Geomagnetic observatories of Ukraine in the Global Network INTERMAGNET

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Received 5 July 2011; accepted 8 August 2011; published 22 August 2011.

It is told about the development of geomagnetic observatories of Ukraine from its establishment up to the present moment. We describe the instruments of the absolute and variational observations of the Earth geomagnetic field. We present the observations data of geomagnetic observatories in Ukraine, which are part of the global network INTERMAGNET.
KEYWORDS: Geomagnetic observatories of Ukraine; INTERMAGNET; Earth geomagnetic field.

Citation: Sumaruk, Yu. P., V. I. Starostenko, and O. V. Legostaeva (2011), Geomagnetic observatories of Ukraine in the Global Network INTERMAGNET, *Russ. J. Earth. Sci., 12,* ES2002, doi:10.2205/2011ES000506.

Introduction

The Earth has its own magnetic field, and first the idea of the Earth as a big magnet was put forward by Gilbert in 1600. The geomagnetic observatories were established for the continuous recording of the geomagnetic field value and its changes over time.

Observatories give average values of the geomagnetic field, but also they give the information about the reduction elements of measurements, which are made in other territories. This material is used to construct the magnetic maps, which are of great practical importance. Maps of magnetic declination (D) are used for the needs of marine and air services, in mining industry. Mainly maps of the vertical component (Z) are used in geology, or more exactly the anomalies of this component are used. These anomalies relate to the deposits of mineral raw materials. Geomagnetic stations are usually scientific centers.

With the development of observatories, they are integrated in specific networks. Criteria for their integration are various: they are the territorial belonging, the industrial specialization and some other criteria. All the observatories of the Soviet Union were combined into the network under the direction of IZMIRAN. There were the same equipment and typical pavilions for them [*Jankowsky, Sucksdorff*, 1996]. Personnel of observatories were regularly trained and checked the instruments in IZMIRAN. Detailed instructions were worked out for making observations of the geomagnetic field [*Belousova*, 1957; *Nechaev*, 2006]. Data from observatories of the former USSR until 1991 have been transferred to the World Data Center in Moscow WDC – B2. Observatories of other countries were integrated mainly by the territorial belonging. Data were transferred to the World Data Center in the USA WDC – A1 and to WDC in Japan – C.

The network of up-to-date magnetic observatories INTERMAGNET (International Real-time Magnetic Observatory Network) was established in 1991 [*St-Louis*, 2008]. This network has combined the observatories with digital registration form and with the ability to transfer data to the geomagnetic information nodes (GIN) within 72 hours with the fulfillment of specified requirements for observations and processing of the geomagnetic field data. At first INTERMAGNET included 47 observatories. GINs were established in Canada, UK, Japan and France, where the observatories of this network transferred data. In these centers they were arranged and recorded on CD-ROM. The observatory, which is a part of INTERMAGNET, is able to use the data of all observatories, included in this network. Today there are more than 100 observatories of the world in INTERMAGNET. Their location diagram is shown in Figure 1.

Main requirements for the data of magnetic observatories (intermagnet magnetic observatory (IMO), which are involved in INTERMAGNET, are presented in Table 1 [*St-Louis*, 2008].

Equipment and Buildings of Geomagnetic Observatory

Geomagnetic observatory is a scientific institution where we implement the continuous recording of geomagnetic field variations, make the regular absolute observations, primary processing and analysis of gotten data [*Jankowsky, Sucksdorff*, 1996]. The main tasks of magnetic observatory are:

- continuous recording of geomagnetic field components;
- making absolute observations to obtain the absolute values of the geomagnetic field components.

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http://elpub.wdcb.ru/journals/rjes/doi/2011ES000506.html

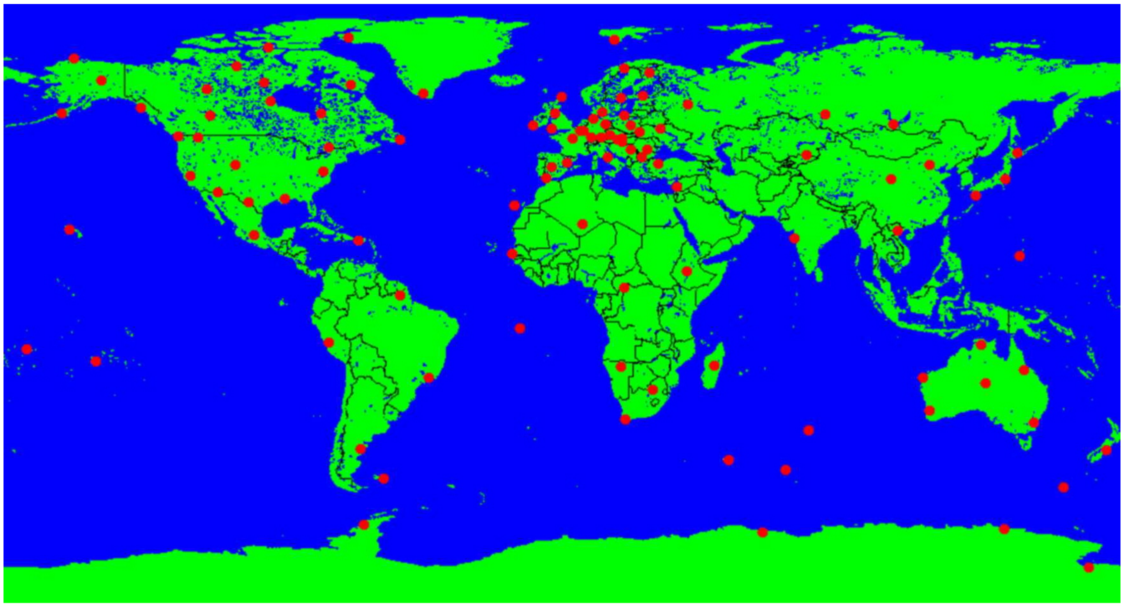

Figure 1. INTERMAGNET observatories are as of 2010.

Earlier they used for registration of the geomagnetic field changes analog instruments such as the LaCour-type station, Eshengagen-type station, Bobrov-type station [*Bobrov*, 1962]. These stations consisted of separate variometers, which were compactly placed in one box or were displayed separately on pillar. The result of the observatory work was magnetograms (photocopying paper with the curves of the geomagnetic field components changes). This process was time-consuming, and it was easy to make a mistake. The measurement accuracy was low: 1–2 nT. On Figure 2. we could see the magnetogram of the geomagnetic field components changes at the observatory "Lviv", which was obtained by Bobrov-type station.

With the advent of digital magnetic variational stations such registration passes into history. Up-to-date magnetic observatories have digital magnetic variational stations. The principle of operation is based on electro-optical transformers, on the effect of nuclear resonance and others. As a result we get figures which are easy to convert by computer programs into the format, required for the user. The stations have a memory for data accumulation for a long time. In most cases the stations connect with computer. Quality of observations of geomagnetic field variations is high because of digital magnetic variational stations. Its accuracy is about 0.01 nT.

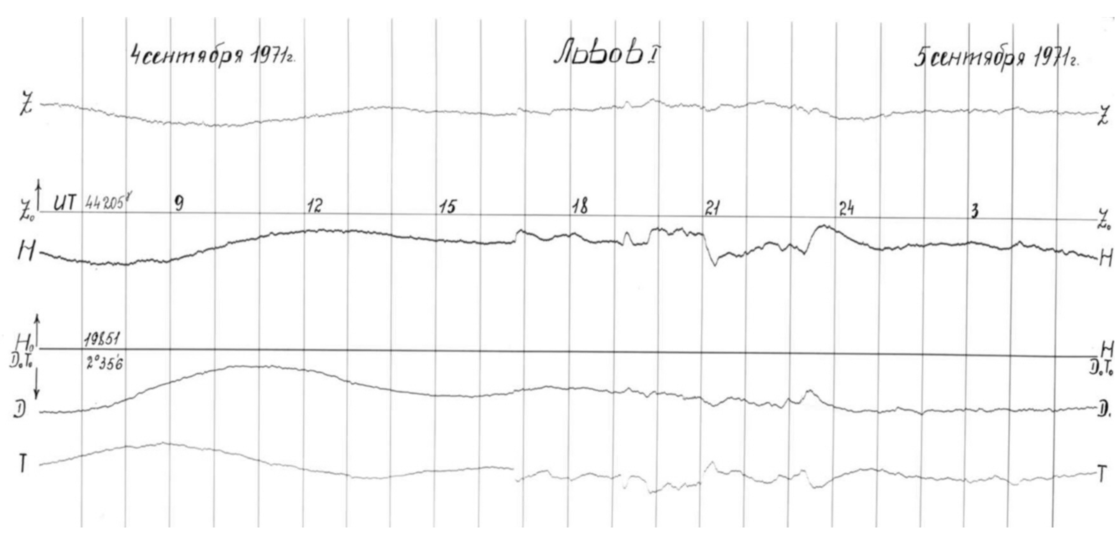

Figure 2. Magnetogram of magnetic observatory "Lviv" for 4–5 September 1971.

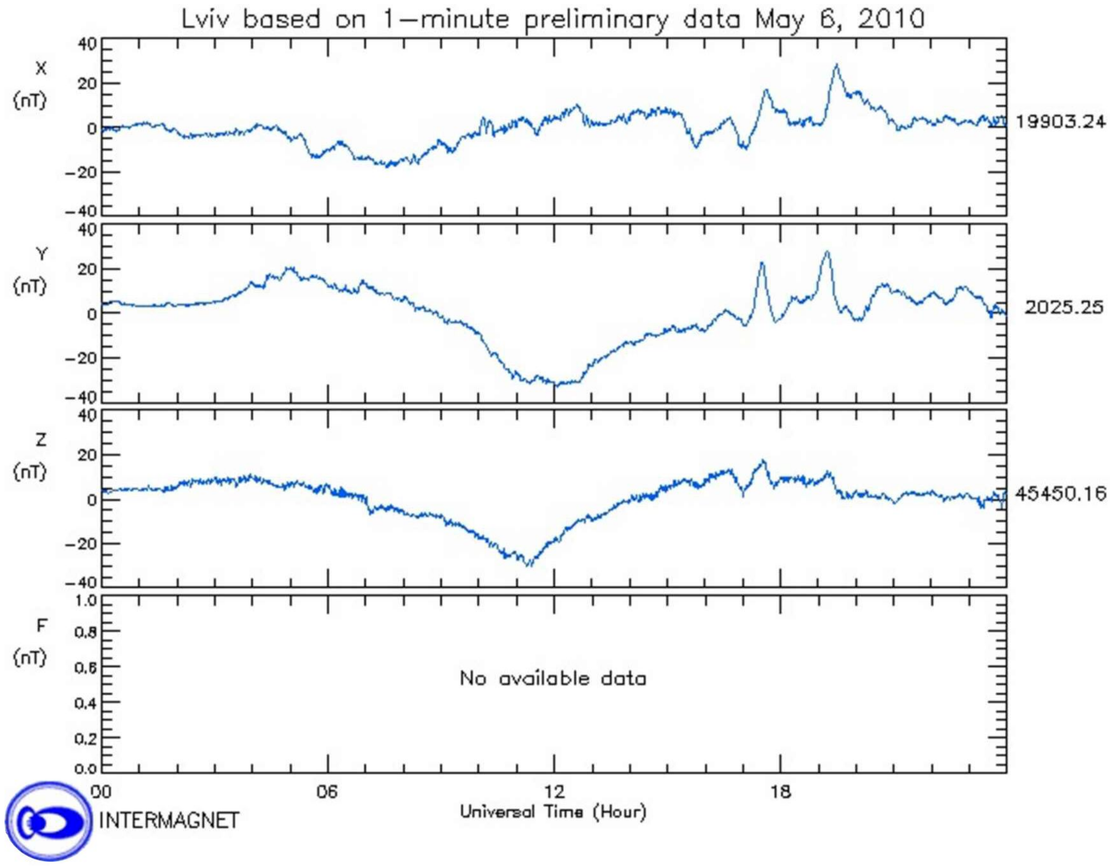

Figure 3. Magnetogram of preliminary data of the INTERMAGNET observatory LVV.

On Figure 3 we could see how the components of the geomagnetic field have changed on the 6th of May 2010 at the observatory "Lviv". These data were obtained by digital magnetic variational station PSM-8911 [*Marianiuk et al.*, 1978].

At the observatories absolute measurements are carried out to obtain absolute values of the geomagnetic field. Earlier instruments: QHM, DI, inclinometer were used for these purposes. Work on the instruments demanded from the personnel a high proficiency. Series of measurements were carried out long enough. Processing of the measurements was made mainly by hand. The accuracy of these measurements was 3–5 nT. Nowadays magnetic observatories use for these purposes DI fluxgate magnetometers and proton magnetometers of different companies and modifications. The use of such instruments has reduced the time of carrying

Table 1. Technical Characteristics of Up-to-Date Geomagnetic Observatory

Magnetic variational station	
Resolution	0.1 nT
Dynamic range (for mid-latitudes)	±60000 nT
Frequency range of measurements	0–0.1 Hz
Scanning frequency of data	1 Hz
Temperature coefficients	0.25 nT/°C
Drift of base lines	5 nT/year
Proton magnetometer	
Resolution	0.1 nT
Measurements error	1 nT

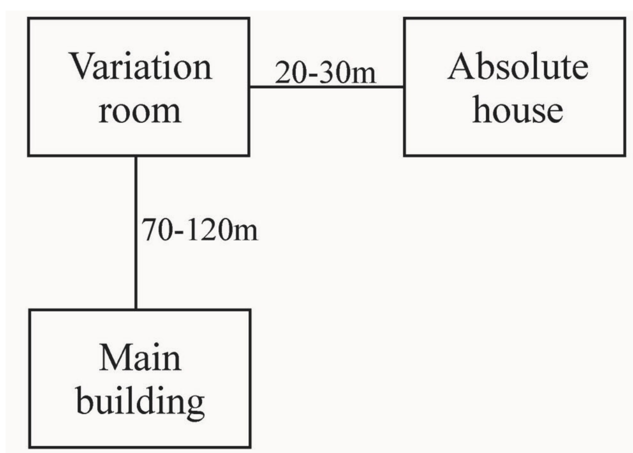

Figure 4. A typical scheme of a geomagnetic observatory.

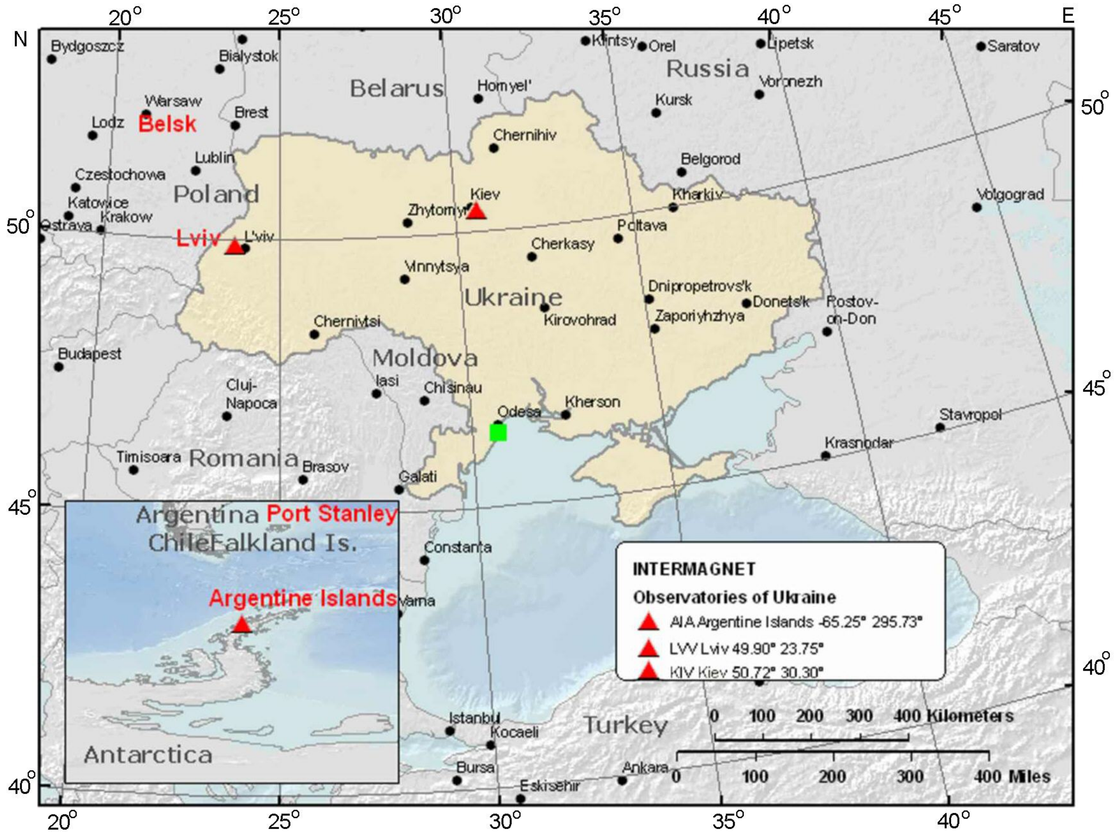

Figure 5. Location of the Ukrainian geomagnetic observatories.

out the series of measurements. Processing of the measurements is computerized and in most cases avoids the errors. The measurements accuracy is 0.5–2 nT.

Making the variational records and absolute observations are carried out in specially equipped buildings. The main ones of them are variational pavilion, pavilion for the absolute measurements and main building. Usually number of buildings differs at the observatories. It depends on the tasks, facing the observatory. A typical location scheme of magnetic observatory buildings is shown in Figure 4.

In the variational pavilion continuous recording of geomagnetic field variations is carried out by different means of instruments. In the same place there could be the equipment, which makes the primary processing and transferring of data. The main requirement for the variational pavilions is the stability of the pillars, on which there are magnetic variational stations. And also the important thing is stability of temperature.

The measurements of absolute values of geomagnetic field are carried out in the absolute pavilion. The instruments, used in this pavilion, are different. The main requirement for this pavilion is the presence of stable pillar and the famous azimuth of “the world” for each pillar. A stable temperature is desirable, but not necessary here.

Analytical center of the geomagnetic observatory is the main building. Here the personnel of observatory make processing of records of geomagnetic field variations, the definition of absolute measurements and transferring the corrected absolute values of the geomagnetic field to the WDC. At the up-to-date observatories all these processes are made by computers and software. The software could be either standard or specific. At each observatory they use the software, needed for the particular purposes.

A necessary condition for the work of the up-to-date observatory is the presence of sustainable and high-speed Internet, because the data must be regularly sent within 72 hours.

Geomagnetic observatories of Ukraine

Today Ukraine has four geomagnetic observatories, three of them, which are “Kiev”, “Lviv”, and “Odessa”, are located in the territory of Ukraine. The forth one “Academician Vernadsky” is located in Antarctica. Location of the Ukrainian geomagnetic observatories is shown in Figure 5. Its equipment is represented in the Table 2.

Table 2. Equipment of the Ukrainian Geomagnetic Observatories

Observatory	Kiev	Lviv	Odessa	Academician Vernadsky
IAGA code	KIV	LVV	ODE	AIA
Coordinates (latitude/longitude)	50.72 N/30.3 E	49.9 N/23.74 E	46.78 N/30.88 E	65.25 S/64.27 W
Instruments for the absolute measurements	Magnetic theodolite THEO-010 with fluxgate GEOMAG-03 and proton precession magnetometer type Mv-01	Magnetic theodolite Tavistock with fluxgate FLM1/B and proton precession magnetometer (type MMP-203)	QHM and proton precession magnetometer (type MMP-203)	Magnetic theodolite THEO 020B with MAG-01H and proton precession magnetometer type PMP-8
Instruments for the variational measurements	Torsion photoelecric magnetometer TPM employing Bobrov-type quartz variometers, LEMI 008	Torsion photoelecric magnetometer TPM employing Bobrov-type quartz variometers,	Fluxgate magnetometer LEMI-018M	LEMI 008 Fluxgate EDA
Orientation	XYZ	XYZ	XYZ	XYZ, HDZ

Geomagnetic Observatory "Kiev" started to function in May 1958 in connection with the second International Geophysical year. At the beginning of 1958 two engineers of geomagnetic observatories have been trained in IZMIRAN. Within this training they were given new instruments for the observatory. Observations were carried out by the variational LaCour-type station with a normal scan 15 mm/hour and high-speed LaCour-type station with scan 386 mm/hour for recording of pulsations. Absolute observations were made by the magnetometers QHM and BMZ twice a week. According to the results of the observations they made decade, and later monthly reviews of magnetic activity. These reports concluded the three-hour K-indexes, the diurnal amplitudes and diurnal characteristics, and also the description of the magnetic storms with the detection of their active periods. According to the magnetograms variations of D, H, Z components of the field were determined. These variations were led to the absolute values by means of observations on the absolute instruments. Reviews of the field condition as well as decade and annual reports were regularly sent to IZMIRAN and to WDC B2 in Moscow.

Figure 6. Magnetic variational station LEMI-008.

In connection with the opening of the Institute of Geophysics, USSR Academy of Sciences, in 1960 Geomagnetic Observatory "Kiev" was placed under its control. In the time of the "Kiev Sea" construction it was planned to flood the territory, in which the observatory was deployed. That's why it was moved to the urban-type settlement Dymer. Geomagnetic observatory started to function from the 11th of May, 1964. Proton magnetometer was received for the absolute observations. In 1967 up-to-date magnetic variational station of V. N. Bobrov system [*Bobrov*, 1962] with zero temperature coefficient was purchased. And the LaCour-type station worked as duplicate one. QHM with very thin quartz filament was purchased for the absolute observations of declination. Staff of IZMIRAN regularly checked the equipment of the observatory.

In 2004 thanks to the project INTAS, geomagnetic observatory was equipped with new digital instruments: the magnetic variational station LEMI-008 (Figure 6), DI fluxgate magnetometer and started to function according to the INTERMAGNET protocol.

In 2008, thanks to the close cooperation with the Institute of Geophysics of the Polish Academy of Sciences the observatory was equipped with a digital magnetic variational station PSM-8411, and in 2009 it was equipped with a new instrument for absolute measurement – Theodolite THEO-010 with ferroprobe GEOMAG-03 (Figure 7). It considerably improved the quality of variational and absolute measurements. In 2010 new equipment for the Internet was purchased and installed at the observatory. It allows easily transferring large volumes of data at high speed.

Figure 7. Theodolite THEO-010 with ferroprobe GEOMAG-03.

New software has been worked out and implemented at the observatory. It made possible the automatic reading off, primary processing and transferring data to world data centers of INTERMAGNET and also to other users. In Figure 8 there are the measured and adjusted values of databases for 2009, and in Table 3 there are the average annual values of the field elements at the geomagnetic observatory “Kiev”.

An official application of entrance of the geomagnetic observatory “Kiev” in the INTERMAGNET was presented at the working session of the administration of this organization in October 2010 (Paris, France). In May 2011 an observatory “Kiev” has become a full member of INTERMAGNET.

Regular observations of the magnetic field components were started at the geomagnetic observatory “Lviv” in 1952 [*Orkisz*, 1936; *Stenz*, 1931; *Sumaruk et al.*, 2009]. At first recording was carried out by the LaCour-type station: the sensitivity of variometers is $\varepsilon_H = \varepsilon_D = 4 - 5$ nT/mm and $\varepsilon_Z = 2 - 3$ nT/mm. In 1970, with the assistance of IZMIRAN magnetic variational Bobrov-type stations with sensitivity $\varepsilon_H = \varepsilon_T = 2$ nT/mm, $\varepsilon_Z = 1.75$ nT/mm, $\varepsilon_D = 0.33$ min/mm were installed at the observatory. In 2002 with the assistance of the Institute of Geophysics of the Polish Academy of Sciences a digital magnetic variational station PSM-8911 (Figure 9) was installed at the observatory. It made possible to simplify the data processing of observations. The sensitivity of this station is $\varepsilon_X = \varepsilon_Y = \varepsilon_Z = 0.025$ nT/bit.

At first the absolute measurements were made using magnetic theodolite COOK, quartz H-magnetometer (Figure 10) induction inclinometer and proton magnetometer PM-001. In 1986 the proton magnetometer PM-001 was replaced by the new one – MMP-203.

In June 2006 with the assistance of British Geological Survey and Royal Meteorological Institute of Belgium DI fluxgate Tavistock with ferroprobe FLM1/B was installed at the observatory (Figure 11)

Since 2003 magnetic observatory “Lviv” transfers data to the GIN in Edinburgh and Paris as an associated member of INTERMAGNET.

In 2005 the magnetic observatory “Lviv” has become a full member of INTERMAGNET [*Sumaruk et al.*, 2009].

Average annual values of the magnetic field components at the observatory “Lviv” are shown in Table 4.

Regular observations of the geomagnetic field components were started at the observatory “Odessa” in 1948. At first they were made using the LaCour-type station, and in the

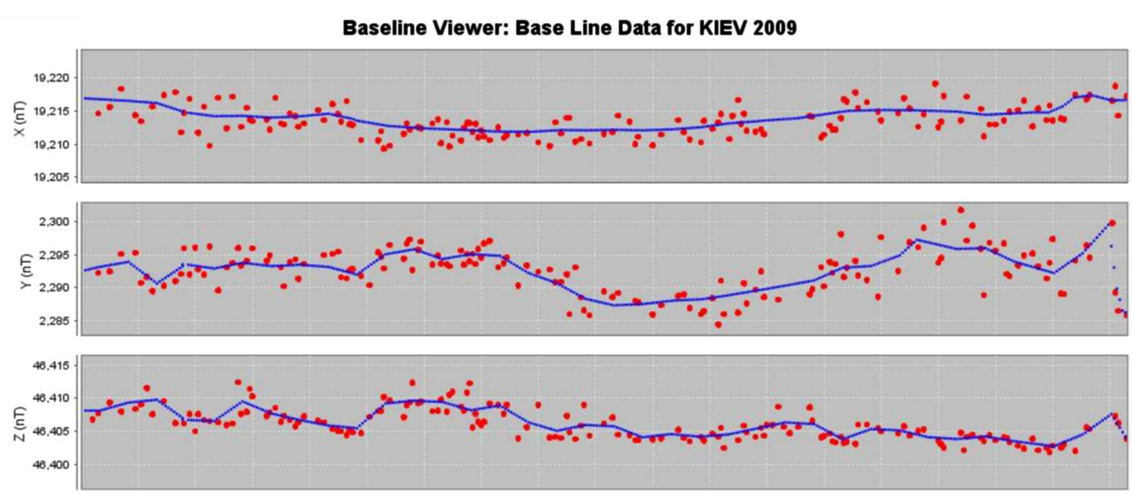

Figure 8. The observed and adopted values of databases at the geomagnetic observatory “Kiev” for 2009.

Figure 9. Digital magnetic variational station PSM-8911.

70s standard Bobrov-type stations were installed at the observatory. A characteristic feature of the geomagnetic observatory "Odessa" is the fact, that the variational pavilion is located underground at a depth of 4 meters. It makes possible to maintain a stable temperature in summer and in winter without much power consumption. Until 1991 the observatory transferred the data to WDC B2 in Moscow. After 1991 the data was stored in the observatory, as well as in the Division of Geomagnetism of Institute of Geophysics of NAS of Ukraine. Over the last years a digital magnetic variational station LEMI-008 was installed at the observatory. It allows transferring the data using the Internet. In the near future it is planned to upgrade the observatory. Average annual values of the magnetic field components at the observatory "Odessa" are shown in Table 5.

In 1996 the United Kingdom gave the Antarctic ob-

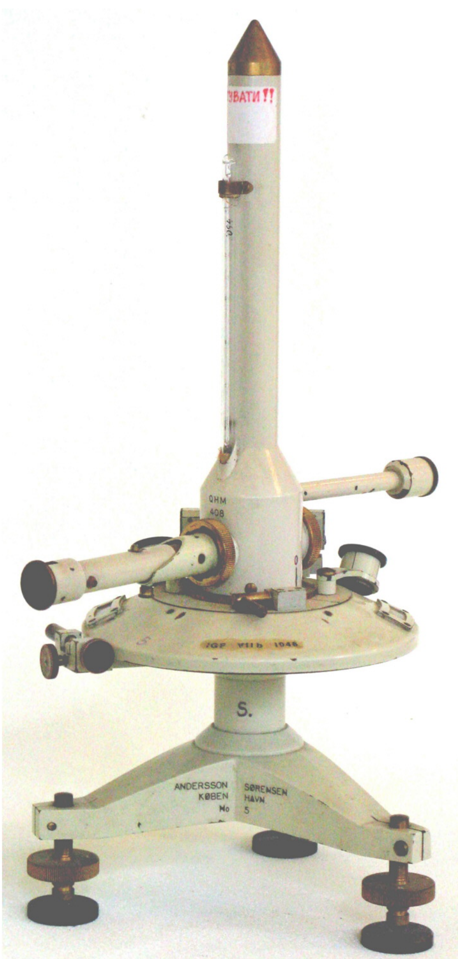

Figure 10. Quartz H-magnetometer.

Figure 11. DI fluxgate Tavistock with ferroprobe FLM1/B.

Table 3. Average Annual Values of the Geomagnetic Field Components of at the Observatory "Kiev"

Year	D, grad	I, grad	H, nT	X, nT	B, nT	Z, nT	F, nT
1958	4.6400	66.7833	19338	19275	1564	45084	49056
1959	4.6900	66.8200	19320	19255	1580	45120	49082
1960	4.7200	66.8250	19327	19261	1590	45149	49112
1961	4.7300	66.8217	19344	19278	1595	45180	49147
1962	4.7700	66.8183	19356	19289	1610	45200	49170
1963	4.7867	66.8233	19361	19293	1616	45222	49192
1964	4.7933	66.8150	19373	19305	1619	45234	49208
1965	4.8050	66.8083	19384	19316	1624	45244	49222
1966	4.8067	66.8100	19391	19323	1625	45263	49242
1967	4.8017	66.8100	19399	19331	1624	45282	49262
1968	4.7867	66.8133	19406	19338	1619	45305	49286
1969	4.7650	66.8033	19421	19354	1613	45320	49306
1970	4.7400	66.7983	19434	19368	1606	45340	49329
1971	4.7200	66.7867	19453	19387	1601	45358	49353
1972	4.7183	66.7817	19467	19401	1601	45381	49380
1973	4.7233	66.7850	19479	19413	1604	45415	49416
1974	4.7300	66.7900	19488	19422	1607	45445	49447
1975	4.7567	66.7900	19499	19432	1617	45472	49476
1976	4.7900	66.8017	19500	19432	1629	45503	49505
1977	4.8217	66.8083	19509	19440	1640	45535	49538
1978	4.8950	66.8367	19499	19428	1664	45575	49571
1979	4.9417	66.8483	19499	19426	1680	45602	49596
1980	4.9900	66.8583	19498	19424	1696	45618	49610
1981	5.0517	66.8850	19480	19404	1715	45635	49619
1982	5.1117	66.9183	19459	19382	1734	45660	49634
1983	5.1650	66.9367	19452	19373	1751	45686	49655
1984	5.2167	66.9517	19441	19360	1768	45694	49658
1985	5.2533	66.9733	19431	19350	1779	45716	49674
1986	5.2933	66.9967	19418	19335	1791	45739	49690
1987	5.3083	67.0100	19414	19330	1796	45759	49708
1988	5.3533	67.0383	19400	19315	1810	45789	49730
1989	5.4000	67.0700	19383	19297	1824	45820	49751
1990	5.4100	67.0833	19378	19291	1827	45838	49766
1991	5.4467	67.1083	19366	19278	1838	45862	49782
1992	5.4767	67.1100	19369	19280	1849	45875	49797
1993	5.5350	67.1150	19371	19280	1868	45891	49812
1994	5.6000	67.1333	19365	19273	1890	45919	49836
1995	5.6700	67.1367	19370	19275	1914	45938	49855
1996	5.7467	67.1467	19375	19278	1940	45970	49886
1997	5.8100	67.1617	19368	19269	1961	45989	49901
1998	5.8483	67.1850	19361	19260	1973	46025	49931
2004	6.1483	67.3033	19352	19241	2072	46269	50153
2005	6.2367	67.3150	19357	19242	2103	46308	50190
2006	6.3033	67.3183	19364	19247	2126	46334	50218
2007	6.3933	67.3283	19369	19249	2157	46368	50251
2008	6.5083	67.3400	19372	19247	2196	46402	50283
2009	6.8867	67.3533	19372	19232	2323	46431	50310

Table 4. Average Annual Values of the Geomagnetic Field Components of at the Observatory "Lviv"

Year	D, grad	I, grad	H, nT	X, nT	B, nT	Z, nT	F, nT
1963	2.7050	65.7217	19902	19880	939	44122	48403
1964	2.7367	65.7167	19913	19890	951	44136	48420
1965	2.7567	65.7233	19915	19892	958	44155	48438
1966	2.7733	65.7250	19921	19898	964	44173	48457
1967	2.7867	65.7350	19923	19899	969	44198	48481
1968	2.7950	65.7300	19937	19913	972	44217	48504
1969	2.7833	65.7417	19948	19924	969	44267	48554
1970	2.7783	65.7333	19964	19941	968	44285	48577
1971	2.7733	65.7300	19974	19951	966	44301	48596
1972	2.7800	65.7067	20005	19981	970	44320	48626
1973	2.8133	65.7083	20017	19993	982	44349	48657
1974	2.8567	65.7117	20029	20004	998	44382	48692
1975	2.9017	65.7083	20050	20024	1015	44424	48739
1976	2.9700	65.7150	20062	20035	1039	44462	48779
1977	3.0283	65.7100	20077	20049	1061	44488	48808
1978	3.1067	65.7350	20069	20040	1088	44520	48834
1979	3.1800	65.7417	20074	20043	1114	44547	48861
1980	3.2483	65.7483	20077	20045	1138	44565	48879
1981	3.3233	65.7783	20061	20027	1162	44592	48897
1982	3.3950	65.8050	20050	20014	1187	44625	48922
1983	3.4633	65.8167	20048	20010	1211	44642	48937
1984	3.5333	65.8383	20038	20000	1234	44666	48955
1985	3.5883	65.8433	20041	20002	1254	44685	48973
1986	3.6500	65.8683	20029	19989	1276	44710	48991
1987	3.6950	65.8817	20026	19984	1292	44730	49008
1988	3.7367	65.9183	20006	19964	1304	44762	49029
1989	3.7967	65.9600	19987	19943	1323	44808	49064
1990	3.8367	65.9717	19985	19941	1337	44827	49080
1991	3.8833	65.9983	19972	19926	1353	44853	49099
1992	3.9250	65.9983	19978	19932	1368	44869	49116
1993	3.9633	65.9983	19986	19938	1381	44887	49135
1994	4.0300	66.0250	19975	19926	1404	44916	49157
1995	4.1550	66.0350	19978	19926	1448	44944	49184
1996	4.2133	66.0317	19990	19936	1469	44966	49209
1997	4.2917	66.0533	19987	19931	1496	45004	49243
1998	4.3883	66.0767	19980	19922	1529	45037	49270
1999	4.4850	66.0883	19979	19917	1562	45062	49292
2000	4.5533	66.1117	19976	19913	1586	45104	49330
2001	4.6517	66.1217	19982	19916	1621	45138	49363
2002	4.7483	66.1433	19981	19912	1654	45182	49403
2003	4.8167	66.1733	19971	19900	1677	45225	49438
2004	4.8967	66.1767	19981	19908	1706	45255	49470
2005	4.9767	66.1900	19986	19910	1734	45291	49504
2006	5.0533	66.1883	19997	19920	1761	45317	49533
2007	5.1400	66.1933	20006	19925	1792	45345	49562
2008	5.2383	66.2050	20010	19926	1827	45381	49597
2009	5.3550	66.2117	20018	19931	1868	45412	49628

Table 5. Average Annual Values of the Geomagnetic Field Components of at the Observatory "Odessa"

Year	D, grad	I, grad	H, nT	X, nT	B, nT	Z, nT	F, nT
1962	1.9983	63.7067	21310	21297	743	43131	48108
1963	2.0200	63.7183	21314	21301	751	43160	48136
1964	2.0267	63.7200	21323	21310	754	43182	48160
1965	2.0317	63.7183	21331	21318	756	43195	48175
1966	2.0433	63.7300	21328	21314	760	43212	48189
1967	2.0483	63.7367	21338	21324	763	43244	48222
1968	2.0433	63.7367	21346	21332	761	43259	48239
1969	2.0250	63.7283	21359	21346	755	43271	48255
1970	2.0117	63.7167	21366	21353	750	43288	48274
1971	2.0017	63.7183	21384	21371	747	43302	48294
1972	1.9950	63.7100	21398	21385	745	43316	48313
1973	2.0100	63.7150	21407	21394	751	43343	48341
1974	2.0283	63.7233	21414	21401	758	43371	48369
1975	2.0650	63.7217	21430	21416	772	43400	48402
1976	2.0967	63.7267	21438	21424	784	43426	48430
1977	2.1350	63.7333	21445	21430	799	43454	48458
1978	2.1900	63.7633	21436	21421	819	43491	48487
1979	2.2400	63.7767	21436	21420	838	43516	48510
1980	2.2867	63.7850	21435	21418	855	43532	48523
1981	2.3367	63.8217	21415	21397	873	43562	48541
1982	2.3933	63.8567	21396	21377	893	43590	48558
1983	2.4383	63.8683	21392	21372	910	43607	48572
1984	2.4867	63.8950	21379	21359	928	43630	48586
1985	2.5167	63.9150	21371	21350	938	43651	48602
1986	2.5483	63.9417	21357	21336	950	43678	48620
1987	2.5733	63.9550	21355	21334	958	43698	48637
1988	2.5967	63.9867	21339	21317	967	43727	48656
1989	2.6300	64.0183	21323	21301	978	43754	48673
1990	2.6450	64.0283	21322	21299	984	43772	48689
1991	2.6817	64.0550	21307	21284	997	43794	48702
1992	2.7167	64.0583	21311	21287	1010	43807	48716
1993	2.7667	64.0633	21314	21289	1029	43824	48733
1994	2.8300	64.0817	21309	21283	1052	43850	48754
1995	2.8917	64.0883	21314	21287	1075	43873	48776
1996	2.9650	64.0950	21319	21290	1103	43894	48797
1997	3.0450	64.1183	21313	21283	1132	43929	48826
1998	3.1217	64.1467	21305	21273	1160	43967	48857
1999	3.2167	64.1633	21306	21272	1195	44000	48887
2000	3.3367	64.1800	21307	21271	1240	44037	48921
2001	3.3950	64.1850	21312	21274	1262	44061	48945
2002	3.4583	64.2017	21314	21275	1286	44102	48982
2003	3.5433	64.2383	21305	21264	1316	44149	49022
2004	3.6067	64.2417	21315	21273	1341	44181	49054
2005	3.6800	64.2583	21314	21270	1368	44218	49086
2006	3.7433	64.2683	21322	21276	1392	44243	49113
2007	3.7800	64.2850	21324	21277	1406	44278	49145

servatory "Faraday" [*Salino*, 1985] to Ukraine, which was renamed into the observatory "Academician Vernadsky". The observatory was named after the eminent academician Vladimir Ivanovich Vernadsky (1863–1945), who was elected as the first president of the Academy of Sciences of Ukraine in 1918 [*Bakhmutov*, 1997].

The main instrument for recording the geomagnetic field was LaCour-type magnetometer. It recorded the changes of the field on the photocopying paper in a coordinates system HDZ (on the magnetic meridian). In 1998 a new sensitive digital three-components ferroprobe magnetometer LEMI-008 of the domestic production was installed at the observatory. It allowed carrying out the observation of geomagnetic pulsations, its frequency and polarization. On 27th of May, 2006 LaCour-type magnetometer was taken out of operation, but it remains operative.

Nowadays the main instruments of the geomagnetic observatory "Akademician Vernadsky" are the two automatic three-component ferroprobe magnetometer of LEMI-008 (No. 2 and No. 16), produced by LC ISR NASU-NSAU. Sensitivity of magnetometers LEMI is about 0.1 nT, and the measurements are made with 1 sec. period. Sensor of magnetometer LEMI-008 No. 2 is set on the magnetic meridian. Sensor of magnetometer LEMI-008 No. 16 is set on the geographical meridian. Magnetometer LEMI-008 No. 2 was installed in 1999. LEMI-008 No. 16 is magnetometer of observatory, installed in 2003, differs from LEMI-008 No. 2 with installed in it board GPS Trimble (for accurate time synchronization) and remote antenna. The antenna is placed on the middle pillar between the variational and fiberglass pavilions. The measurements data come into the INTERMAGNET network through DCP system in data collection center in Ottawa (Canada). Besides mentioned above ones also magnetometer EDA No. 501 (with the sensitivity as high as 0.48 nT) with a digital recording system "Geologger" is operated. Its sensor is set on the magnetic meridian. Absolute measurements are carried out by two proton magnetometers GM-122 No. 6364 (with a sensitivity of about 1 nT) and PPM-8 (with a sensitivity of about 0.01 nT) and also by theodolite THEO 020B with a single component sensor MAG-01H Bartington 0552H. In 2004 geomagnetic observatory "Academician Vernadsky" has become a full member of INTERMAGNET [*Melnik, Bakhmutov*, 2008].

Conclusion

The most accurate and on-line information about the geomagnetic field is provided by the network of INTERMAGNET. It includes digital magnetic observatories, which use up-to-date standards of measuring and recording equipment, as well as the same data formats to simplify the dissemination, acquisition and processing of geomagnetic data in near to real time. Data of the geomagnetic observations are promptly transferred by observatories and institutions, which participate in the program, to the regional geomagnetic information nodes by means of satellite and computer networks using INTERMAGNET standards. Regional geomagnetic information nodes implement a global exchange of data and the results of its processing and also provide an access to the geomagnetic data for all interested users over the world.

Three geomagnetic observatories of Ukraine ("Lviv", "Kiev" and "Akademician Vernadsky") are full members of INTERMAGNET. At the geomagnetic observatory "Odessa" a digital magnetic variational station is installed. Observatories are equipped with computers and the Internet, as well as software. It makes possible promptly to send and receive necessary information. Data of these observatories of Ukraine are used for studying the dynamics of the secular variations of the geomagnetic field at middle latitudes and for making the international model IGRF. They are the basic points for the observations on the positions of the secular trend, for studying the spatial and temporal characteristics of the geomagnetic field, both in the territory of Ukraine and in adjacent territories.

Acknowledgments. We express thanks to Prof. Jean-Lois Le Mouel (the Institute of Earth Physics of Paris, Paris, France), Prof. Jerzy Jankowsky (Institute of Geophysics, Polish Academy of Sciences, Warsaw, Poland), Dr. Jean Rasson (Royal Meteorological Institute of Belgium, Dourbes, Belgium), Dr. Christopher Turbitt (British Geological Survey, Edinburgh, UK) for help in equipping the observatories of Ukraine with the instruments of INTERMAGNET standards. Especially we want to thank the personnel of the geomagnetic observatory "Belsk" (Institute of Geophysics, Polish Academy of Sciences, Belsk, Poland) for help in installing the equipment. We also express thanks to Prof. Alexey Gvishiani (Geophysical Center, Russian Academy of Sciences, Moscow, Russia), Prof. Jeffrey Love (United States Geological Survey, Denver, Colorado, USA) and Prof. Arnuad Chulliat (the Institute of Earth Physics of Paris, Paris, France) for their cooperation. This article was written with partial support of a joint project of RFBR and NAS of Ukraine No. 28-05-10 (U)/10-05-90441 (R).

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