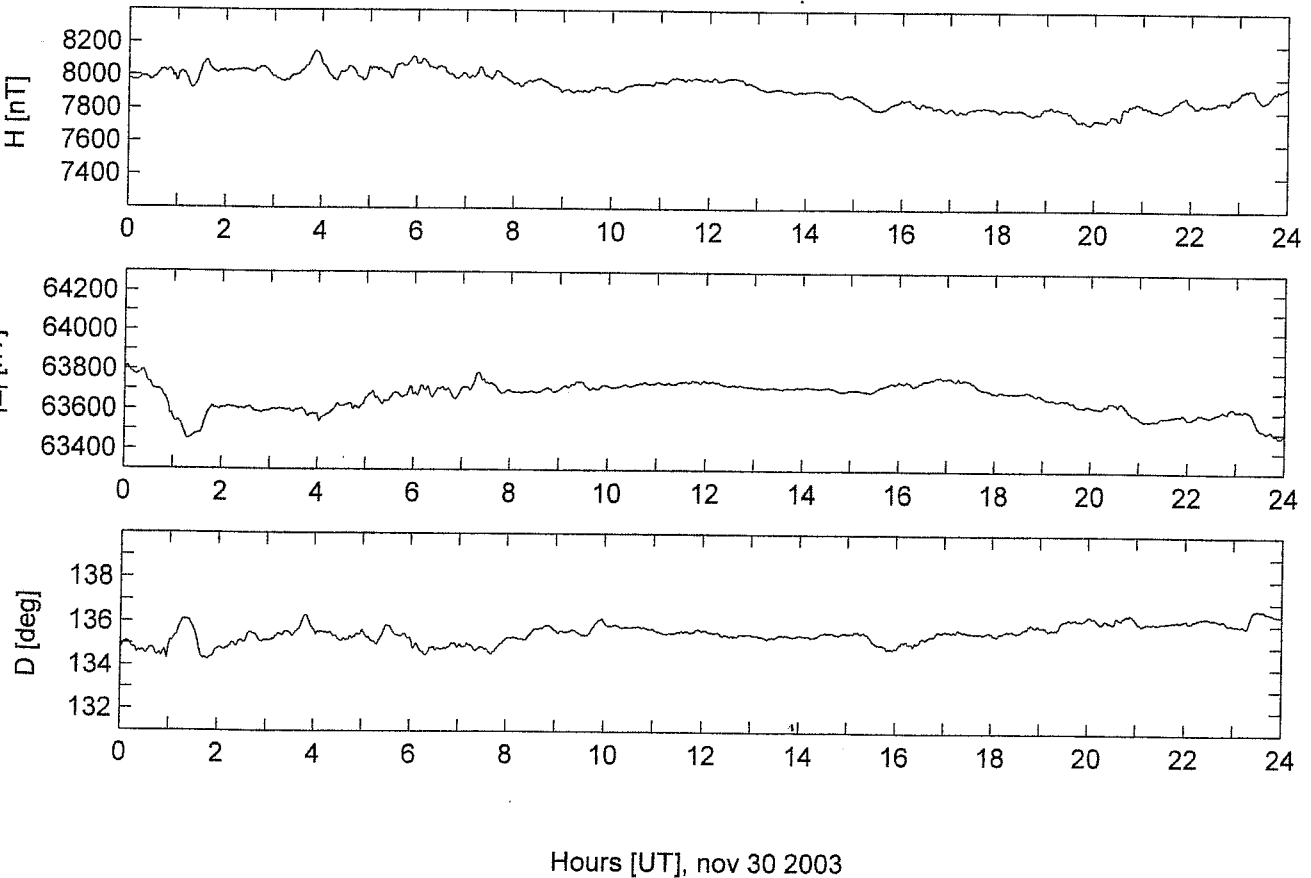


Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



Hours [UT], nov 29 2003

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



Hours [UT], nov 30 2003

NATIONAL ANTARCTIC RESEARCH PROGRAM

Terra Nova Bay, Antarctica Geomagnetic Observatory

Magnetic Observation Results 2004-2005

2007

Geomagnetic Observation Results 2004-2005 Terra Nova Bay - Antarctica

Introduction

During 2004 the Italian Base name was changed from Terra Nova Bay to Mario Zucchelli Station; however the international code of the Geomagnetic Observatory is still TNB.

This report deals with activities undertaken at the Antarctic Italian Geomagnetic Observatory during the austral summer 2004-2005.

The coordinates of the Observatory at OASI are the following:

Geographic latitude:	74.6936°S
Geographic longitude:	164.0975°E
Corrected Geomagnetic latitude (IGRF05):	79.97°S
Corrected Geomagnetic longitude (IGRF05):	306.82°E
Magnetic local time midnight:	08:12 UT

This report describes the activities performed from October 30, 2004 to December 3, 2005.

For the present work H, D and Z INTERMAGNET formatted data from the fluxgate magnetometer have been used.

The proton precession magnetometers used to record F total values were Overhauser type; for a description of instruments we refer to geomagnetism text books, for example Parkinson (1983) and Wienert (1970).

Since the total intensity F time variations, at polar latitudes, where values of inclination is almost 90°, are very close to the vertical component Z time variations, the plots of total intensity time variations are not shown. They can however be obtained from the well known equation:

$$F^2=H^2+Z^2$$

Absolute measurements

For the normal absolute measurements-taking at the Observatory, a standard fluxgate magnetometer theodolite for the determination of D, I angles has been used.

At OASI three different azimuth marks are available, for the computation of the Declination (please refer to the 2001/2002 report for details). The coordinates of geodetic points (mark piers and measuring location) were established on the basis of GPS measurements. From these coordinates the azimuth values 152° 44' 04'', 60° 13' 36'' and 338° 07' 59'' were found.

The proton magnetometer recordings, continuously undertaken during the execution of the DI measurements, have allowed the calculation of the absolute intensive elements.

Table 1 shows absolute measurement values for each element; the values of the intensive components H and Z (rounded off to the nT) were computed using the relations:

$$H = F \cdot \cos I$$
$$Z = F \cdot \sin I$$

H₀ and D₀ reference values computation

Since the fluxgate was magnetically oriented in the horizontal plane, as in the previous installations, it was necessary to compute H₀ and D₀ reference values, comparing absolute and relative measurements, at the same time. For the Z component, once the vertical levelling of the sensor was assured, it was assumed that the variations measured by fluxgate were actually the vertical component of the geomagnetic field variations.

In the description the mathematical procedure used for computation of H₀ and D₀, the following symbols are used:

H ₀ , D ₀	Reference values
H _{abs} , D _{abs}	Values of absolute measurements at time t
x, y	Instantaneous variations recorded by fluxgate system at time t

For each absolute measurement, the reference values were computed as:

$$H_0 = H_{abs} \cos(\varphi) - x$$
$$D_0 = D_{abs} - \varphi$$

where

$$\varphi = \arcsin (y/H_{abs})$$

In order to reduce this dispersion in the set, the Chauvenet criterion was used. The method, based on the hypothesis of a Gauss probability distribution for the data, consists in the elimination of measurements whose difference from the average is greater than a multiple of the standard deviation fixed by the sample dimension (in this case a value 2.74 σ , corresponding to a sample of about 82 data elements, was used). This method, however, cannot be applied more than once, since an iterative procedure could exclude most of the values up to the complete elimination of the data (Worthing and Jeffner, 1943).

The average values of H₀ and D₀ are:

$$H_0 = (7853 \pm 8) \text{ nT}$$
$$D_0 = (138.34 \pm 0.07) \text{ deg}$$

These values are considerably different from those reported in the previous yearbooks because a different instrument was used for the measurements of the instantaneous variations (please refer to the Introduction for more details).

Daily base lines computation

After H₀ and D₀ reference values are found, the computation of the base lines in relation to absolute measurements and then the computation of the daily base lines for all days, can follow. The available data are the H, D and Z magnetic element variations recorded by fluxgate system

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Table captions

Table 1: Absolute measurement values 2004/2005

Table 2: Horizontal intensity hourly and daily means
(from Oct 30, 2004 to Dec 3, 2005)

Table 3: Declination hourly and daily means
(from Oct 30, 2004 to Dec 3, 2005)

Table 4: Vertical intensity hourly and daily means
(from Oct 30, 2004 to Dec 3, 2005)

Table 1**TNB Geomagnetic Observatory****Absolute measurements 2004/2005**

date julian day	D		(+)	I		(-)	(+)	(+)	(-)
	beg	end	D	beg	end	I	F	H	Z
	(UT)		(deg min)	(UT)		(deg min)	(nT)	(nT)	(nT)
303	05:54	6:03	136 11.3	6:13	6:22	82 49.4	64184	8018	63681
303	06:32	6:40	135 59.9	6:46	6:54	82 48.7	64192	8033	63687
305	05:55	6:00	135 34.2	6:08	6:14	82 49.5	64145	8013	63643
305	06:17	6:21	135 36.7	6:25	6:31	82 49.7	64145	8007	63644
306	05:38	5:43	136 05.6	5:49	5:56	82 48.5	64151	8032	63646
306	06:05	6:11	136 06.2	6:15	6:21	82 49.5	64160	8014	63658
307	03:27	3:31	136 27.5	3:34	3:39	82 49.7	64138	8008	63636
307	03:58	4:03	136 24.4	4:07	4:11	82 49.5	64139	8010	63637
307	06:00	6:05	136 02.1	6:08	6:14	82 49.7	64174	8011	63672
307	06:17	6:23	136 00.0	6:27	6:32	82 49.7	64171	8012	63669
308	04:48	4:54	135 20.2	4:58	5:03	82 48.6	64126	8026	63622
308	05:06	5:10	135 33.9	5:14	5:18	82 49.6	64126	8007	63625
309	04:55	4:59	135 53.9	5:04	5:09	82 45.8	64155	8082	63644
309	05:14	5:19	136 00.2	5:22	5:27	82 45.3	64161	8091	63649
310	04:50	4:54	135 50.7	4:58	5:03	82 50.3	64176	8001	63676
310	05:07	5:11	135 44.1	5:15	5:20	82 48.6	64176	8033	63672
311	05:35	5:40	135 51.0	5:43	5:48	82 49.0	64162	8023	63659
311	05:54	5:57	135 51.5	6:01	6:05	82 49.0	64162	8024	63659
314	05:00	5:04	136 21.3	5:09	5:16	82 41.9	64247	8166	63726
314	05:19	5:23	135 56.9	5:29	5:35	82 40.9	64262	8185	63739
315	05:47	5:50	136 17.9	5:54	5:59	82 35.2	64274	8293	63737
315	06:06	6:10	136 13.0	6:13	6:17	82 38.2	64261	8236	63731
316	04:31	4:36	137 03.7	4:39	4:44	82 46.1	64220	8084	63709
316	04:53	4:56	137 05.2	4:59	5:03	82 44.3	64241	8121	63726
316	05:13	5:17	136 52.9	5:20	5:24	82 37.7	64298	8250	63767
317	04:51	4:55	136 39.1	4:58	5:02	82 45.4	64245	8101	63732
317	05:05	5:09	136 01.5	5:12	5:16	82 41.0	64266	8184	63743
317	05:21	5:25	135 54.5	5:28	5:32	82 42.2	64240	8159	63719
318	04:34	4:39	136 23.1	4:43	4:47	82 46.9	64153	8061	63645
318	04:50	4:53	136 10.2	4:57	5:00	82 46.8	64156	8062	63647
320	04:31	4:35	135 44.3	4:39	4:43	82 49.7	64185	8013	63683
320	04:46	4:50	135 53.1	4:54	4:57	82 49.2	64198	8024	63694
321	05:24	5:28	136 13.7	5:31	5:34	82 48.9	64176	8027	63672
321	05:40	5:43	136 05.0	5:46	5:49	82 49.0	64187	8026	63683
322	06:30	6:33	135 47.9	6:35	6:38	82 47.4	64180	8055	63673
322	06:42	6:46	135 48.7	6:49	6:53	82 47.2	64181	8058	63673
323	04:59	5:03	135 47.2	5:05	5:09	82 49.4	64191	8020	63689
323	05:12	5:15	135 45.2	5:17	5:21	82 49.9	64181	8008	63679
324	01:31	1:35	136 04.6	1:37	1:41	82 50.3	64179	8001	63678
324	01:43	1:48	136 02.4	1:52	1:55	82 50.4	64172	7999	63671
324	05:55	5:58	136 00.2	6:00	6:03	82 48.9	64169	8026	63665
324	06:07	6:10	135 54.4	6:12	6:15	82 49.1	64178	8024	63674
325	03:40	3:43	135 26.2	3:46	3:49	82 41.6	64104	8152	63584
325	03:55	3:58	135 23.7	4:00	4:03	82 42.2	64104	8141	63585
325	05:33	5:36	135 50.2	5:38	5:42	82 41.8	64164	8156	63643
325	05:46	5:49	135 32.3	5:52	5:56	82 43.9	64169	8118	63653
325	06:01	6:04	135 13.6	6:07	6:10	82 41.7	64195	8162	63674
326	06:04	6:08	136 06.9	6:10	6:14	82 47.0	64207	8066	63698
326	06:17	6:20	135 37.8	6:22	6:25	82 47.1	64204	8064	63696
326	06:27	6:30	135 47.5	6:33	6:36	82 46.4	64206	8078	63696
327	09:20	9:24	135 07.7	9:28	9:31	82 51.4	64232	7988	63733
327	09:37	9:40	135 14.3	9:43	9:45	82 52.2	64219	7970	63722

327	09:58	10:01	135	31.9	10:03	10:06	82	52.9	64213	7957	63718
328	05:33	5:37	136	01.4	5:39	5:42	82	49.0	64173	8024	63669
328	05:48	5:51	136	03.8	5:54	5:57	82	49.1	64191	8024	63687
328	06:00	6:03	136	05.4	6:05	6:08	82	48.6	64200	8035	63695
329	05:59	6:02	136	26.2	6:04	6:08	82	47.0	64169	8061	63660
329	06:14	6:17	136	10.0	6:19	6:23	82	46.9	64186	8065	63678
329	06:26	6:29	135	46.2	6:31	6:35	82	46.8	64190	8068	63681
330	05:52	5:56	136	06.8	5:58	6:02	82	41.6	64208	8166	63686
330	06:08	6:11	135	49.8	6:13	6:17	82	42.4	64216	8153	63696
330	06:19	6:22	135	58.9	6:24	6:28	82	43.2	64211	8137	63694
331	05:23	5:27	136	41.5	5:30	5:33	82	44.0	64172	8117	63657
331	05:36	5:39	136	33.7	5:41	5:44	82	43.1	64185	8134	63667
331	05:59	6:02	136	32.0	6:04	6:07	82	43.0	64193	8138	63675
331	06:10	6:13	136	25.0	6:16	6:19	82	43.1	64204	8137	63686
332	04:22	4:25	136	03.7	4:27	4:30	82	48.8	64208	8033	63704
332	04:53	4:56	136	10.6	4:58	5:01	82	46.8	64161	8063	63652
333	05:47	5:50	136	07.6	5:53	5:56	82	45.0	64186	8101	63673
333	05:59	6:02	136	12.9	6:05	6:08	82	45.3	64188	8095	63676
333	06:11	6:15	136	11.1	6:17	6:20	82	45.1	64202	8100	63689
334	05:39	5:43	135	32.2	5:45	5:48	82	42.4	64149	8143	63630
334	05:52	5:55	135	34.4	5:58	6:02	82	41.6	64148	8159	63627
334	06:05	6:08	135	23.8	6:11	6:15	82	43.4	64145	8125	63628
335	05:51	5:56	136	10.1	5:59	6:03	82	43.3	64154	8127	63637
335	06:06	6:10	135	47.5	6:12	6:15	82	45.7	64159	8084	63647
335	06:18	6:21	135	28.8	6:23	6:26	82	44.7	64179	8104	63665
336	05:09	5:12	136	17.1	5:16	5:19	82	43.3	64192	8132	63675
336	05:21	5:24	136	09.6	5:26	5:29	82	44.1	64185	8117	63670
336	05:31	5:34	135	60.0	5:36	5:40	82	43.3	64192	8132	63675
337	03:36	3:40	136	03.0	3:42	3:45	82	47.1	64128	8055	63620
337	03:51	3:54	136	06.2	3:55	3:58	82	46.8	64131	8060	63623

Table 2**Terra Nova Bay Antarctica, Italian Geomagnetic Observatory***Hourly H values (nT) from Oct 29,2004 to Dec 3,2004*

UT	0	1	2	3	4	5	6	7	8	9	10	11	DAILY MEAN
	12	13	14	15	16	17	18	19	20	21	22	23	
julian day													
303	7975	7981	7991	8002	8013	8016	8028	8028	8010	7999	7988	7953	7962
	7919	7928	7930	7912	7894	7898	7915	7903	7994	7963	7939	7920	
304	7927	8000	7944	8076	8059	8058	8085	8071	8071	8032	7945	7945	7962
	7962	7936	7923	7930	7909	7934	7963	7860	7892	7800	7856	7916	
305	7963	7996	7998	8053	8051	8048	8018	8015	7994	7996	8004	7951	7950
	7976	7920	7899	7902	7884	7927	7864	7879	7865	7838	7870	7898	
306	7966	7988	8014	8018	8029	8036	8012	8001	7983	7985	7985	7965	7969
	7971	7955	7909	7942	7928	7949	7964	7967	7944	7898	7932	7929	
307	7937	7929	7955	7997	8009	8009	8009	7994	8012	8001	8003	7969	7963
	7973	7959	7946	7913	7880	7874	7879	7913	7982	7988	7975	8002	
308	8016	8019	8031	8069	8038	8000	7982	7981	7977	7992	7974	7968	7953
	7944	7955	7953	7946	7918	7906	7893	7858	7819	7810	7898	7923	
309	7945	7985	8014	8055	8047	8083	8068	8018	7977	7965	7974	7950	7972
	7947	7958	7955	7941	7915	7899	7919	7948	7994	7939	7911	7929	
310	7967	7954	7991	8002	7993	8024	7988	7970	7968	7976	7972	7965	7969
	7961	7955	7958	7955	7946	7962	7960	7975	7951	7953	7954	7949	
311	7966	7979	8015	8016	8014	8015	8018	8003	7991	7980	7965	7957	7976
	7965	7959	7959	7945	7945	7964	7947	7956	7946	7963	9999	7981	
312	7995	7997	7969	8057	8078	8036	8024	8014	7986	7975	7960	7982	7890
	7952	7920	7907	7913	7887	7826	7546	7655	7743	7514	7648	7781	
313	8011	8145	8277	8480	8370	8412	8247	8180	8250	8199	8138	8040	8013
	7838	7840	7843	7866	7881	7858	7767	7717	7689	7707	7754	7808	
314	7878	7969	8048	8094	8130	8179	8158	8163	8196	8150	8136	8073	7965
	7957	7905	7733	7661	7752	7753	7838	7430	7469	8101	8210	8170	
315	8386	8289	8460	8390	8572	8334	8237	8201	8241	8211	8104	8021	8041
	7991	7839	7738	7813	7741	7658	7697	7820	7780	7757	7839	7874	
316	7915	7950	7979	7990	8061	8200	8165	8174	8099	8013	7998	7941	7969
	7906	7936	7933	7924	7925	7904	7879	7970	7844	7837	7792	7910	
317	8015	8144	8115	7969	8021	8150	8067	8046	8066	8043	7985	8014	7974
	7976	7943	7927	7897	7875	7879	7841	7826	7861	7857	7901	7950	
318	7961	7987	8005	8030	8063	8083	8095	8082	8037	8024	7995	7968	8000
	7951	7958	7967	7964	7966	7955	7999	8014	7946	8066	7967	7922	
319	7929	7998	8137	8075	8051	8027	8027	8048	8020	8001	7974	7977	8001
	7973	7965	7932	7964	7969	7966	7980	8002	8064	7988	7985	7963	
320	7966	7993	8020	8023	8034	8036	8013	7996	7988	7999	7975	7968	7986
	7963	7980	7960	7972	7968	7981	7991	8001	7977	7949	7957	7964	
321	7984	7997	8013	8020	8025	8038	8023	8051	8080	8035	8013	7940	7990
	7967	7967	7935	7909	7951	7939	7954	8011	7994	7929	8012	7982	
322	7996	8019	8030	8026	8032	8044	8060	8106	8066	8050	8006	7963	7996
	7953	7961	7963	7953	7952	7945	7979	7970	7942	7942	7952	7987	
323	7989	7984	8003	8021	8036	8013	8010	7993	7990	7993	7987	7976	7980
	7976	7979	7967	7952	7946	7955	7950	7959	7945	7951	7961	7978	
324	7994	7997	8016	8035	8047	8057	8025	8010	8002	7988	7981	7972	7997
	7972	7969	7967	7958	7953	7949	7949	7965	8088	8080	8045	7913	
325	7952	8022	8076	8148	8144	8136	8157	8079	7997	7991	7991	7990	7997
	7908	7924	7913	7913	7924	7902	7885	7959	7947	8037	8000	7931	
326	7943	8008	7992	8032	8039	8047	8067	7999	8006	8010	7963	8007	7970
	7949	7909	7874	7872	7928	7913	7943	7870	8027	7979	7947	7968	
327	7966	8003	9999	8042	8063	8150	8139	8040	8034	7999	7967	7984	8001
	7968	7958	7963	7962	7960	7963	7957	7971	7985	8007	7931	8002	
328	7968	7972	8017	8060	8044	8031	8033	8015	7996	8004	7987	7980	7972
	7978	7968	7946	7939	7935	7920	7915	7941	7963	7938	7897	7887	
329	7896	7925	7978	8020	8029	8045	8055	8031	8030	8007	7994	7973	7939
	7984	7958	7927	7910	7892	7862	7809	7885	7822	7834	7853	7826	
330	7922	7970	8098	8150	8177	8182	8150	8108	8033	8010	7999	7972	

	7940	7921	7889	7901	7895	7865	7847	7779	7800	7825	7817	7832	7962
331	7906	7935	8022	8153	8178	8140	8138	8082	8064	8043	8010	7946	
	7932	7965	7941	7915	7893	7842	7858	7839	7830	7791	7818	7894	7964
332	7945	7959	7965	8002	8041	8074	8092	8078	8050	7983	7975	7972	
	7956	7964	7926	7902	7885	7836	7778	7796	7826	7845	7837	7857	7939
333	7893	7918	8001	8017	8076	8116	8099	8096	8070	8062	8029	8002	
	7956	7964	7952	7882	7875	7904	7957	7965	7985	7952	7913	8015	7987
334	7951	8096	8115	8033	8070	8118	8078	8040	8014	7968	7964	8003	
	7927	7930	7911	7930	7892	7910	7940	7971	7905	7911	7965	7937	7982
335	7980	8063	8080	8106	8100	8137	8099	8015	7998	8011	7963	7987	
	7912	7896	7934	7935	7956	7963	7901	7860	7876	7910	7966	7959	7983
336	7969	7994	8063	8076	8088	8125	8111	8091	8062	8024	7987	7955	
	7957	7955	7954	7949	7941	7936	7984	7997	7965	7890	7926	7978	7999
337	7982	7959	7988	8026	8040	8043	8043	8043	8005	7984	7964	7956	
	7969	7995	7963	7923	7930	7953	7935	7875	7940	7953	9999	7958	7975
338	7975	7986	7992	8002	8035	8022	8007	7996	7988	7980	7957	7963	
	7963	7955	7955	7946	7949	7945	7947	7911	7934	7939	7947	7969	7969

TOTAL MEAN = 7976 nT

Table 3

Terra Nova Bay Antarctica, Italian Geomagnetic Observatory

Hourly D values from Oct 29,2004 to Dec 3,2004
(deg: first three digit, minutes: second two digits)

Table with columns: UT, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, DAILY MEAN. Rows represent Julian days from 303 to 329. Each row contains 12 D-value entries and a final DAILY MEAN value.

	13523	13530	13549	13551	13603	13608	13644	13622	13647	13626	13615	13716	13611
330	13657	13655	13648	13634	13610	13544	13543	13546	13548	13530	13508	13518	
	13535	13527	13514	13535	13542	13618	13615	13652	13718	13726	13706	13706	13611
331	13655	13652	13649	13639	13636	13625	13609	13554	13545	13532	13534	13537	
	13544	13535	13540	13544	13540	13555	13618	13617	13629	13626	13633	13651	13610
332	13639	13645	13611	13552	13552	13614	13602	13555	13536	13521	13536	13542	
	13538	13520	13515	13508	13517	13522	13548	13559	13612	13610	13623	13629	13552
333	13643	13722	13708	13656	13640	13604	13557	13514	13532	13535	13529	13528	
	13527	13520	13513	13529	13537	13543	13516	13534	13440	13355	13447	13521	13541
334	13548	13513	13511	13557	13529	13518	13460	13500	13515	13527	13530	13515	
	13519	13515	13524	13517	13550	13524	13510	13559	13707	13524	13520	13610	13530
335	13621	13607	13540	13538	13543	13559	13511	13526	13530	13508	13515	13507	
	13504	13515	13506	13519	13507	13514	13512	13539	13552	13551	13537	13535	13530
336	13548	13560	13536	13549	13638	13547	13523	13516	13433	13524	13527	13531	
	13536	13535	13541	13525	13531	13519	13503	13449	13524	13637	13548	13528	13534
337	13533	13544	13546	13552	13541	13538	13534	13533	13522	13520	13529	13540	
	13538	13525	13526	13526	13532	13521	13536	13543	13601	13601	99999	13540	13537
338	13545	13542	13551	13553	13606	13560	13550	13542	13533	13532	13535	13535	
	13537	13539	13539	13540	13535	13540	13542	13530	13523	13543	13551	13550	13542

TOTAL MEAN = 135° 47' nT

330	63675	63598	63620	63623	63650	63694	63697	63696	63722	63747	63754	63759	
	63753	63761	63765	63756	63781	63786	63766	63764	63735	63710	63662	63666	63714
331	63682	63685	63661	63681	63657	63657	63688	63715	63737	63766	63786	63768	
	63728	63733	63736	63731	63761	63821	63833	63789	63745	63730	63728	63706	63730
332	63706	63654	63696	63681	63686	63666	63687	63699	63709	63720	63724	63739	
	63739	63754	63782	63832	63771	63793	63830	63804	63793	63756	63725	63718	63736
333	63706	63665	63609	63608	63625	63660	63692	63724	63729	63743	63770	63792	
	63786	63817	63790	63759	63777	63755	63683	63660	63630	63494	63374	63454	63679
334	63663	63526	63512	63537	63588	63614	63620	63646	63644	63689	63727	63722	
	63689	63693	63668	63679	63673	63617	63569	63622	63671	63581	63520	63591	63628
335	63497	63529	63556	63584	63603	63627	63663	63659	63700	63687	63680	63686	
	63696	63711	63715	63670	63650	63594	63627	63619	63600	63652	63585	63607	63633
336	63659	63628	63591	63619	63621	63667	63665	63676	63732	63711	63726	63732	
	63725	63709	63720	63711	63684	63671	63655	63639	63642	63693	63648	63598	63672
337	63600	63619	63617	63603	63639	63652	63674	63671	63681	63703	63715	63715	
	63721	63721	63697	63705	63720	63728	63714	63704	63661	63654	99999	63626	63676
338	63601	63601	63629	63644	63649	63668	63687	63696	63696	63695	63693	63687	
	63691	63702	63718	63716	63695	63690	63711	63693	63658	63650	63659	63652	63674

TOTAL MEAN = 63697 nT

Figure Captions

Fig 1: Scatter plot and linear regression for daily H, D and Z^1 base lines.

Fig 2: Hourly means of the H, D and Z^1 elements during the whole campaign.

Fig. 3 – 38: Daily plots of the one minute values of the H, D and Z^1 elements.

Fig. 39: Geomagnetic field trend since 1987.

¹ Z values must be considered negative

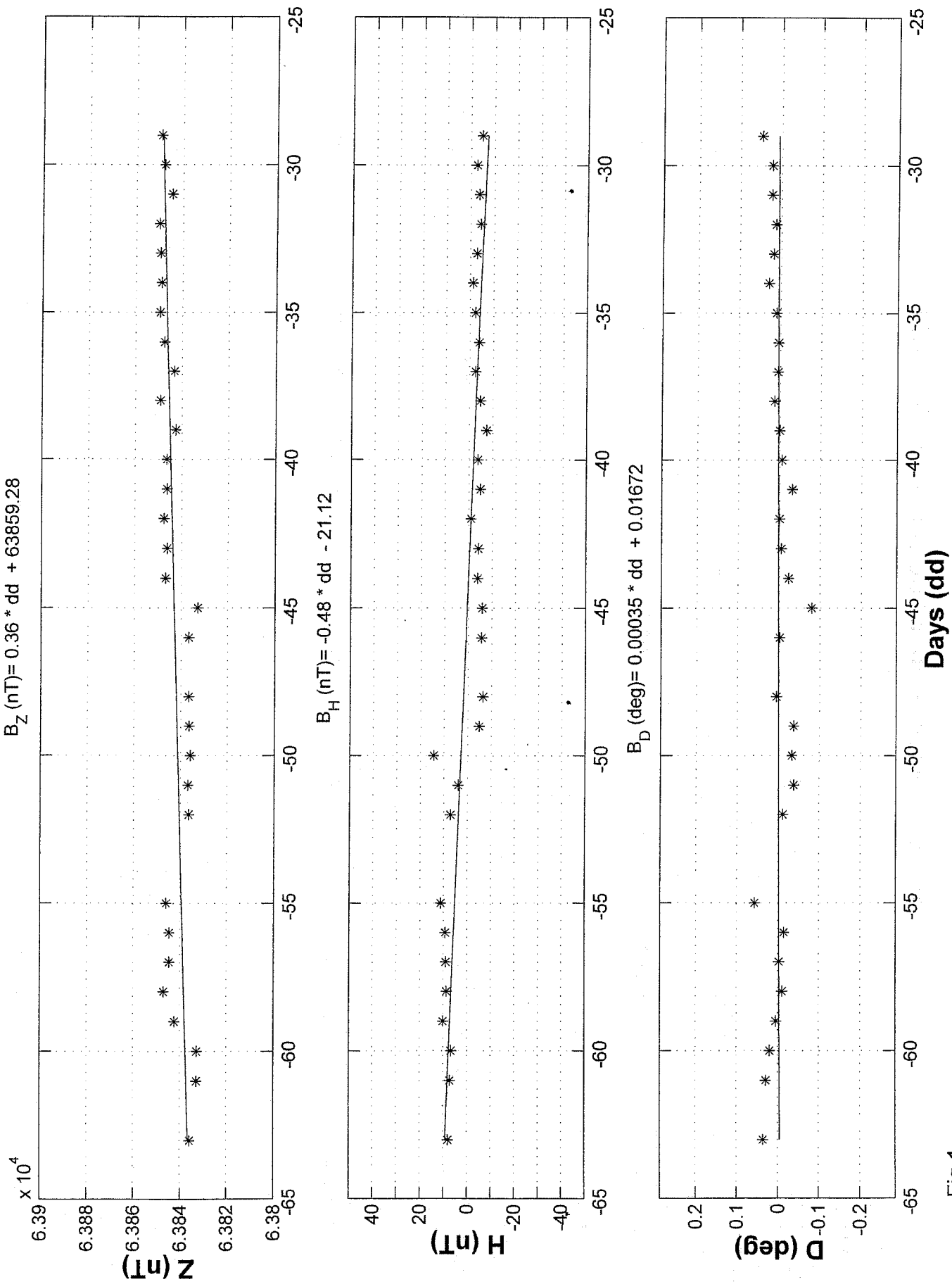


Fig.1

Mario Zucchelli Station hourly means 2004/2005

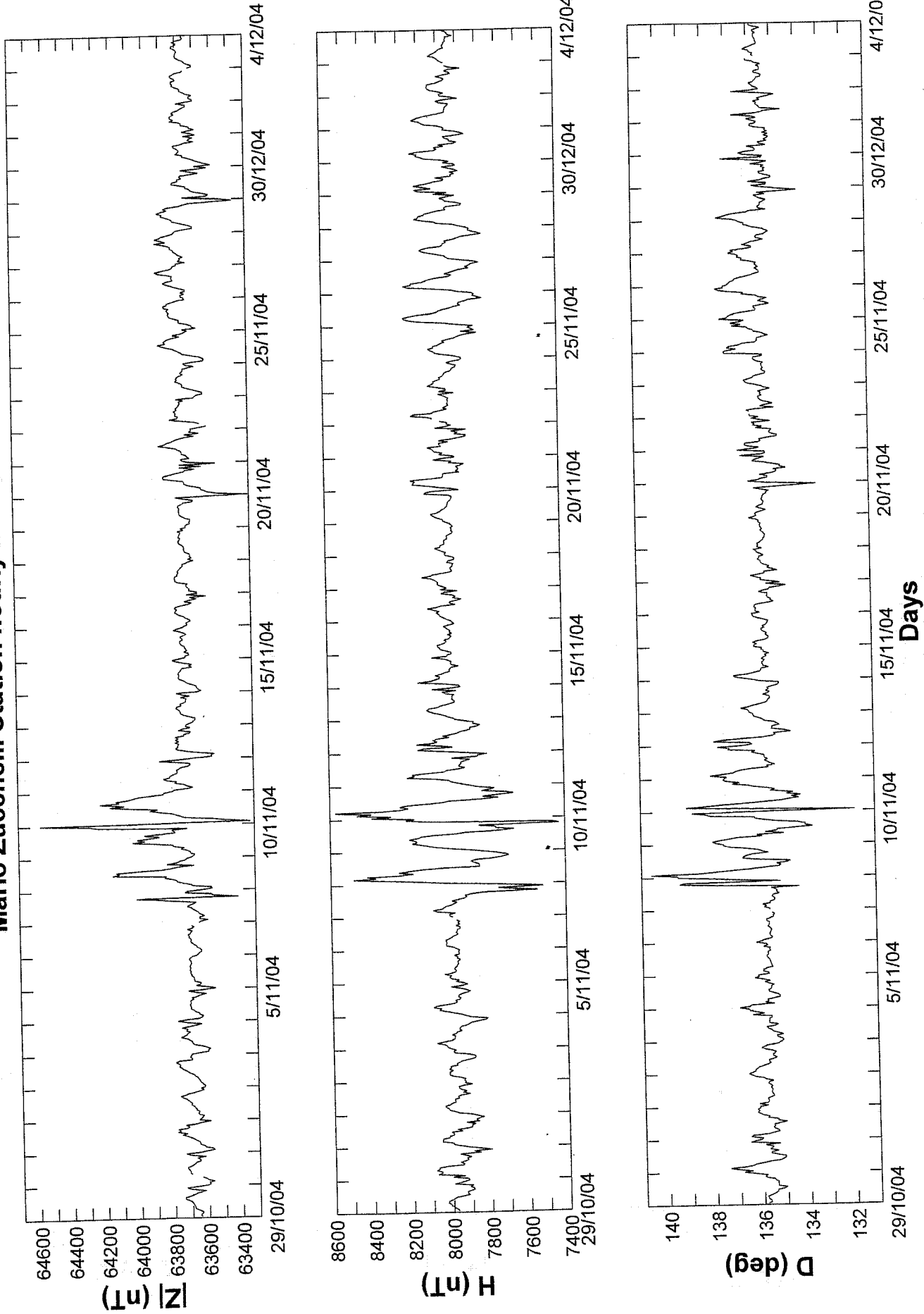
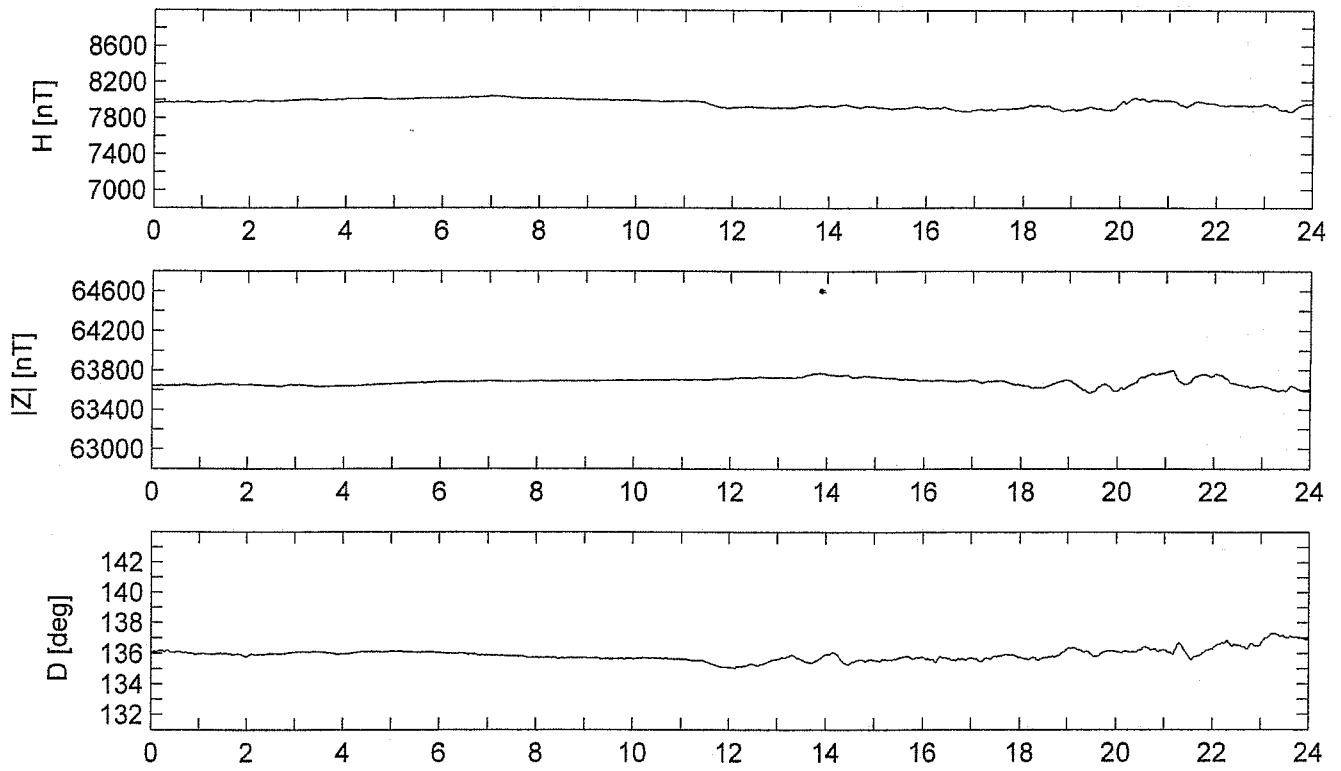


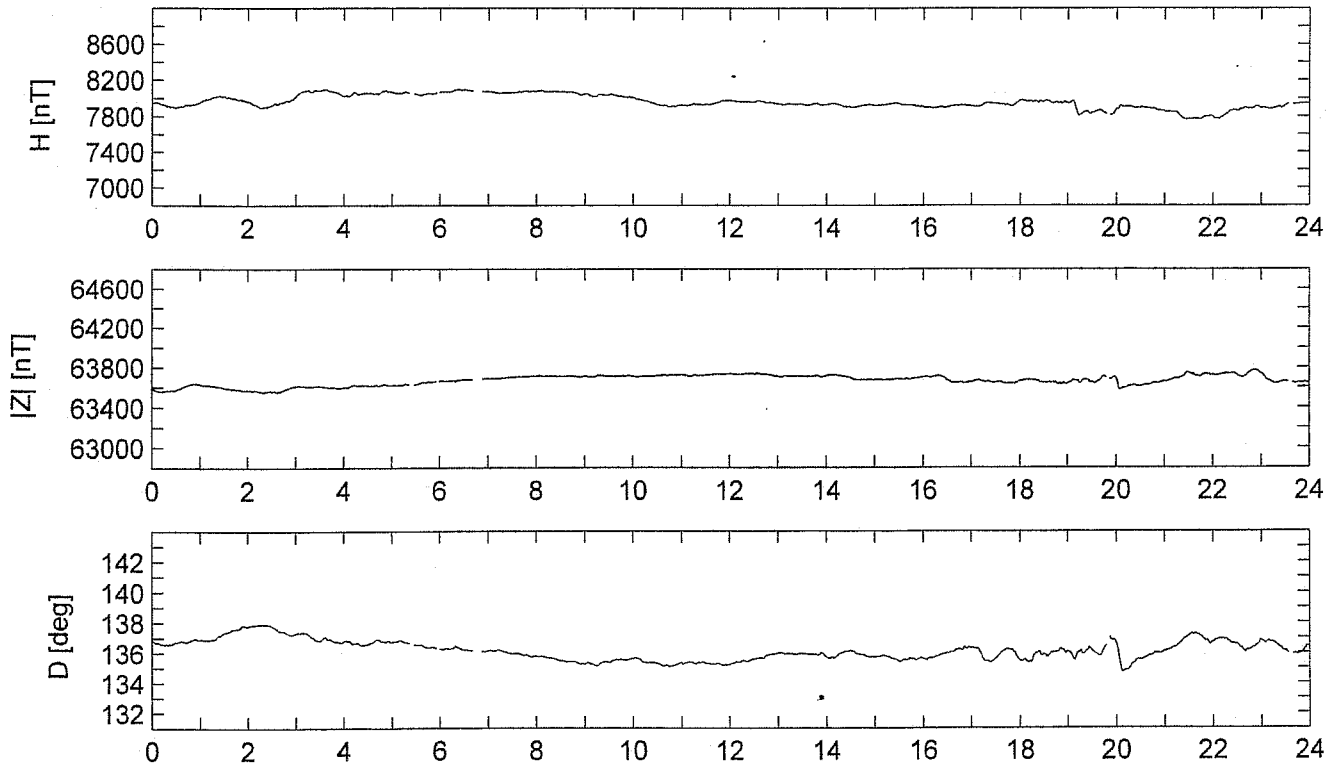
Fig.3-38

TNB Italian Geomagnetic Observatory, Antarctica



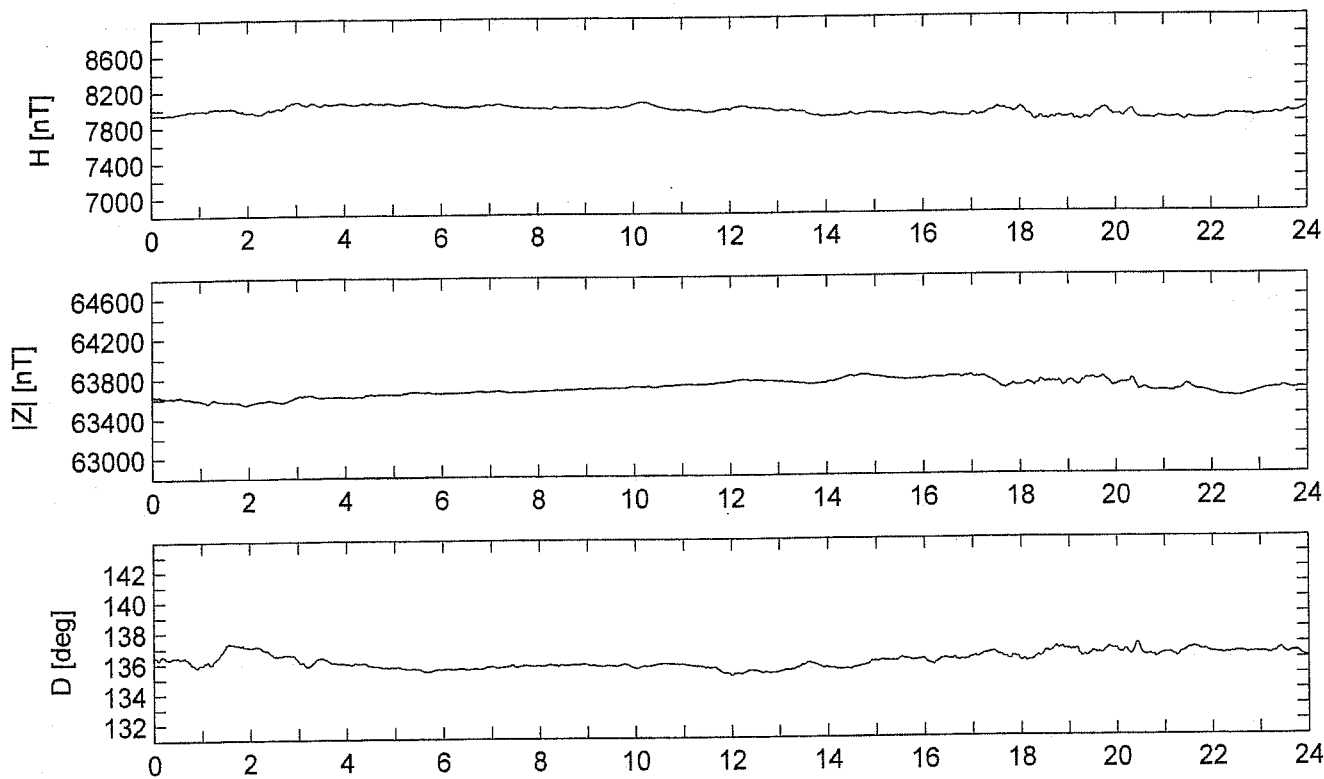
Hours [UT], oct 29 2004

TNB Italian Geomagnetic Observatory, Antarctica



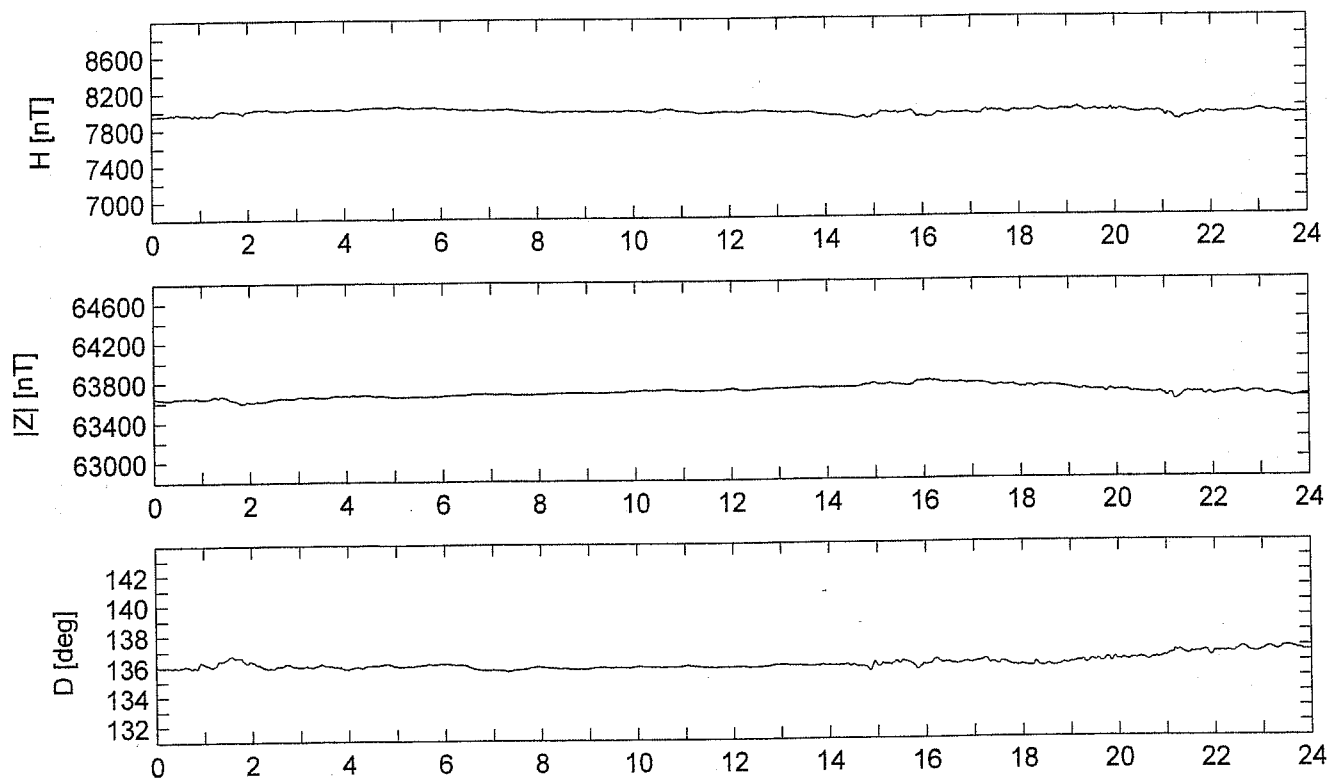
Hours [UT], oct 30 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



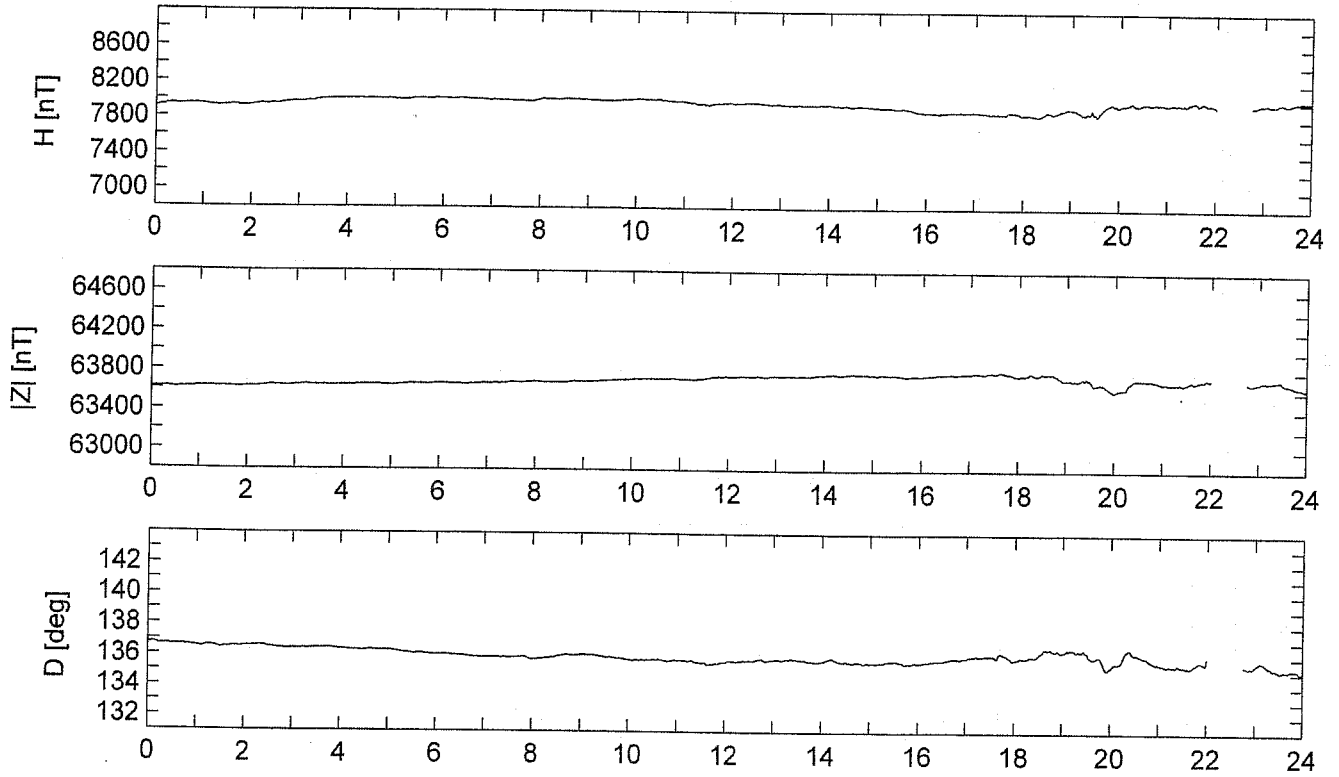
Hours [UT], oct 31 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



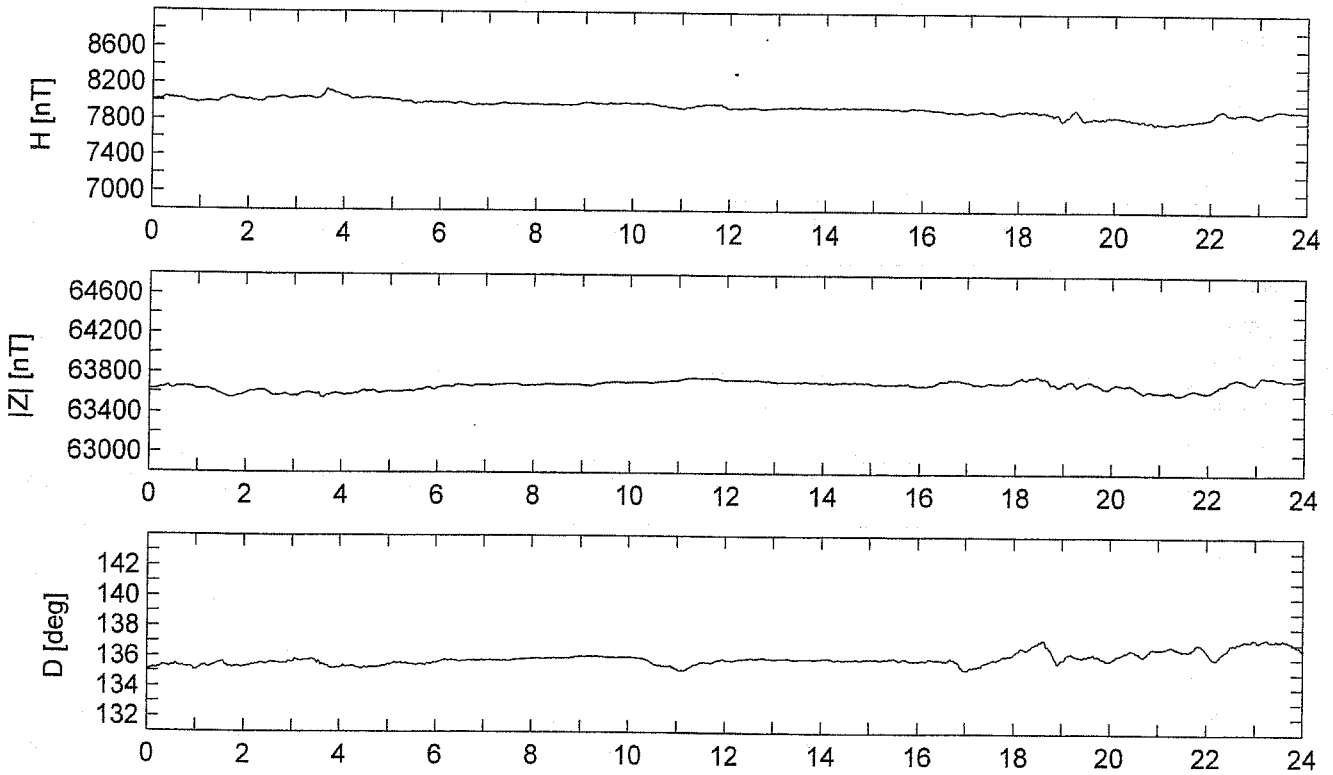
Hours [UT], nov 1 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



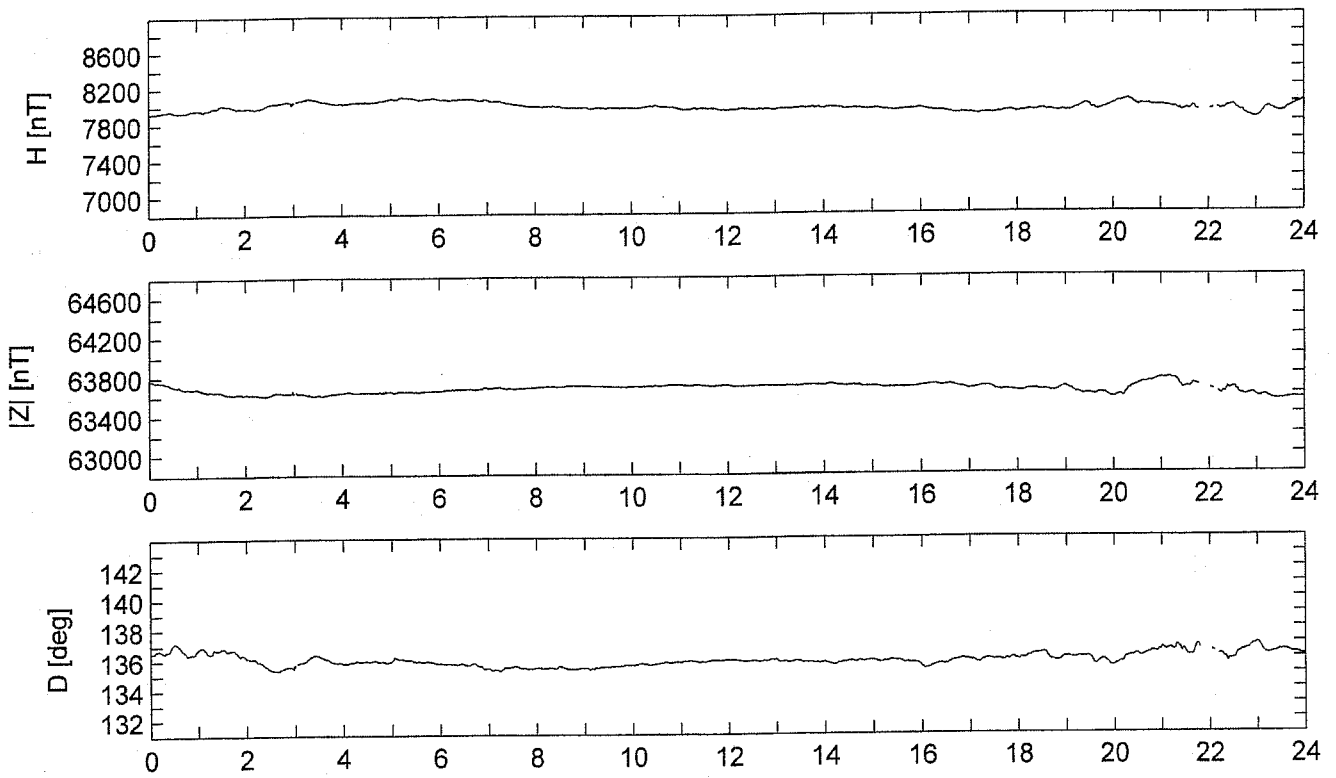
Hours [UT], nov 2 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



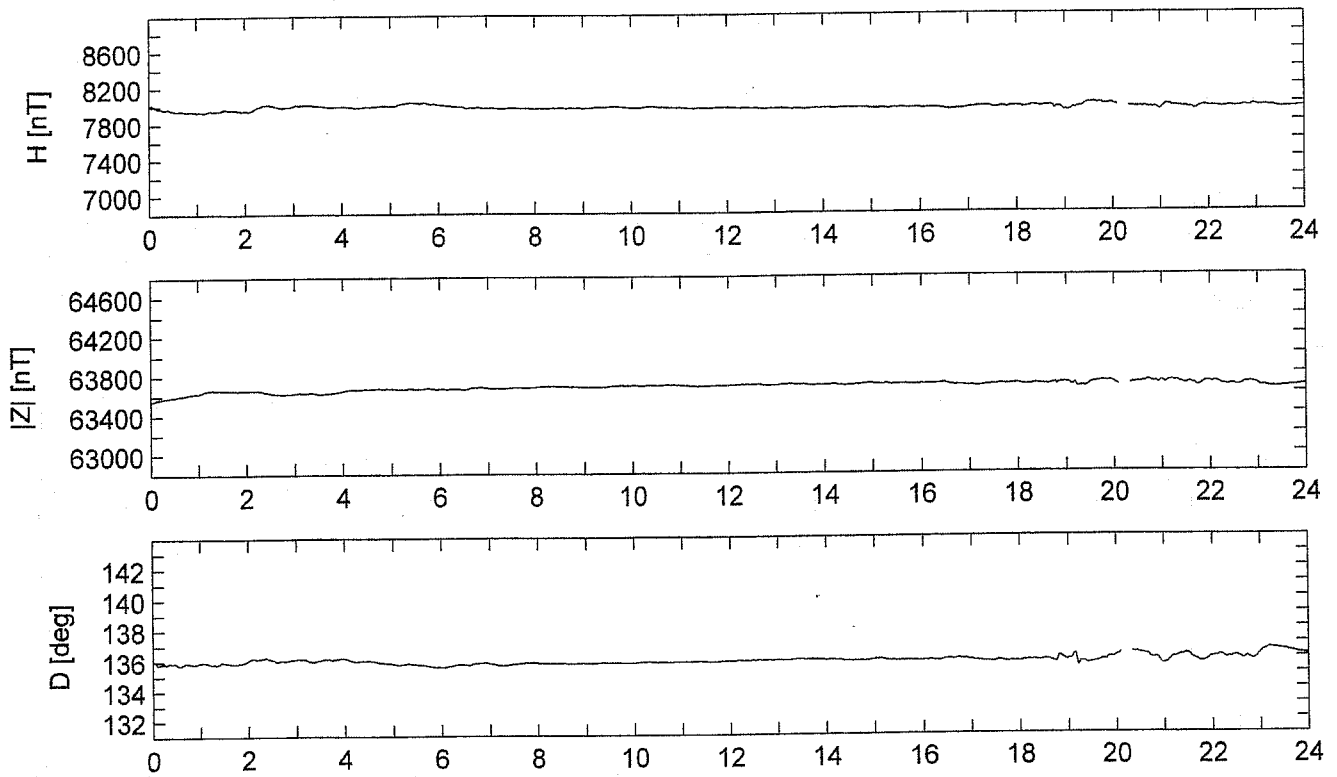
Hours [UT], nov 3 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



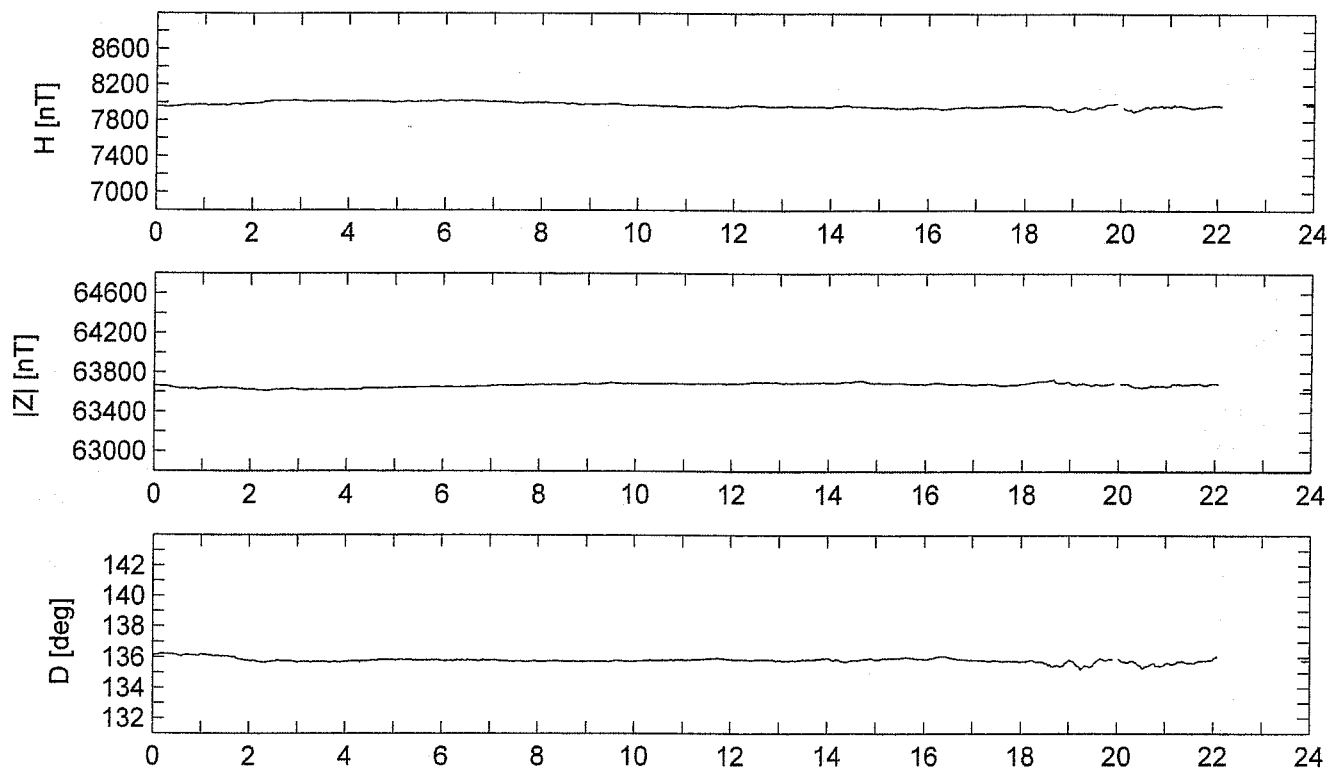
Hours [UT], nov 4 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



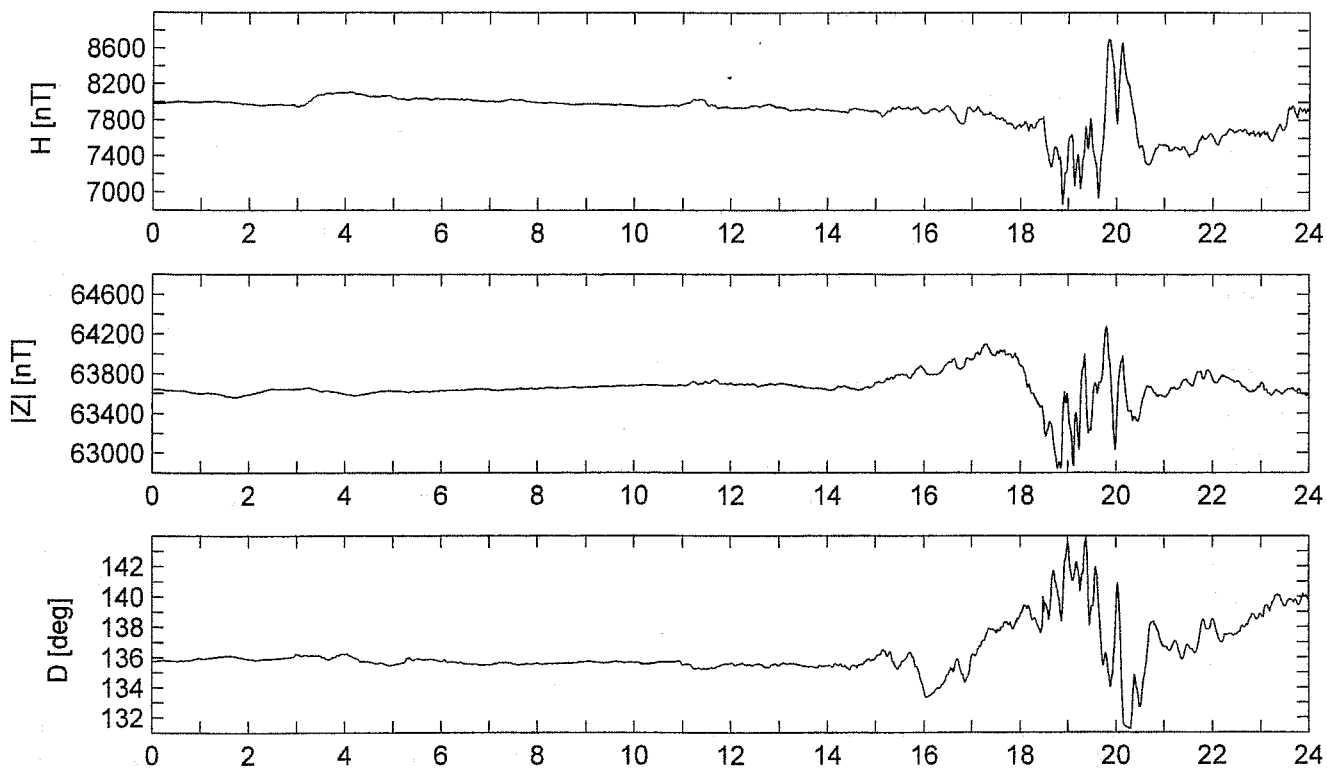
Hours [UT], nov 5 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



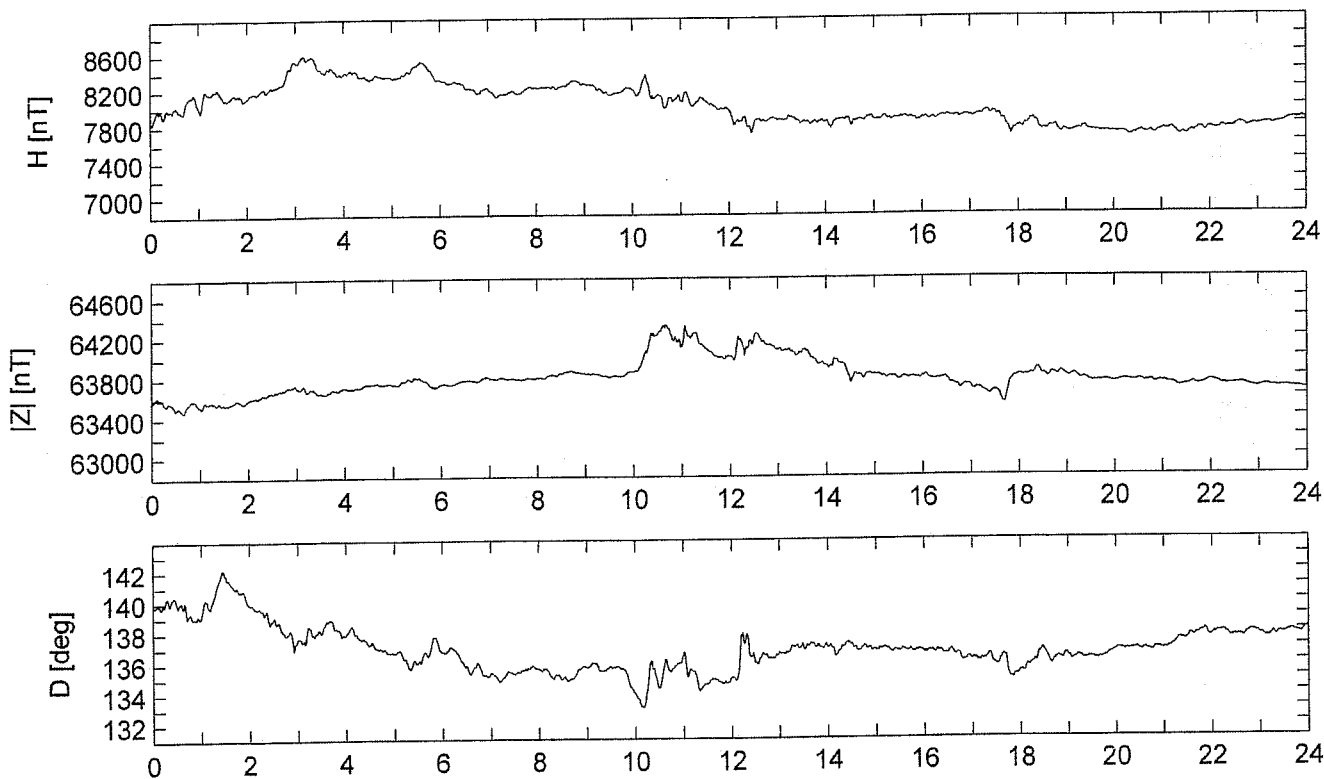
Hours [UT], nov 6 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



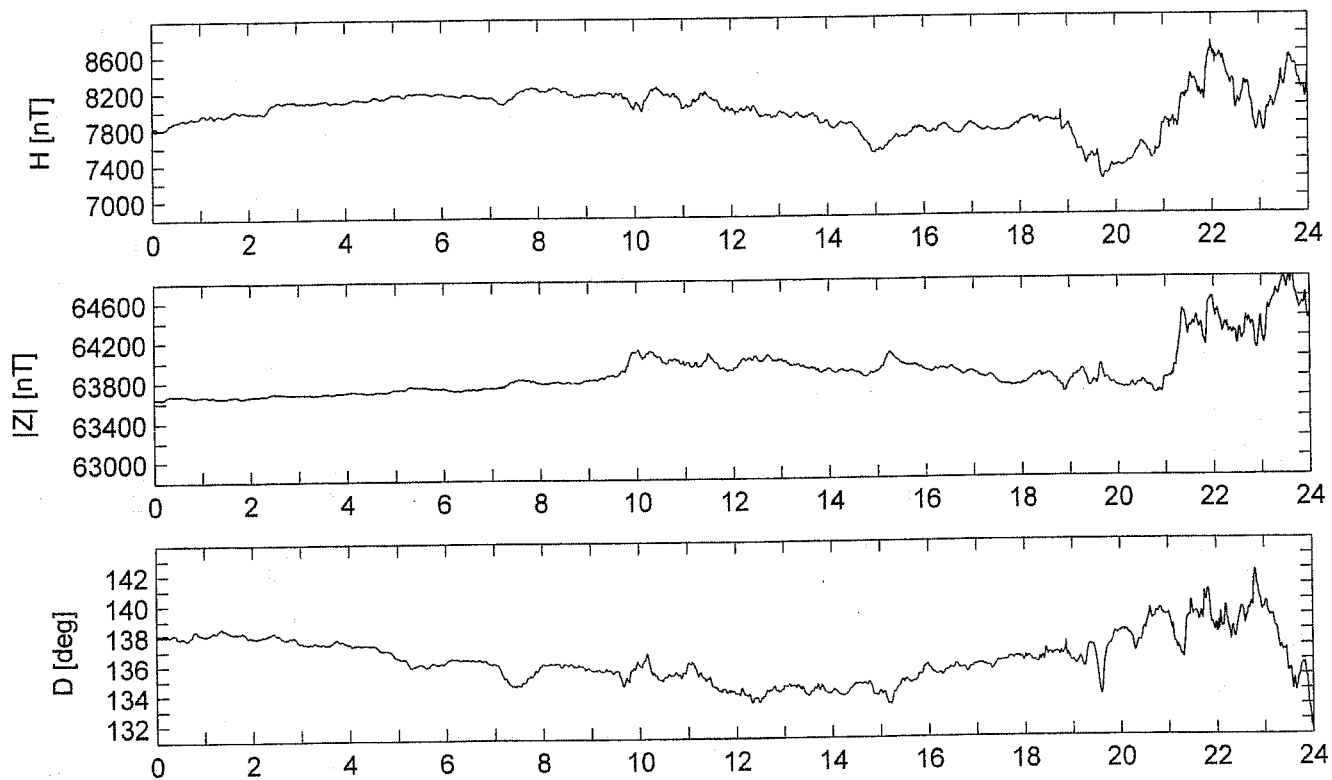
Hours [UT], nov 7 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



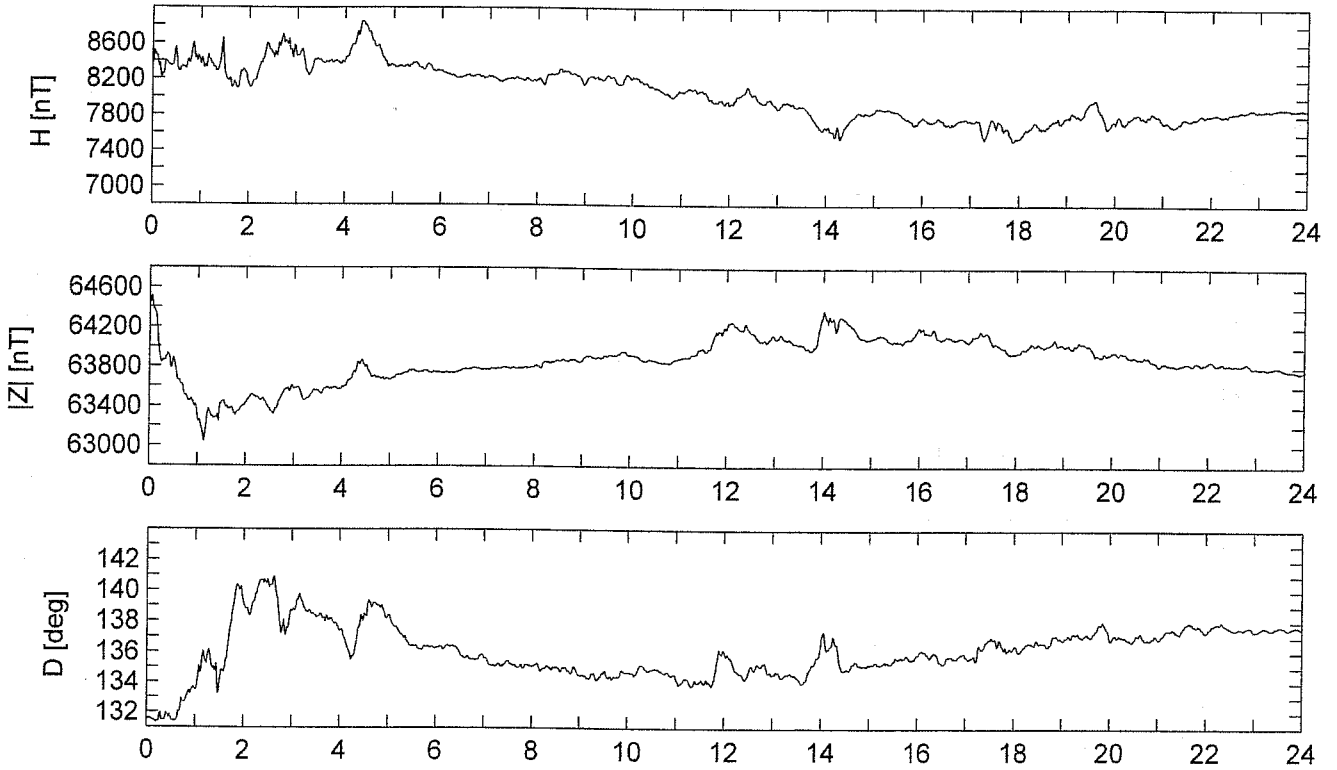
Hours [UT], nov 8 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



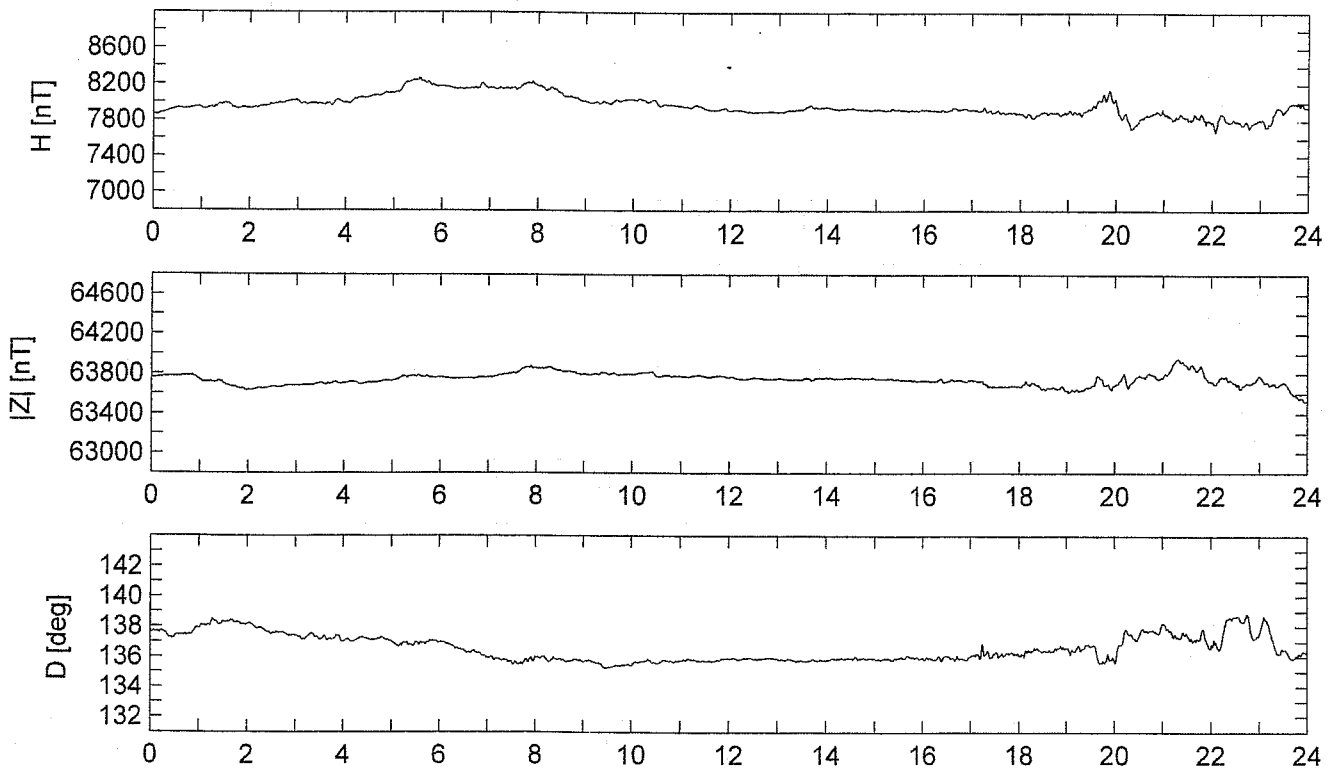
Hours [UT], nov 9 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



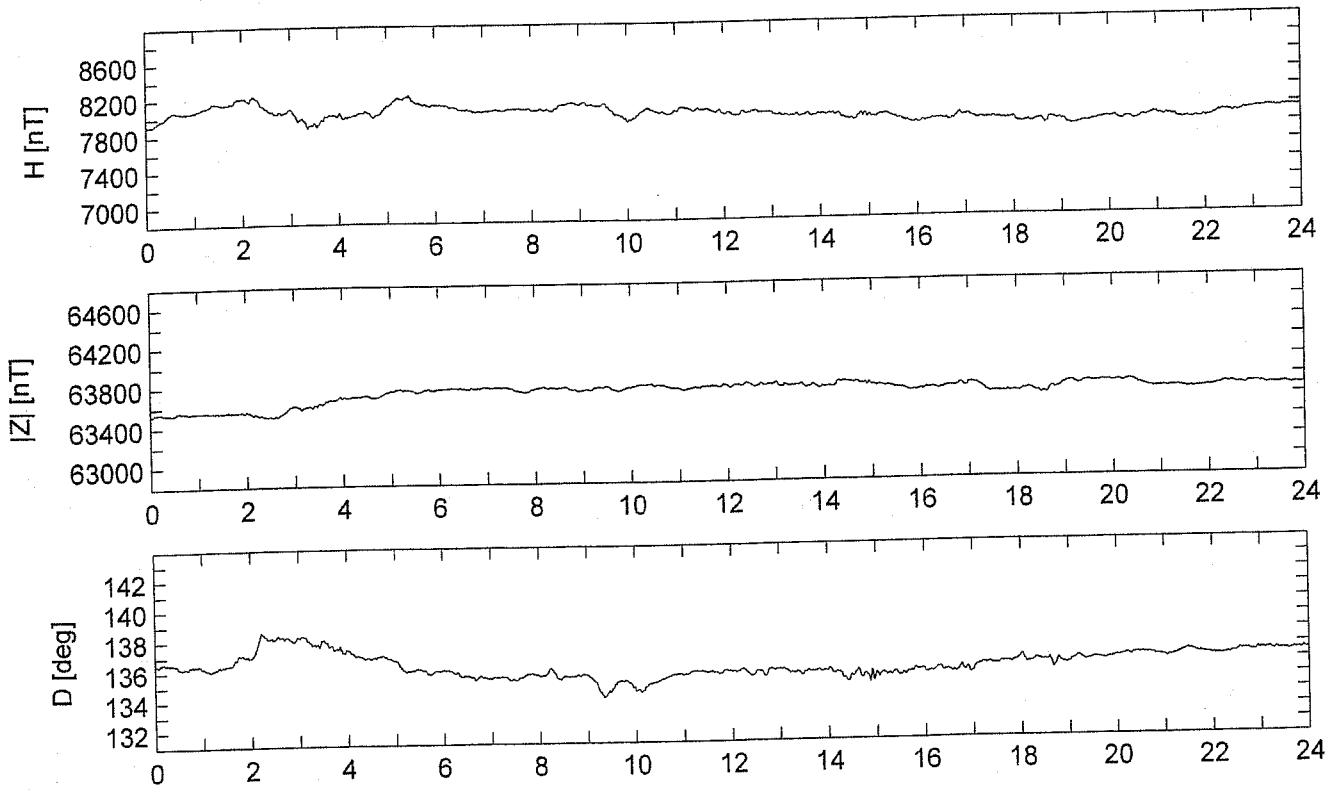
Hours [UT], nov 10 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



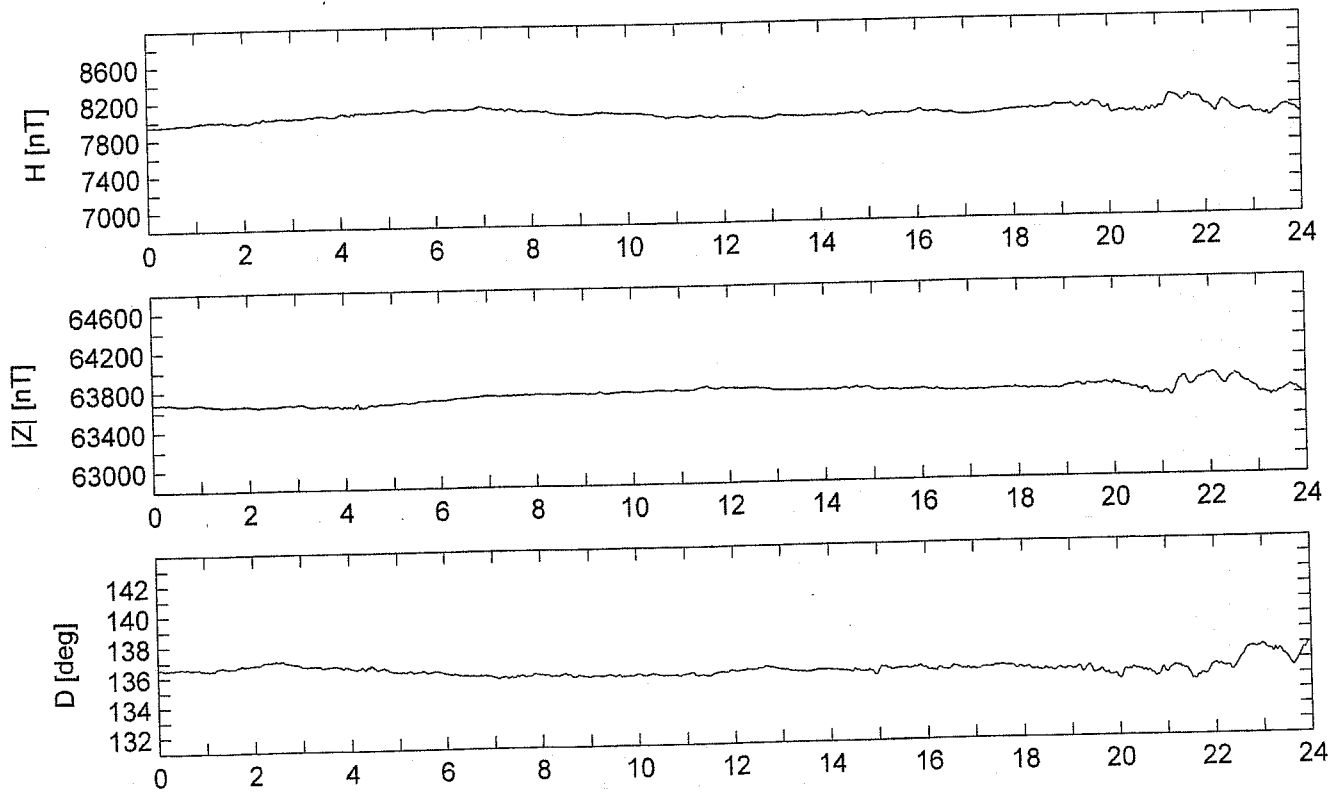
Hours [UT], nov 11 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



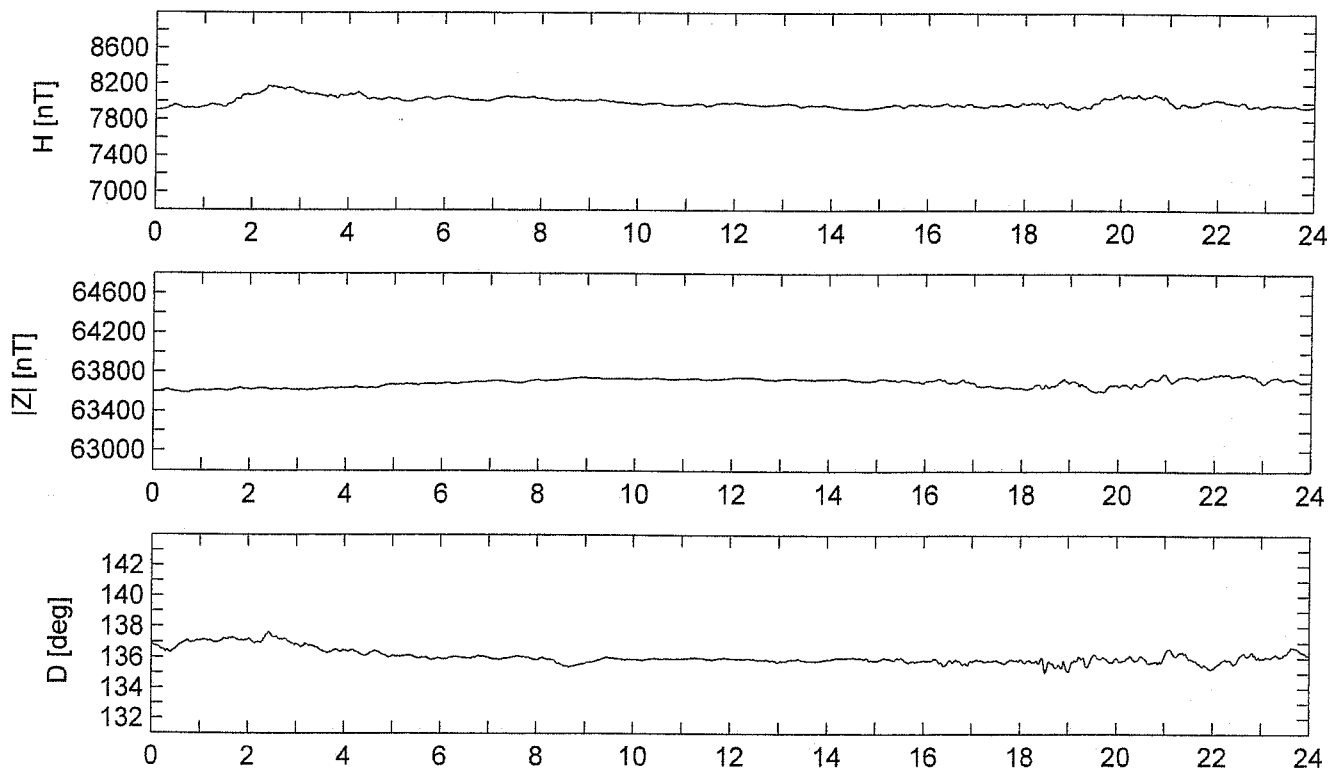
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



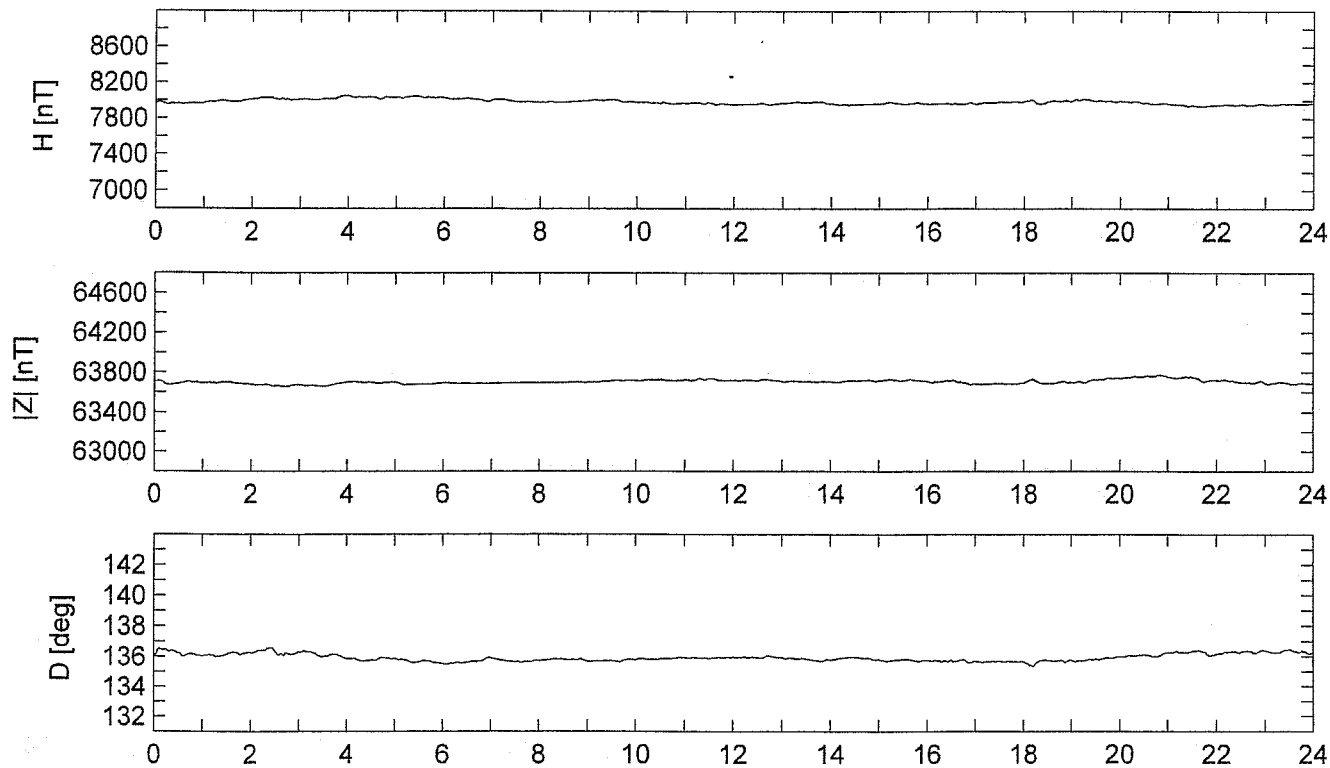
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



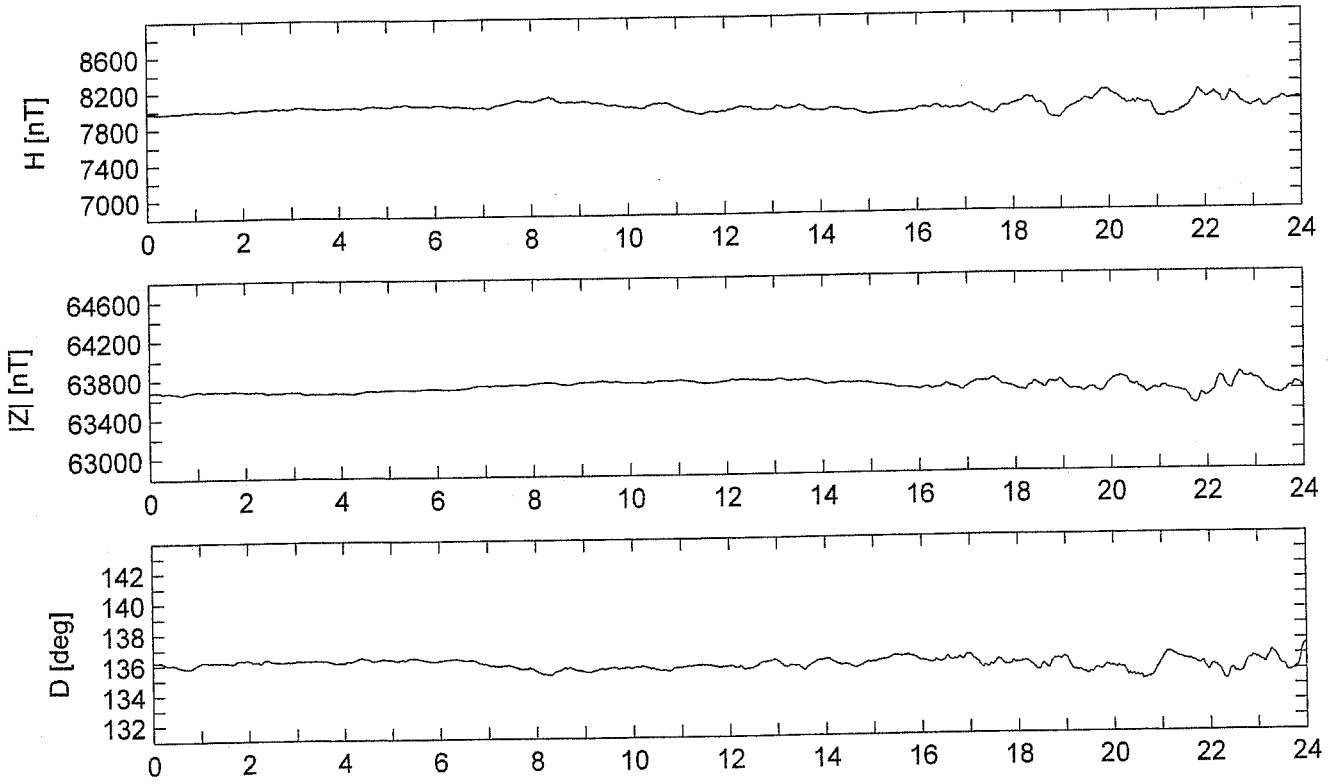
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



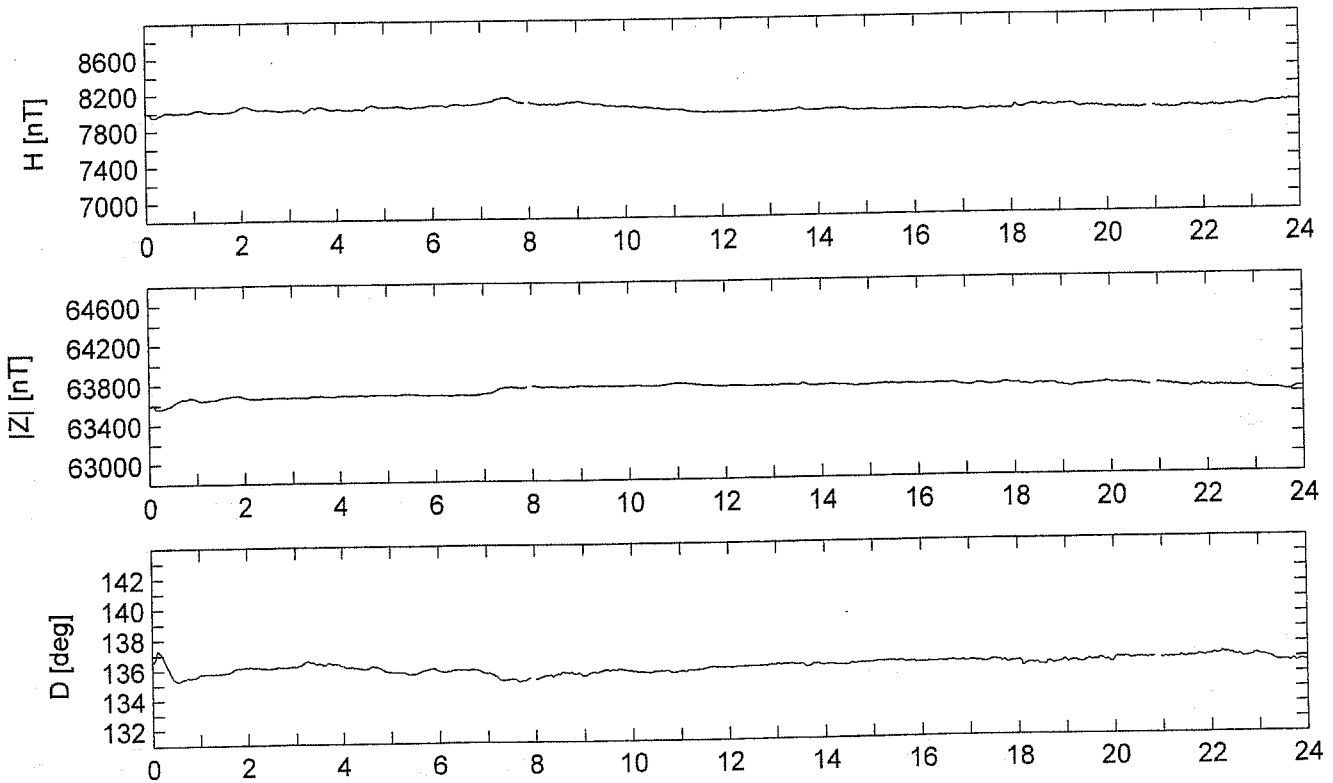
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



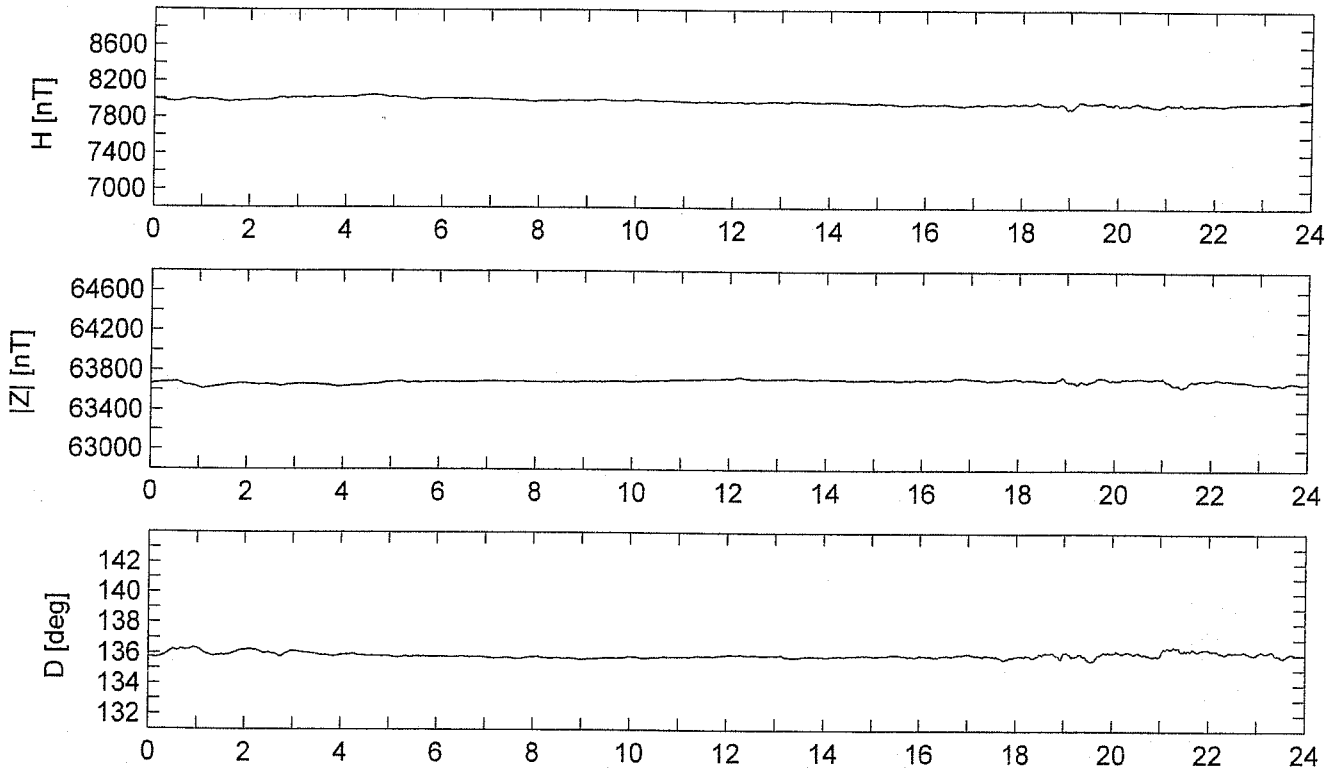
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



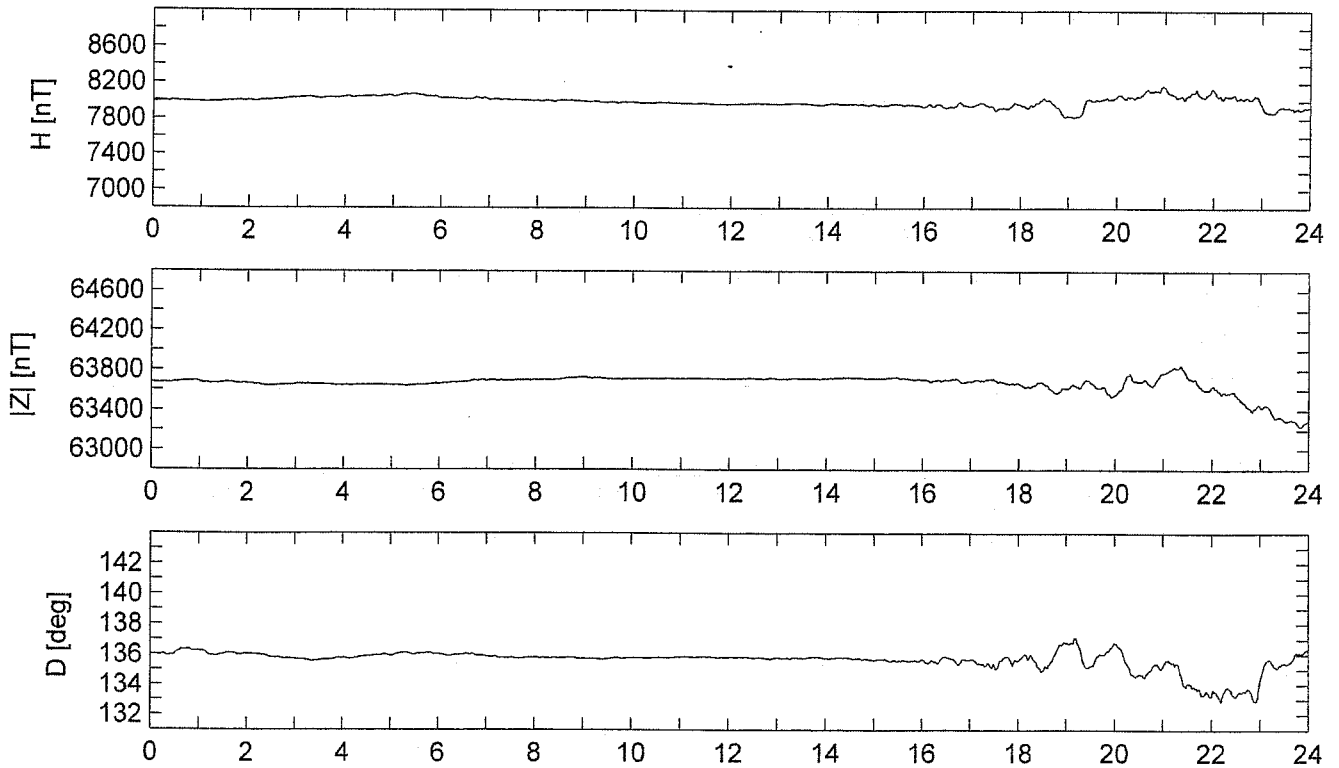
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



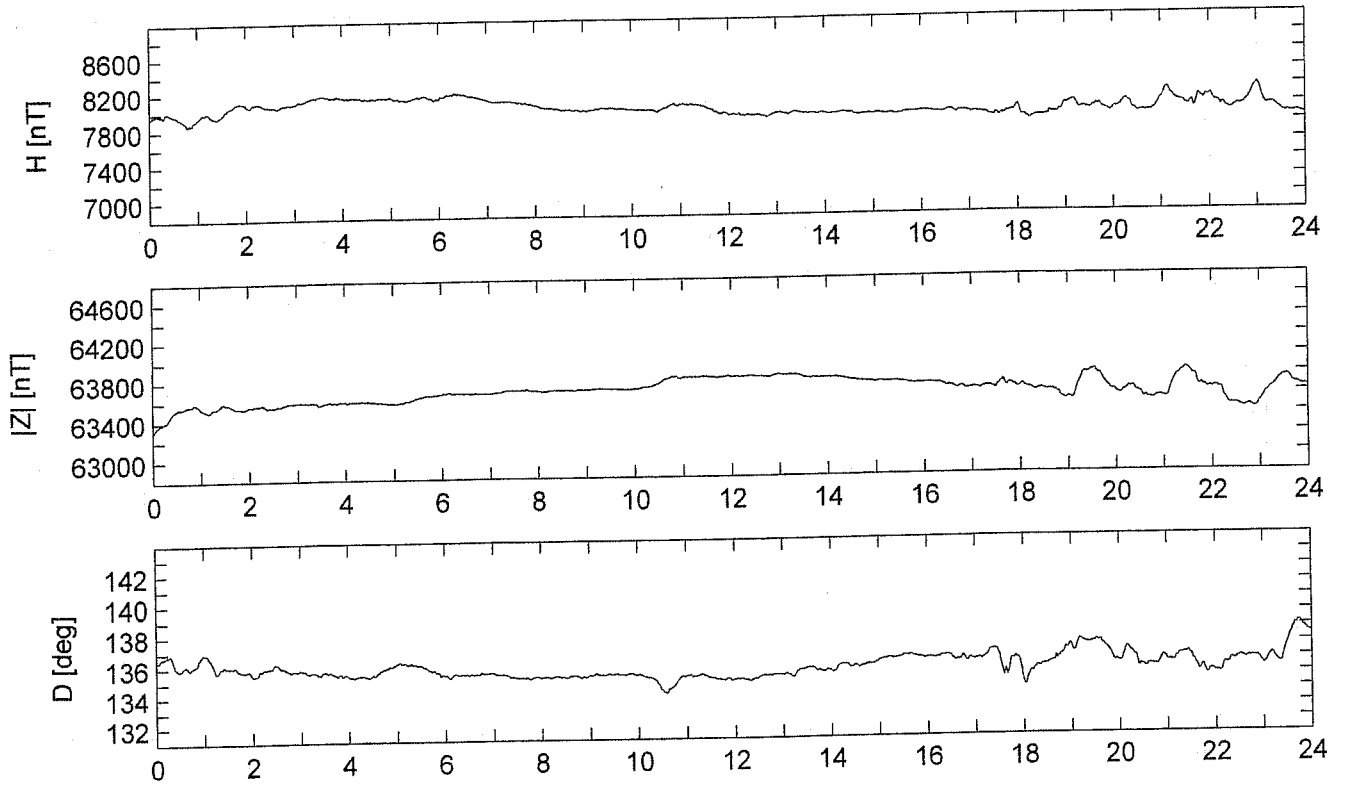
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



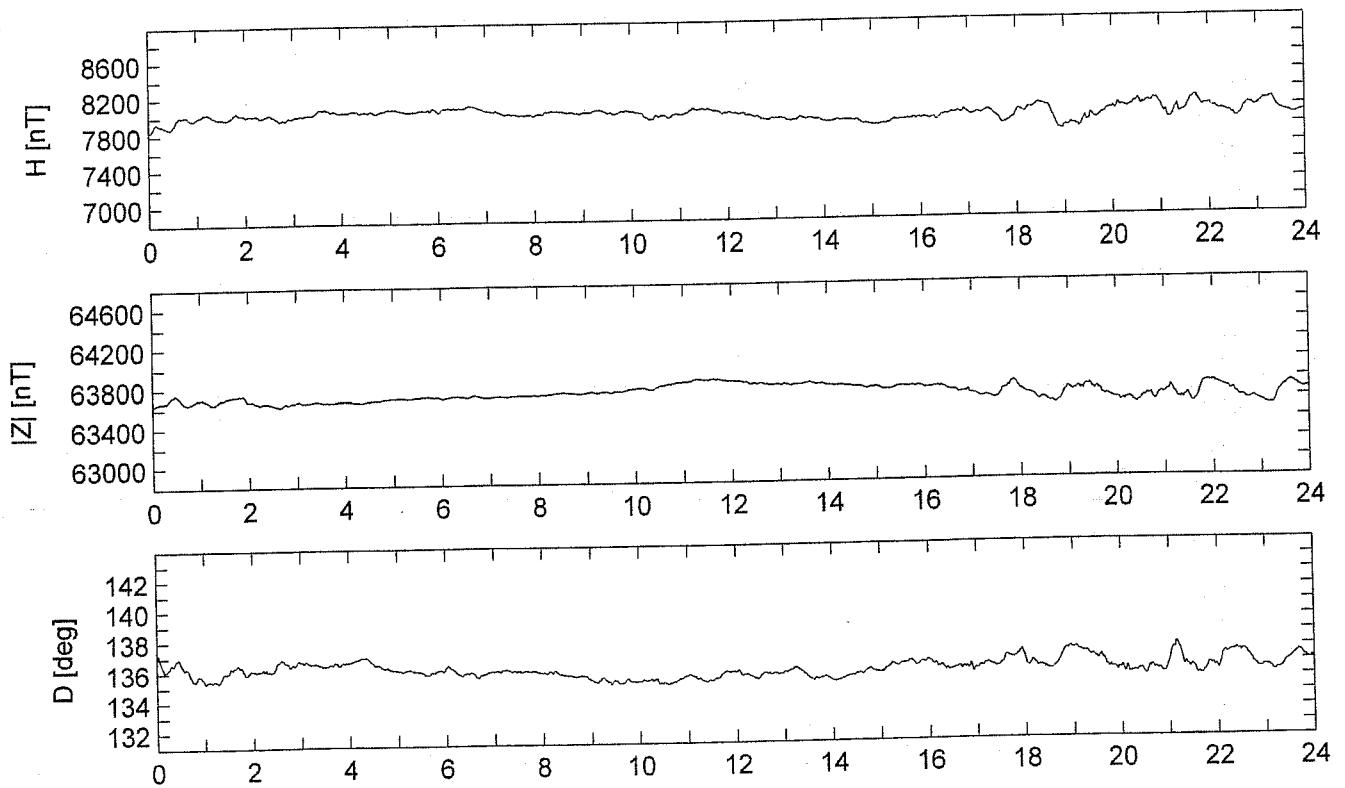
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



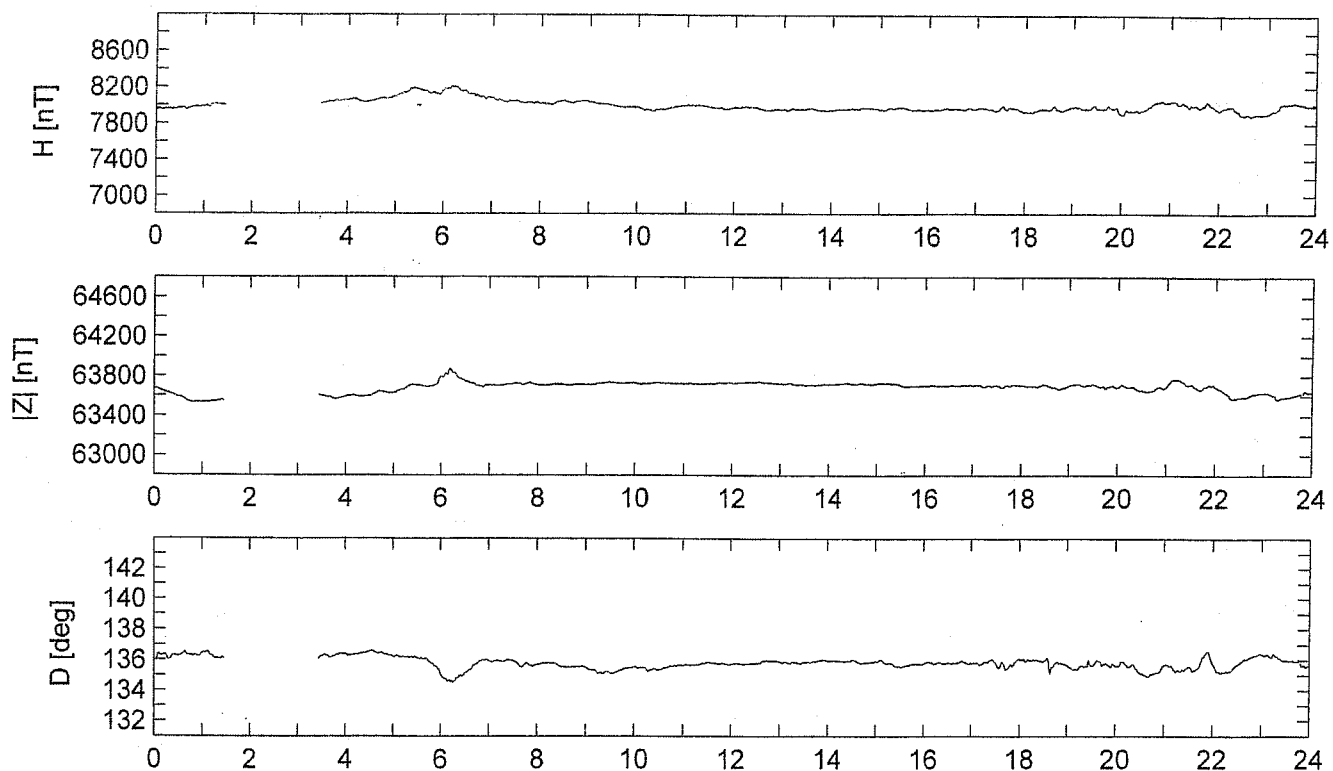
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



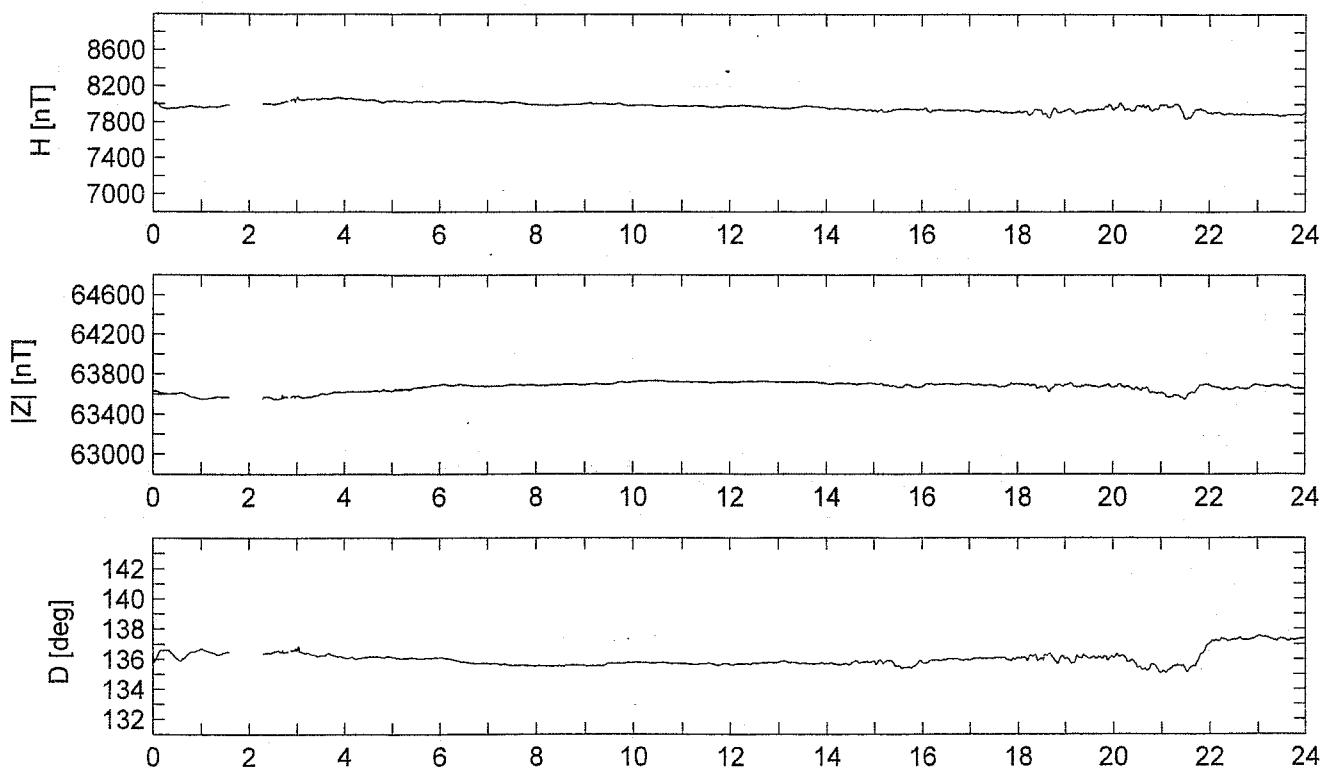
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



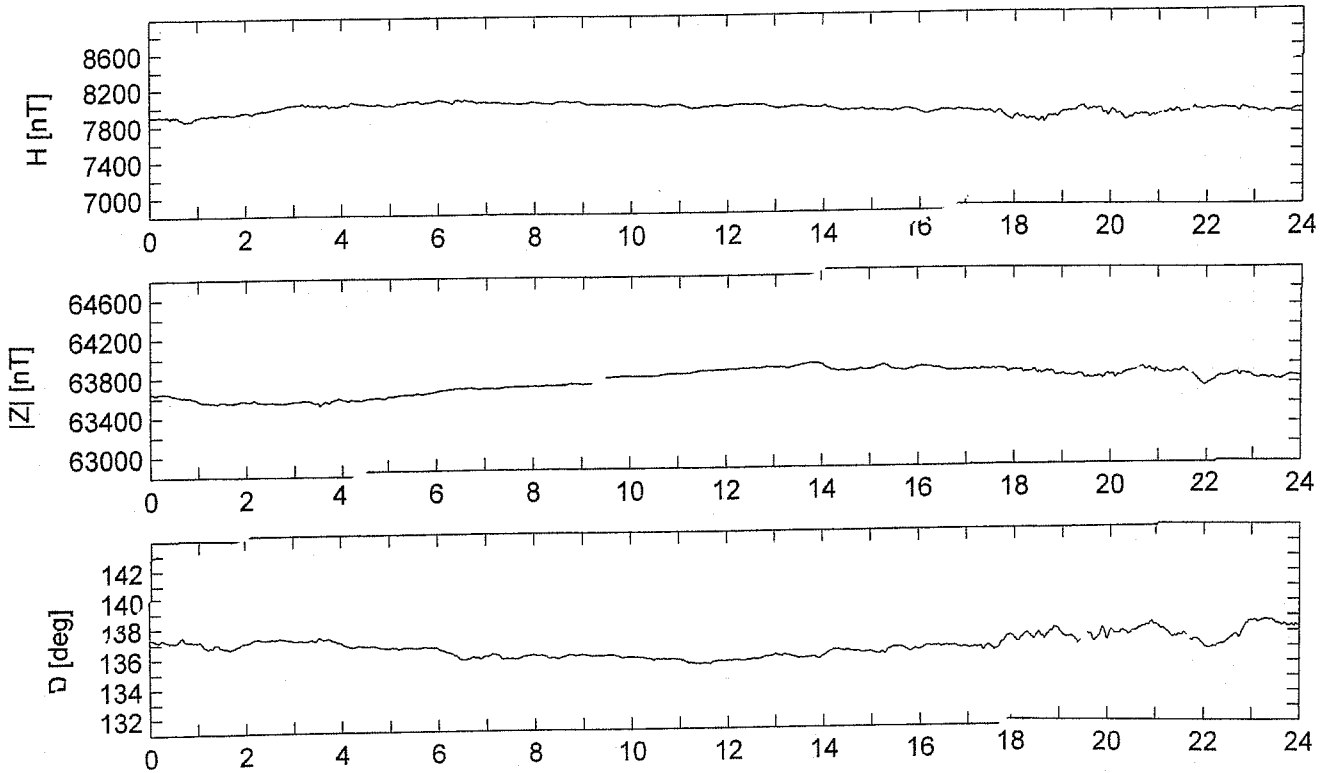
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



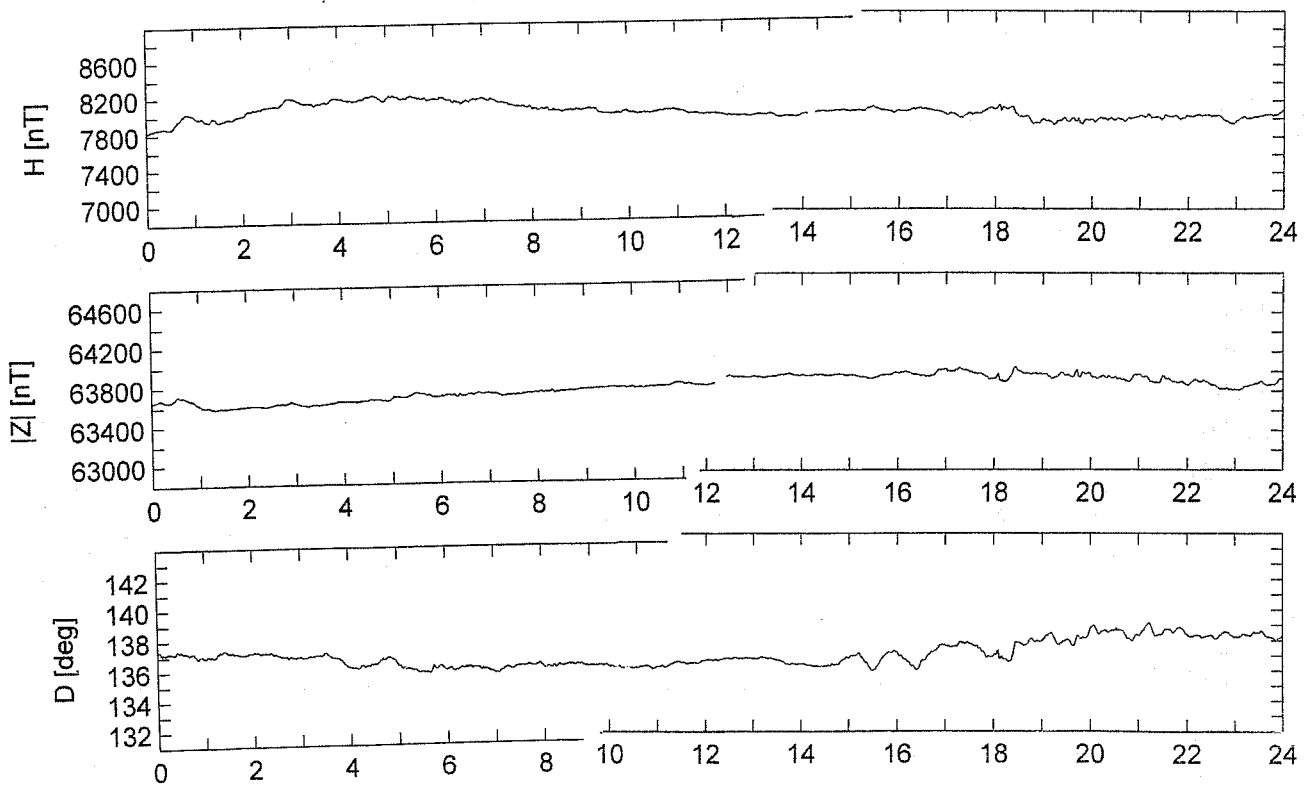
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



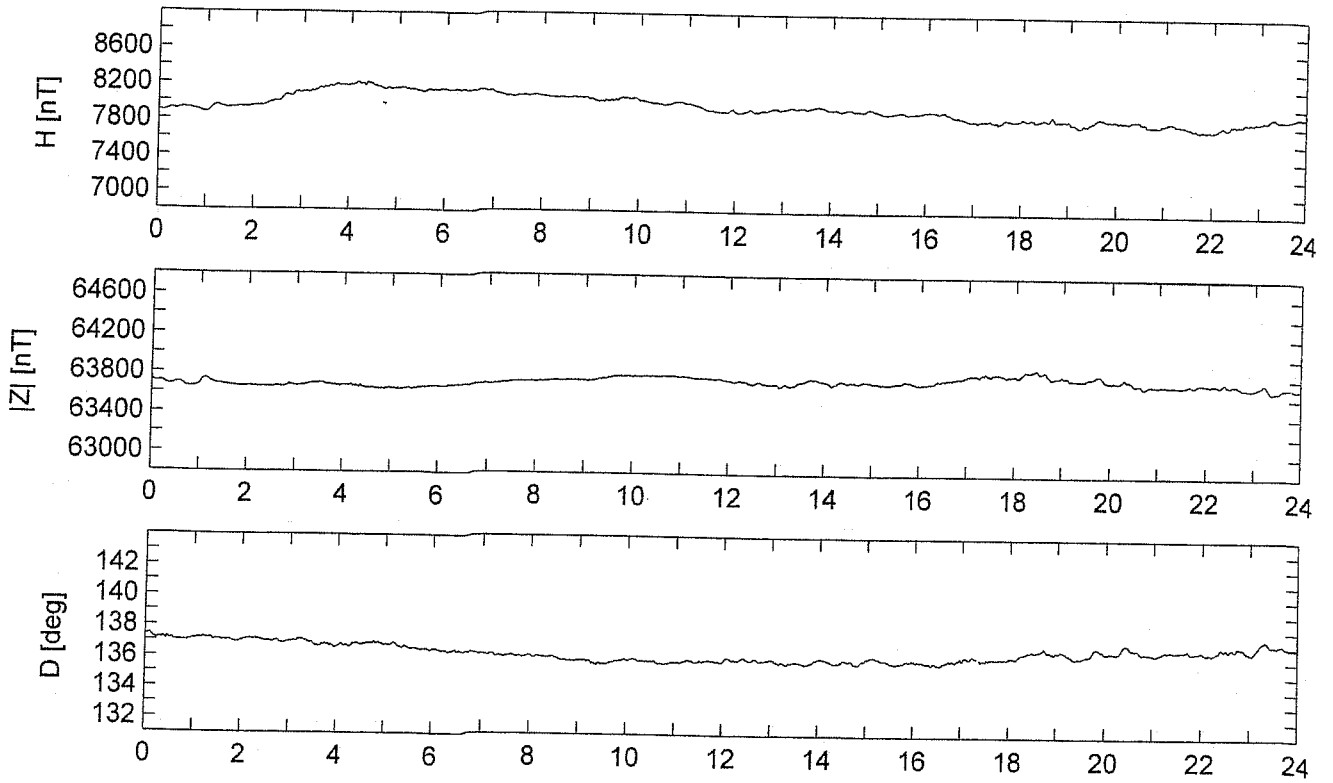
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



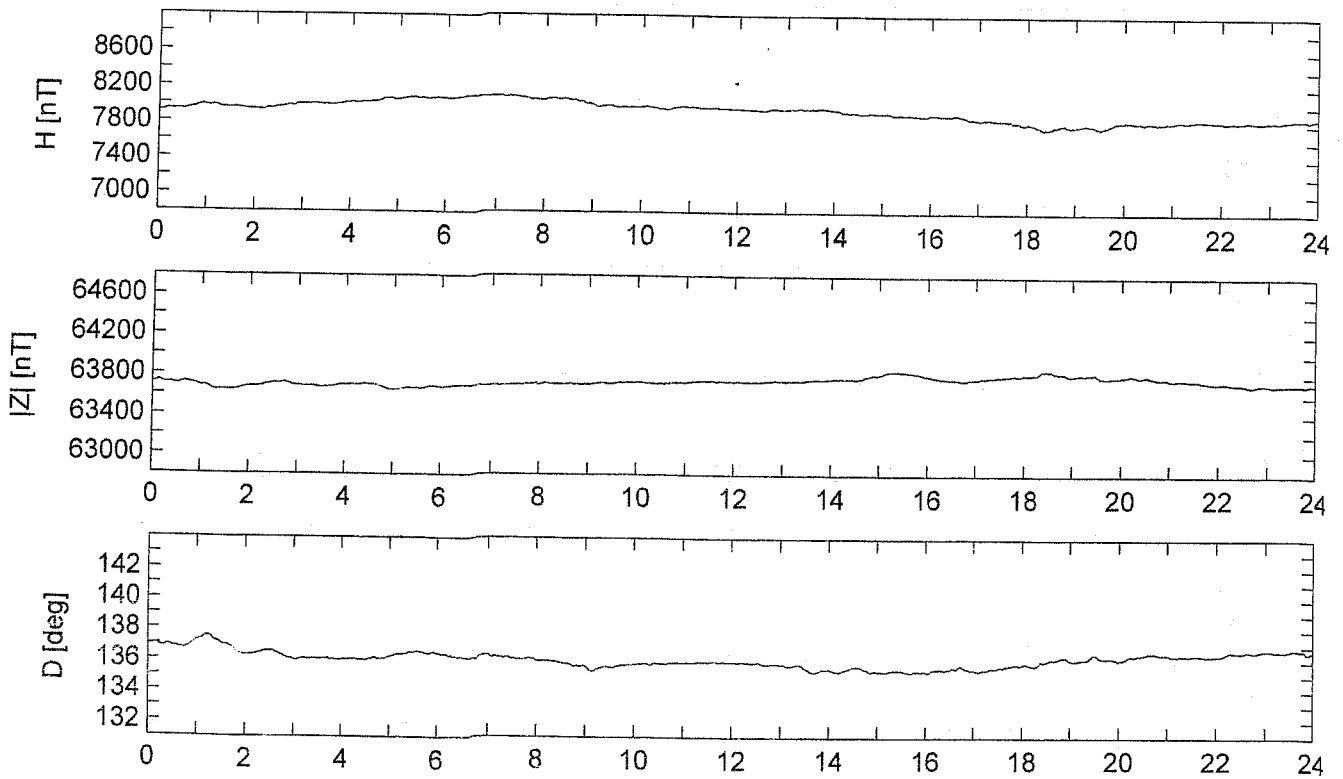
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



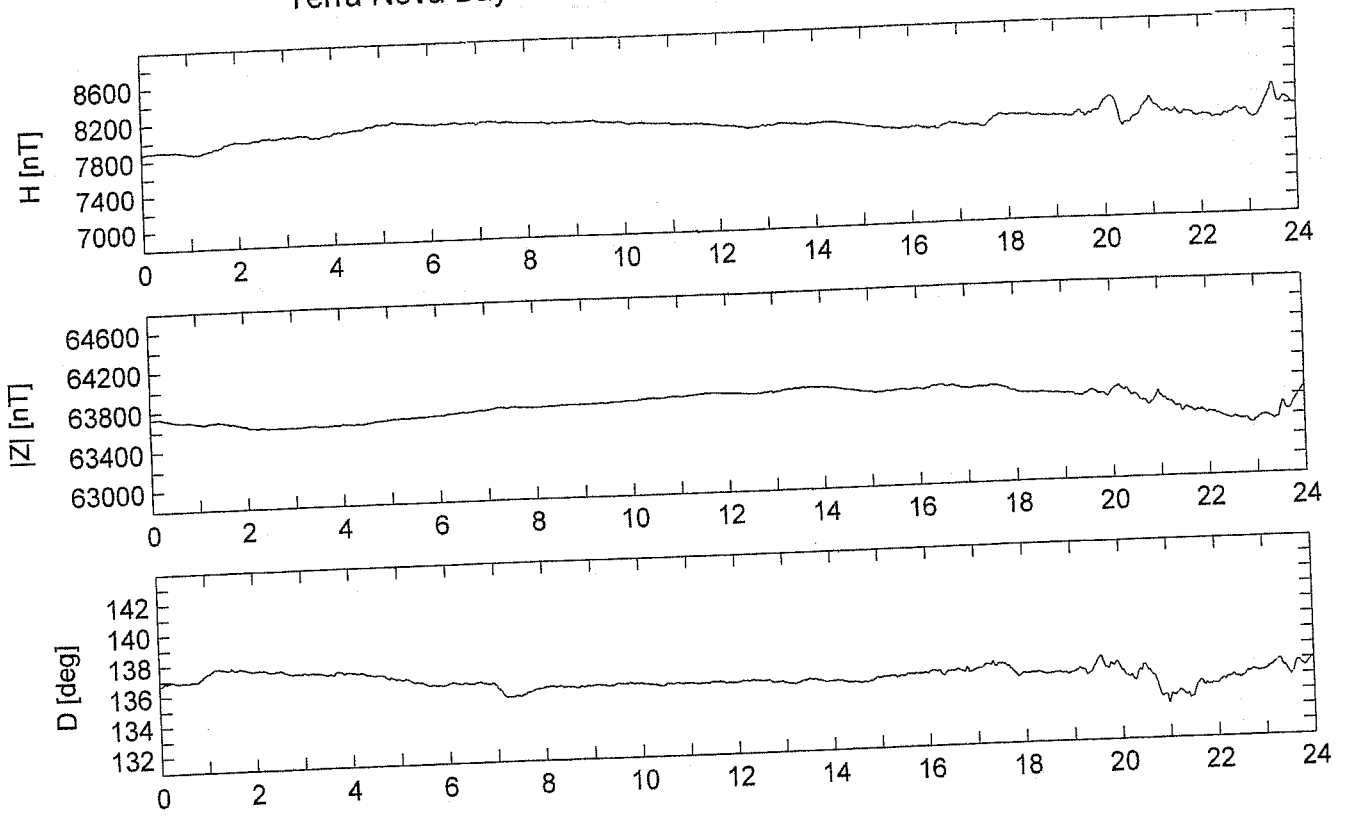
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



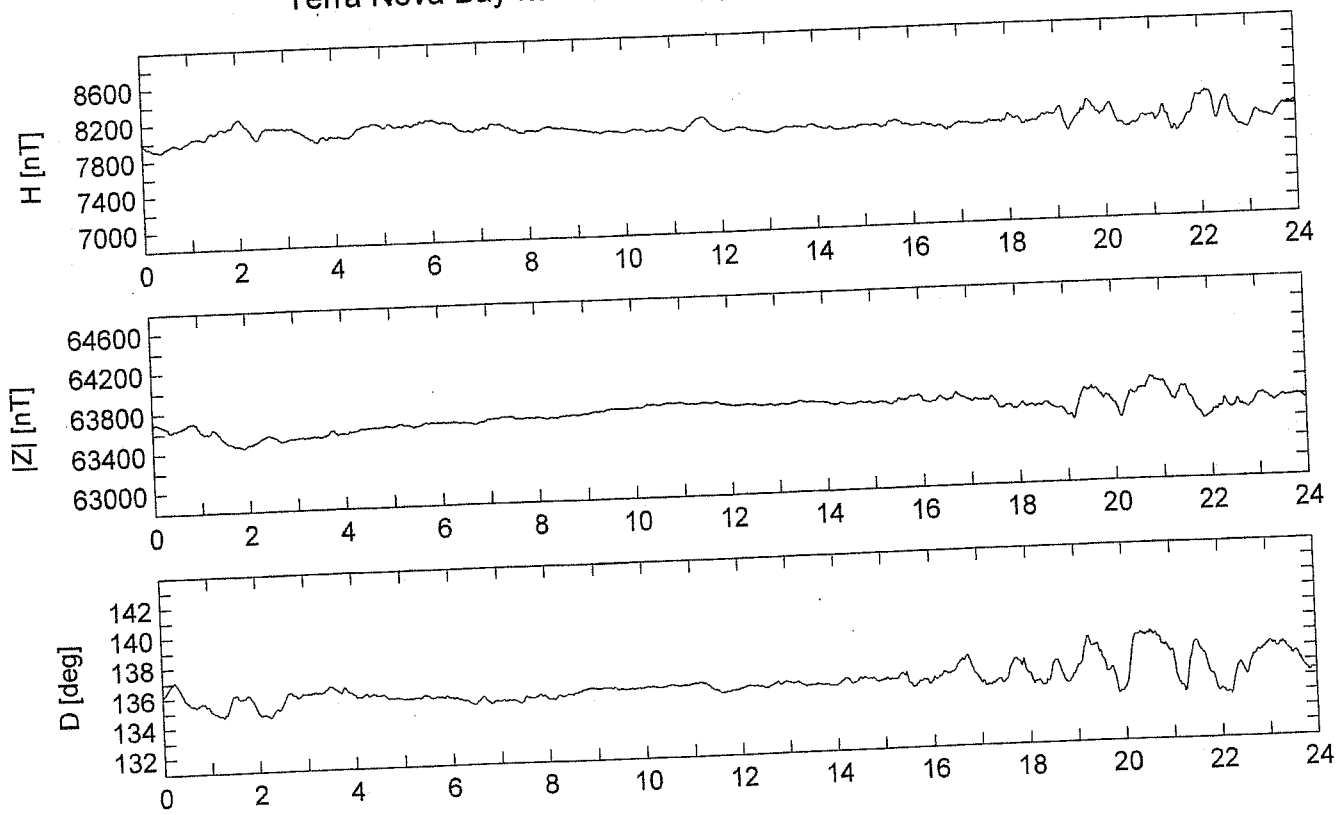
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



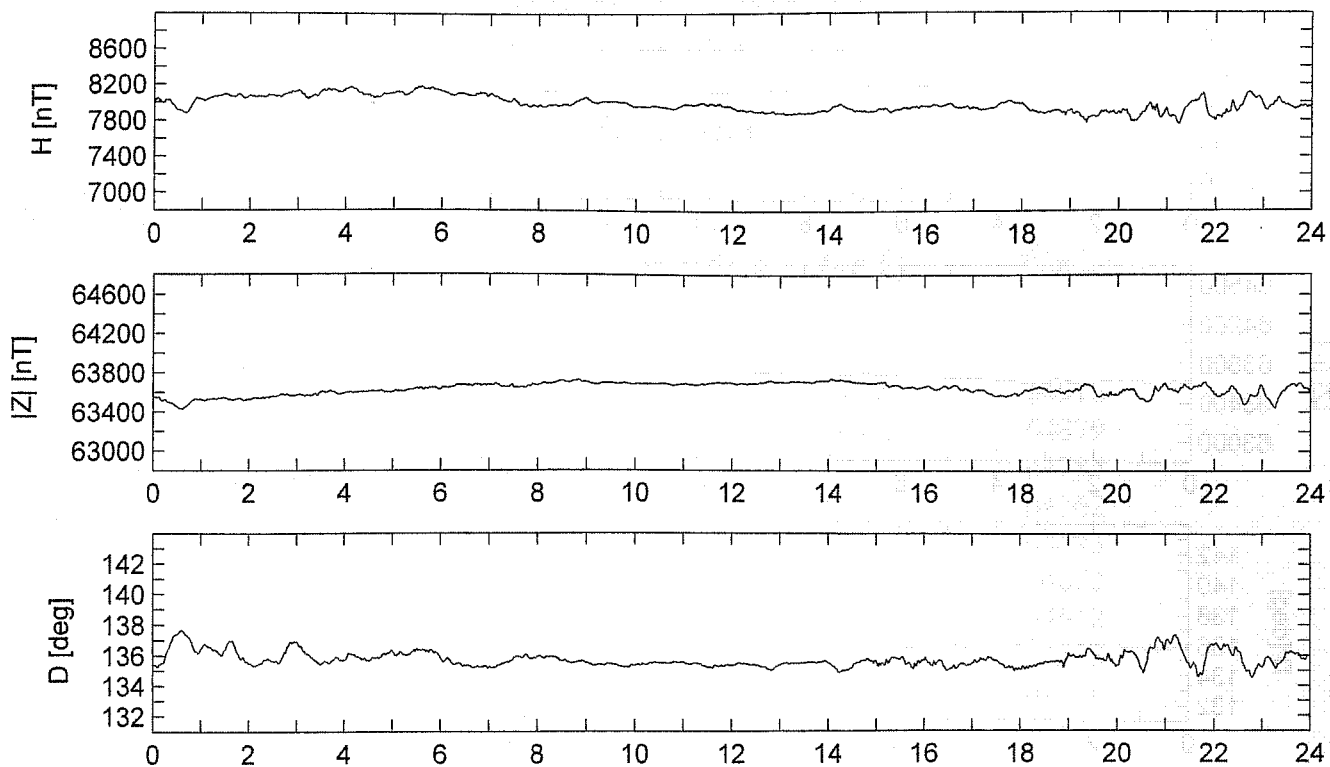
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



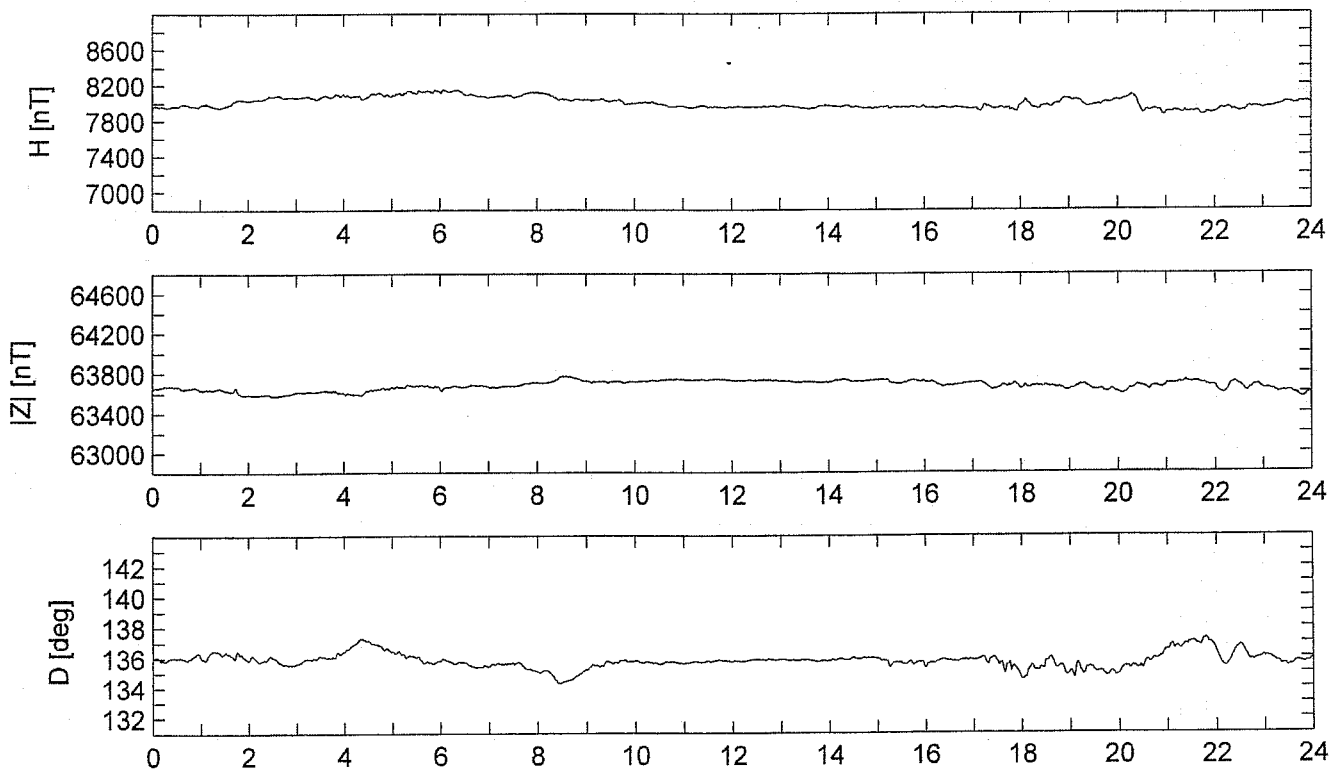
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



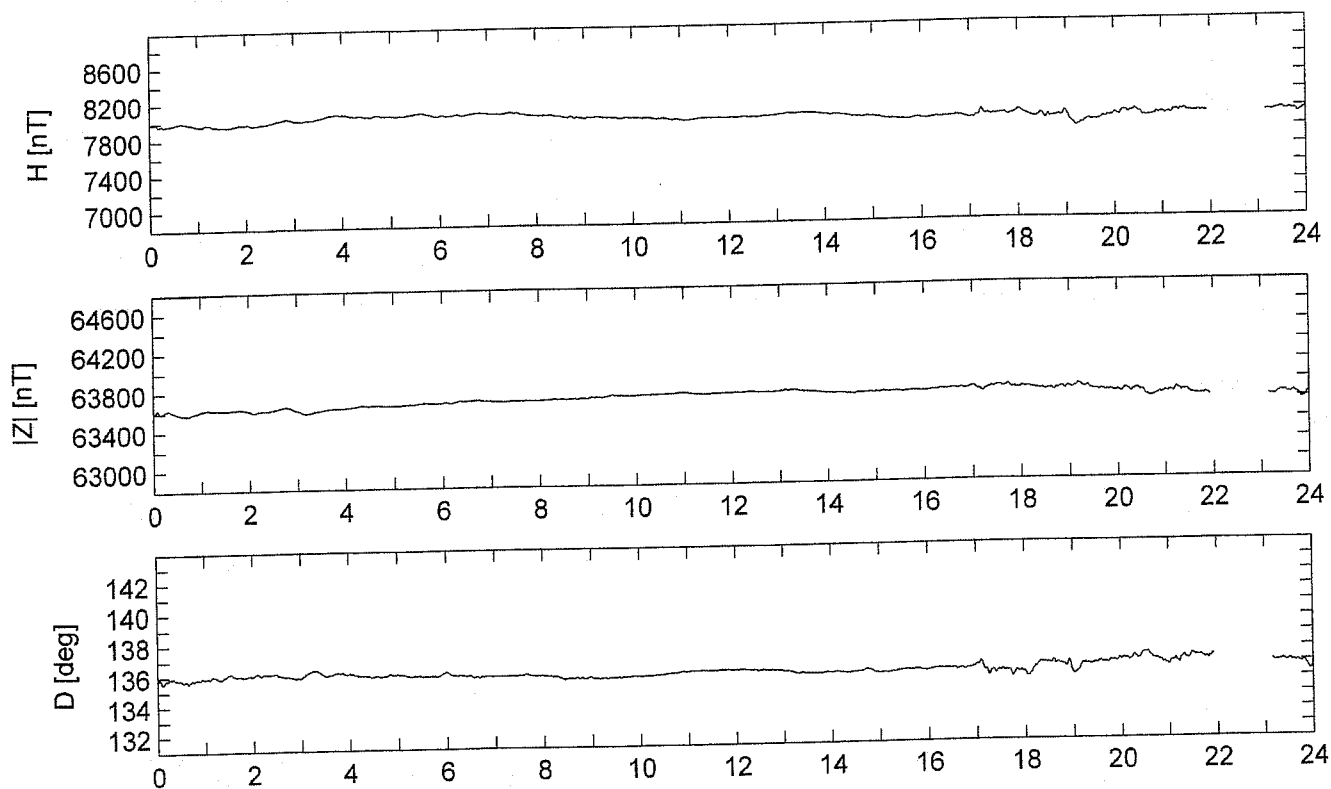
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Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



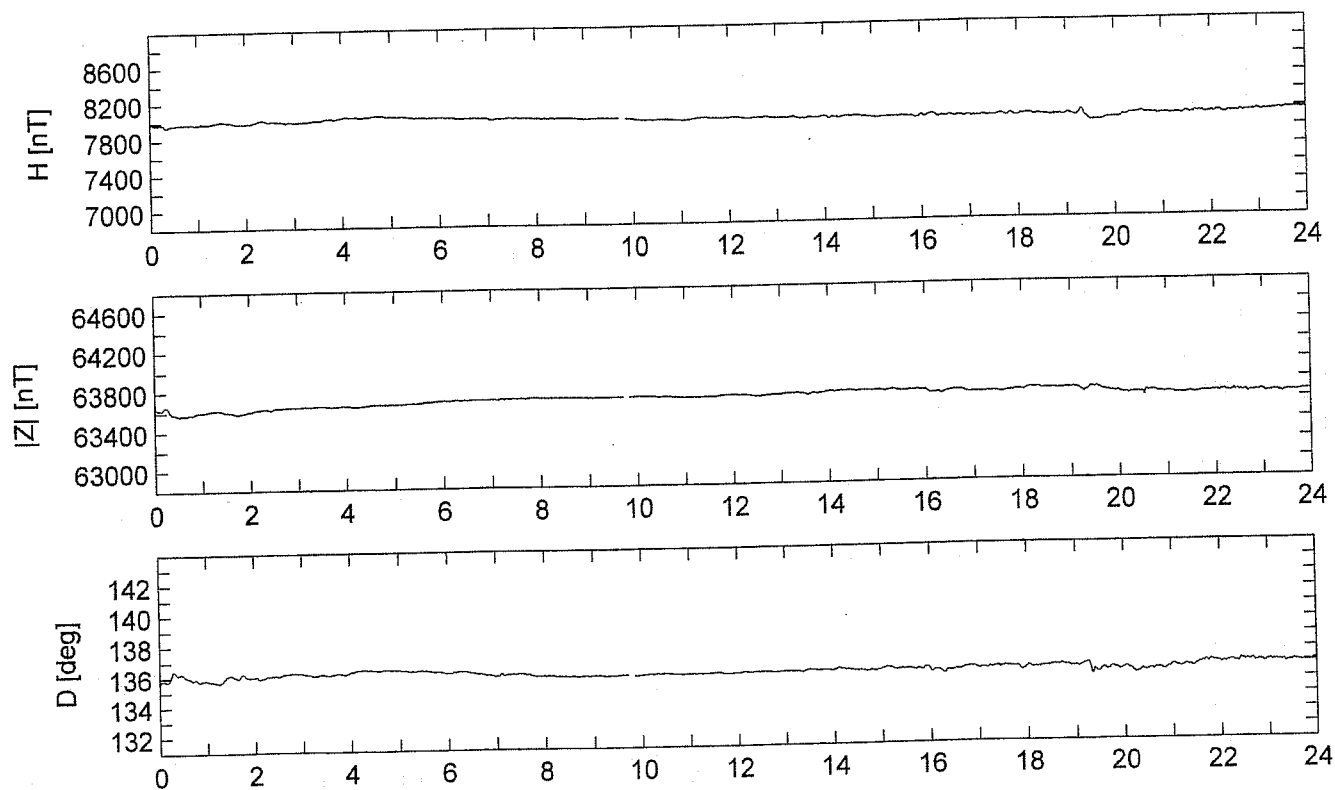
Hours [UT], dec 1 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



Hours [UT], dec 2 2004

Terra Nova Bay Italian Geomagnetic Observatory, Antarctica



Hours [UT], dec 3 2004

TNB Geomagnetic Observatory

Mean values

Campaign	H(nT)	D(deg min)		Z(nT)	F(nT)
1986/1987	7391	136	49	64494	64916
1987/1988	7432	136	54	64452	64879
1988/1989	7444	136	40	64355	64784
1989/1990	7509	136	48	64325	64762
1990/1991	7522	136	45	64254	64693
1991/1992	7564	136	29	64228	64672
1992/1993	7582	136	40	64166	64612
1993/1994	7610	136	41	64148	64598
1994/1995	7643	136	46	64112	64566
1995/1996	7682	136	29	64062	64521
1996/1997	7716	136	33	64018	64481
1997/1998	7756	136	27	63979	64447
1998/1999	7789	136	24	63932	64405
1999/2000	7829	136	14	63886	64364
2000/2001	7861	136	18	63848	64330
2001/2002	7889	136	02	63794	64280
2002/2003	7916	135	58	63761	64251
2003/2004	7929	135	48	63729	64220
2004/2005	7976	135	47	63697	64194

