PROCESSING AND ORGANIZATION OF THE DATA OBTAINED FROM THE ANALOG MAGNETOGRAMS OF PANAGJURISTE GEOMAGNETIC OBSERVATORY

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Abstract. A brief history of the Panagjuriste Geomagnetic Observatory sins its establishment in 1937 to the present day is given. The data processing in the past and the contemporary geomagnetic data organization are described (Fig. 1). A brief description of the programming software for post-processing of the observed geomagnetic data in machine-readable form for PC is given. A few tables elaborated with this software are presented. More information and details are available on the telephone numbers and E-mails given in item 2.

Key words: Geomagnetic data; Geomagnetic Observatory. Panagjuriste.

1. History

The Military Topographic Service at the Ministry of Defense of Bulgaria established Panagjuriste geomagnetic observatory in 1937. The Geophysical Institute of the Bulgarian Academy of Sciences took over the administration of the Observatory in 1961 till present days (Kostov and Nozharov, 1987). The absolute observations of the geomagnetic elements are carried out in the so-called "Absolute house", while their time variations, registered on standard 48-cm photo paper analogue magnetograms by means of Bobrov's variometers, are made in the so-called "Relative house". The elements: ***D*** – declination, ***H*** – horizontal intensity, ***Z*** – vertical component and ***I*** – inclination of the geomagnetic field are measured, and the elements: ***D***, ***H***, ***Z*** and ***F*** – total intensity – are registered nowadays.

In the past the diurnal mean, monthly mean and annual mean values of the geomagnetic elements were calculated only for reduction of the field geomagnetic measurements to the common epoch and they were not published. The first publication of the data was released in 1965 under the guidance of Dr. D. Zidarov, head of the Section of Geomagnetism and Gravimetry of the Geophysical Institute at that time. The Geomagnetic Yearbooks of the hourly mean, monthly mean, annual mean and s. o. values were published

according to the standards of the International Association of Geomagnetism and Aeronomy (IAGA).

The hourly mean values and their extreme values (maximum and minimum) in mm were read from the magnetograms manually. The calculation of the geomagnetic elements in respective units and the calculation of the diurnal, monthly and annual means were carried out by means of very primitive calculators. The Geomagnetic Yearbooks were composed on a typewriter and printed off in the printing house of the Military Topographic Service. They were made in this way till 1975 and backward till 1956 inclusive with the invaluable technical assistance of S. Ustichkov (expert) and S. Koniarova (translator) and, of course, of all Observatory staff at that time.

The author drew up the first computer program (in FORTRAN code) for processing and printing the geomagnetic data of the Observatory in 1975. The geomagnetic element hourly mean and extreme values (in mm) continued to be read manually. These values, the base-line values, the variometer scale-values, the variometer temperature coefficient values, the local K and C indices of the geomagnetic activity, and the temperature in the "Relative house" were written on coding forms and punched on punch cards in the Computer center of the Institute of Building Cybernetics. The best computer in Sofia was installed there at that time. It was an IBM 360 and it had 256 KB RAM, and 4 big (physically big) removable disks 100 – 200 MB. The Geomagnetic Yearbooks were worked out and printed off on this computer from 1976 till 1983 according to the IAGA standards.

All these Yearbooks were sent to the World Data Centers (WDC) and to the other interested institutions and geomagnetic observatories (Geomagnetic Yearbooks, Geomagnetic observatory – Panagjuriste, 1956-1983).

The Geophysical Institute purchased the first personal computers (PC) in the end of the 80-es. Then the author began developing computer programs in TURBO PASCAL 5.5 under DOS for processing the observatory geomagnetic data. Therefore and for other reasons the publication of the Yearbooks in hard copy was suspended.

2. Brief information on the development of the programs for processing and organizing of the geomagnetic data in a database

A package of basic program units (composed of different subprograms – procedures and functions) in TURBO PASCAL 5.5 code was first carried out. On the basis of this package it is possible to work out a variety of computer programs (software) under DOS. After that, another package of programs was elaborated for processing of the geomagnetic data and their organization in database. This software was completed in 1998. The source code and the description of the basic units and programs printout are available in the Geophysical Institute and in the Observatory. Information with regard to this can be received from the Geophysical Institute and the Observatory at telephone No +(359-2)-979-3347 and (359-357)-3231, and by e-mail – buch@geophys.bas.bg and cholakov@inter-pan.net.

The goal of these packages is: all geomagnetic data to be recorded in machine-

readable form so that they can easily be sent to the WDC and other institutions on CD or through INTERNET; to create a WEB page with them; and to process them on PC for obtaining different scientific results.

The record format of the rough data (read from the magnetograms manually) was adopted in the time when the Geomagnetic Yearbook was issued as a hard copy. The record had a length of 80 bytes in ASCII code (you remember, the data were punched on punch cards) and for 1-day-data there were two records. These data (for a single day) can be written on 1 record with a length about 160 bytes when the record is on HDD or FDD. However the problem in this case is that the record becomes too long. It is difficult to see the entire record on the screen and it is not simple to print it out. For this reason it was decided to keep the old format: 1-day-data – two records of 80 bytes. The record formats of the files sent to the WDC however are exactly according to the IAGA standards (WDC Data Catalogue, 2002). The format of the other files (for example the monthly means, the daily means, etc.) was designed by the author and can be changed if necessary. The programs creating corresponding files have to be changed in this case too.

3. Data organization

The geomagnetic database structure is presented in Fig. 1 and the contents of all folders – in Table 1.

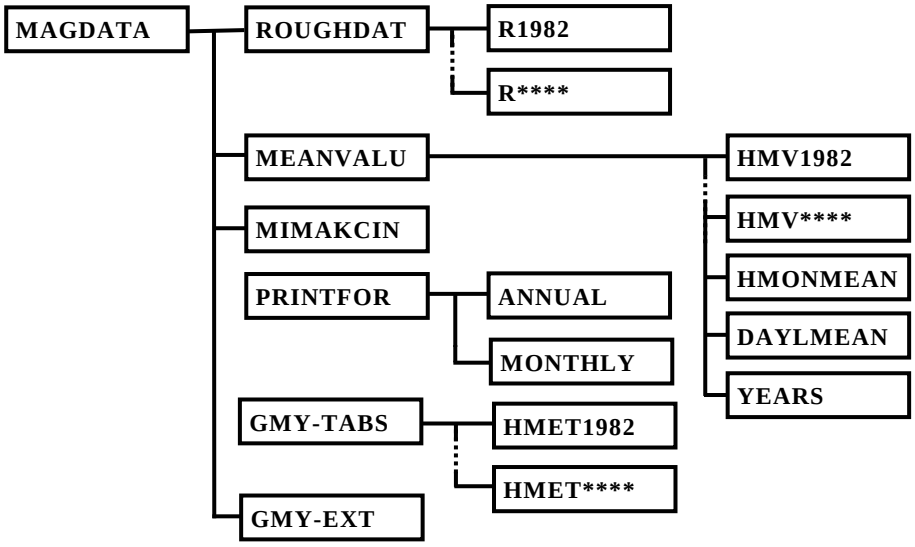

Fig. 1. The organization of the geomagnetic data in folders on a PC.

We shall introduce the following symbols and conditions for making the folder and file descriptions simpler:

1) **** – defines a year – 1989, 2000 and s. o.

2) +++ – defines a month – JAN, FEB, …, DEC.

3) GMFE – defines “GeoMagnetic Field Element(s)".

4) & – defines the GMFE symbols: ***D*** – declination, ***F*** – total intensity, ***H*** – horizontal intensity, ***I*** – inclination, ***X*** – north component, ***Y*** – east component or ***Z*** – vertical component in the names of the files containing the tables of respective elements; and ***E*** – in the names of the files containing the tables of extreme values, K and C indices, and the temperature of the "Relative house" in the same form like the old Geomagnetic Yearbook that was edited in a hard copy.

5) Rough data" – defines the values read from the magnetograms and quantity received after elementary manual processing.

Table 1. The folder and file description of the geomagnetic data database.

Folder	Description
MAGDATA	Main folder. Contains all other folders. There are no files in it.
ROUGHDAT	Contains all folders R**** of rough data. There are no files in it.
R****	They contain the files R*******.PAG of rough data. There is 1 folder of 12 files for every year – each one for 1 month.
MEANVALU	Contains the folders HMV**** of hourly mean values for *ONE MONTH* and the folders: HMONMEAN – of hourly-monthly mean values, DAYLMEAN – of daily mean values, and YEARS – of hourly mean values for *ONE YEAR*. Contains the files: MONTMEAN.PAG of monthly mean values and ANNMEANS.PAG of annual mean values too. The last two files are unique in the Observatory and they are only for 100 years.
HMV****	They contain the files W*******.PAG of hourly mean values for *ONE MONTH*. There is 1 folder of 12 files for every year – each one for 1 month.
HMONMEAN	Contains the files HMMV****.PAG of hourly-monthly means values. There is 1 file for every year.
DAYLMEAN	Contains the files DM****.PAG of daily mean values. There is 1 file for every year.
YEARS	Contains the files PAG****.WDC of hourly mean values for *ONE YEAR*. There is 1 file for every year.
MIMAKCIN	Contains the files EXKC****.PAG of D, H and Z extreme values, K and C indices, and the temperature in the "Relative house". There is 1 file for every year.
PRINTFOR	Contains the folders: ANNUAL – of annual mean value files, and MONTHLY – of files containing simultaneously annual and monthly mean values. There are no files in it.
ANNUAL	Contains the files PAG-ANN.ALL (Fig. 2) and PAG-ANND.ALL of annual mean value tables. In the first one the declination is presented in ° (degrees) and ' (minutes), and in the second one – in degrees and tenth of degrees. There is only 1 file of the two types (2 files only) for all years. The file PAG-ANN.ALL is sending to the WDCC1 in Edinburgh.

Folder	Description
MONTHLY	Contains the files PAG****.ALL of annual and monthly mean value tables simultaneously (Fig. 3). There is 1 file for every year.
GMY-TABS	Contains the folders HMET**** of files &****+++.PAG described below. There are no files in it.
HMET****	They contain the files &****+++.PAG of the GMFE tables and the tables of extreme values, etc. in the same form as the old Geomagnetic Yearbook that was issued like a hard copy. There is 1 folder of 8 files for every year.
GMY-TEXT	Contains different files for the history of the Observatory, some of its characteristics, etc.

4. Description of the files in the database

The files in the geomagnetic database of Panagjuriste observatory and their brief description are given in Table 1. They will be described in more detail below. Additional information can be received by phones and E-mails shown in item 2. A CD-ROM with detailed description of all available information will be produced in the near future. It will be sent to the interested institutions. A WEB page will be created with it. All files are text files (in ASCII-code).

1. Files R****+++.PAG – the rough data for *ONE MONTH*.

These files are the primary files and contain the manually read values from the magnetograms and some preliminary calculated quantities. They can be created by any text editor in ASCII-code. The length of their records is 80 bytes.

The local magnetic activity indices K and C in the Observatory (calculated manually), the symbols of quiet (Q) and disturbed (D) days (when a given day is neither quite nor disturbed this field is left blank) and the temperature in the "Relative house" are recorded in the beginning of the files consecutively.

The records of the GMFE in the order ***H***, ***D*** and ***Z*** follow. There are two records for each day of the month. There are so many times two records for each element as days there are in the month (no lacks). In the beginning of the first record the GMFE symbol (***H***, ***D*** or ***Z***), the day of month (01 – 31) and the month (01 – 12) are put. 15 hourly mean values read from the magnetograms in mm follow. The remaining 9 hourly mean values are written in the beginning of the second record. Then follow: the extreme values (maximum and minimum) read in mm too; the hour and the minute when they occur; the adopted base-line value in nT for ***H*** and ***Z***, and in degrees and tenth-minutes for ***D***; the scale value of the variometer in nT/mm for ***H*** and ***Z*** and in tenth-minutes/mm for ***D***; and its temperature coefficient in the same dimension as in the case of the scale value. The missing hourly mean and extreme values are identified by 9999.

2. Files W****+++.PAG – the GMFE hourly mean values for *ONE MONTH*.

The GMFE hourly mean values are recorded in the sequence: ***D***, ***F***, ***H***, ***I***, ***X***, ***Y***, ***Z***. For every element there are as many records as days in the respective month. The records consecutively contain: the Observatory's mnemonic code (in our case PAG); the last 2 digits of the year (82 = 1982); the month (01 – 12); the element number, i.e. ***D*** – 1, ***F*** – 2, ***H*** – 3, ***I*** – 4, ***X*** – 5, ***Y*** – 6 or ***Z*** – 7; the day of month (01 – 31); the element symbol (***D***, ***F***, ***H***, ***I***, ***X***, ***Y*** or ***Z***); the symbols Q for the quiet or D for the disturbed days (if the day is neither quiet nor disturbed this field is left blank); the tabular base value in hundreds of nT for ***F***, ***H***, ***X***, ***Y***, ***Z*** and in degrees for ***D*** and ***I***; twenty-four 4-digit hourly mean values for the day in nT for the intensity elements and in tenth-minutes for D and I. The last 4-digit number is the daily mean. The missing values are identified by 9999. The record length is 120 bytes.

3. Files PAG****.WDC – the GMFE hourly mean values for *ONE YEAR*.

The structure of these files is according to the IAGA standard (as it is known, the WDC GMEF hourly mean values database contains exactly these files) (Data Catalogue, 2002). The records are arranged in ascending order according to the months. They are similar to these of the files W****+++.PAG. However, there is a little difference – after the day of the month the symbol of the corresponding GMFE is put, and the GMFE number and the symbols for quiet and disturbed days are not placed. The remaining part of the records is identical to the same part of the records described in the previous item. The record length is 120 bytes too.

4. Ffile MONTMEAN.PAG – the GMFE monthly mean values.

This file is the only one in the Observatory. It is designed for 100 years.

The records are arranged in ascending order according to years and months. There are 3 records for every month: for all days – A, for disturbed days – D and for quiet days – Q. The records consecutively contain: the Observatory's mnemonic code (in our case PAG); the Observatory's geographical coordinate – latitude and longitude – in degrees; the year (4-digits); the symbols A, D or Q (depending on the day type); and 7 groups each of 2 numbers – the EGMF monthly mean values and the number of days on which they were calculated in the following order: ***D***, ***F***, ***H***, ***I***, ***X***, ***Y*** and ***Z***. The intensity elements are in nT and ***D*** and ***I*** – in tenth-minutes. The missing values are identified by 99999. The record length is 94 bytes.

5. The files HMMV****.PAG – the GMFE hourly-monthly mean values for *ONE YEAR*.

The data in these files represent the mean of GMFE hourly mean values for a given hour for all days of a month.

The records are arranged in ascending order according to the months. For every month there are 21 records – for all GMFE – in the following order: ***D***, ***F***, ***H***, ***I***, ***X***, ***Y***, ***Z***, and for every GMFE there are 3 records: for all – A, for disturbed – D and for quiet – Q days (i.e. 7 elements x 3 day types = 21). The records consecutively contain: the Observatory's mnemonic code (in our case PAG); the year (4-digits); the month (01 – 12), the EGMF symbol ***D***, ***F***, ***H***, ***I***, ***X***, ***Y*** or ***Z***; the symbols A, D or Q (depending on the day type); the number of days on which the hourly-monthly mean values were calculated; the tabular base

value in hundreds of nT for the intensity elements and degrees for D and I; twenty-four 4-digits hourly-monthly means values; and the daily mean value in the end. The intensity elements are in nT and D and I – in tenth-minutes. The missing values are identified by 9999. The record length is 122 bytes.

6. Files DM****.PAG – the GMFE daily mean values for *ONE YEAR*.

The records are arranged in ascending order according to the months. For every month there are 7 records – for all GMFE – in the following order: ***D***, ***F***, ***H***, ***I***, ***X***, ***Y***, ***Z***. The records consecutively contain: the Observatory's mnemonic code (in our case PAG); the year (4-digits); the month (01 – 12), the EGMF symbol ***D***, ***F***, ***H***, ***I***, ***X***, ***Y*** or ***Z***; the tabular base value in hundreds of nT for the intensity elements and degrees for D and I; and the corresponding number 4-digits daily mean values according to the number of days in the month. The intensity elements are in nT and ***D*** and ***I*** – in tenth-minutes. The missing values are identified by 9999. The record length varies from 129 bytes for February of 28 days to 141 bytes for July, for example, depending on the number of days in the months.

7. File ANNMEANS.PAG – the GMFE annual mean values centered on July 1 of the corresponding year.

This file is the only one in the Observatory. It is designed for 100 years.

The records are arranged in ascending order according to the years. There are 3 records for every year: for all – A, for disturbed – D and for quiet – Q days. The records consecutively contain: the Observatory's mnemonic code (in our case PAG); the year (4-digits); the symbols A, D or Q (depending on the day type); and 7 groups each of 2 numbers – the EGMF annual mean values and number of days on which they were calculated in the following order: ***D***, ***F***, ***H***, ***I***, ***X***, ***Y*** and ***Z***. The intensity elements are in nT and ***D*** and ***I*** – in tenth-minutes. The missing values are identified by 99999. The record length is 80 bytes.

8. Files EXKC****.PAG – the EGMF extreme values (minimum and maximum), K and C indices and the temperature in the "Relative house" for *ONE YEAR*.

The records are arranged in ascending order according to the months. There are as many records for each month as days there are in it. The records consecutively contain: the Observatory's mnemonic code (in our case PAG); the year (4-digits); the month (01 – 12), the day of month (01 – 31); the symbols D or Q (depending on the day type; when a given day is neither quiet nor disturbed this field is left blank). Three groups, each of them consisting of 7 numbers referring to the extreme values of ***D***, ***H*** and ***Z***, follow: the tabular base values (in hundreds of nT for ***H*** and ***Z***, and in degrees for ***D***); the hour and the minute when the maximum value has occurred; and the proper maximum value; and there is the same configuration for the minimum value. The extreme values are in nT for ***H*** and ***Z***, and in tenth-minutes for ***D***. 8 values of three-hour K index, the value of C index (both manually calculated) and the temperature of the "Relative house" are after that put. The record length is 91 bytes.

9. Files PAG****.MON – the EGMF monthly and annual mean tables for *ONE YEAR*.

A table is shown in Fig. 2. Such a table can be worked out for an arbitrary year.

10. File PAG-ANN.ALL – the EGMF annual mean table.

The file is the only one in the Observatory. The table is shown in Fig. 3.

11. Files &*******+++.PAG.

The files contain the tables with the EGMG ***H***, ***D*** and ***Z*** hourly mean values or the tables with there extreme values, K and C indices, and the temperature in the "Relative house" in the same form as the Magnetic Yearbook was issued like a hard copy (Geomagnetic Yearbooks, Geomagnetic observatory – Panagjuriste, 1956-1983).

5. Brief description of the programs and their modus operandi

The software (written in TURBO PASCAL 5.5 under DOS) for processing the EGMF data from the analogue magnetograms and their organization in a database consists of 10 different modules (programs), independent of each other. We will describe what the programs do further on. More information and details are available on the telephones and E-mails shown in item 2.

1. Program Check_UpRoughData (unit CHECK-RD.PAS).

This program serves for checking-up the file with the rough data R*******+++.PAG. It reads the file and gives messages about the number of the record and the type of error in it if an error exists. If there are no errors in the file it gives a message that the file is correct. The errors have to be corrected with an arbitrary text editor.

N.B. If the program does not give messages about errors this does not mean that there are no errors in the checked file. For example, in some hourly mean a wrong digit but a digit (0 – 9) might be entered. In this case it is impossible for the program to guess that there are errors in the record.

2. Program HourlyMeanValuesForOneMonth (unit HM-MONTH.PAS) and the unit HMBEGEND.PAS.

The unit HMBEGEND.PAS contains several subprograms of the program HourlyMeanValuesForOneMonth. The last program serves for calculating the EGMF hourly mean values and for creating a file with them for *ONE MONTH*. The input file is R*******+++.PAG – the rough data. The output file is W*******+++.PAG – the hourly mean values.

3. Program HourlyMeanValuesForOneYear (unit HM-YEAR.PAS).

This program serves to unite the files W*******+++.PAG of EGMF hourly mean values for *ONE MONTH* created by HM-MONTH.PAS in a file of these values for *ONE YEAR*. The input file is W*******+++.PAG, the output file – PAG****.WDC.

4. Program MonthlyMeanValues (unit MONTMEAN.PAS).

This program serves to calculate the EGMF monthly mean values. The input file is W*******+++.PAG, the output file – MONTMEAN.PAG of the monthly mean values.

Data Report: Observatory Annual Means Date: 9-Dec-2000
Station Name: Panagjuriste IAGA Code: PAG Country: Bulgaria (BG)
Sponsoring Institution: Geophysical Institute, BAS
Latitude: 42°30.9' N Longitude: 24°10.6' E Elevation [m]: 556
Elements Measured: DHZ

Year	**Type**	***D***	***F***	***H***	***I***	***X***	***Y***	***Z***
1986.5	A	2°14.9'	46437	23681	59°20.3'	23663	929	39945
1986.5	D	2°15.5'	46433	23668	59°21.2'	23650	933	39948
1986.5	Q	2°14.4'	46440	23689	59°19.7'	23671	926	39943
1987.5	A	2°17.2'	46461	23683	59°21.2'	23664	945	39972
1987.5	D	2°17.6'	46458	23672	59°22.0'	23654	947	39975
1987.5	Q	2°16.9'	46463	23689	59°20.8'	23670	943	39970
1988.5	A	2°19.5'	46484	23671	59°23.3'	23651	960	40006
1988.5	D	2°20.1'	46480	23654	59°24.6'	23634	964	40011
1988.5	Q	2°18.9'	46487	23682	59°22.5'	23662	957	40003
1989.5	A	2°22.3'	46505	23657	59°25.4'	23637	979	40038
1989.5	D	2°23.6'	46498	23632	59°27.2'	23611	986	40045
1989.5	Q	2°21.6'	46508	23670	59°24.4'	23651	974	40034
1990.5	A	2°24.0'	46525	23656	59°26.3'	23636	991	40062
1990.5	D	2°24.9'	46520	23638	59°27.6'	23617	996	40067
1990.5	Q	2°23.5'	46528	23667	59°25.5'	23646	987	40059
1991.5	A	2°26.8'	46541	23646	59°27.9'	23624	1009	40087
1991.5	D	2°28.1'	46534	23619	59°29.9'	23597	1017	40095
1991.5	Q	2°26.1'	46544	23659	59°26.8'	23638	1005	40082
1992.5	A	2°28.9'	46557	23653	59°28.0'	23631	1024	40102
1992.5	D	2°29.6'	46552	23633	59°29.5'	23610	1028	40107
1992.5	Q	2°28.3'	46560	23665	59°27.1'	23643	1021	40098
1993.5	A	2°32.0'	46576	23658	59°28.4'	23635	1046	40121
1993.5	D	2°32.7'	46571	23641	59°29.6'	23618	1050	40124
1993.5	Q	2°31.6'	46579	23667	59°27.7'	23644	1043	40118
1994.5	A	2°35.7'	46596	23655	59°29.6'	23631	1071	40146
1994.5	D	2°36.4'	46592	23641	59°30.5'	23617	1075	40148
1994.5	Q	2°35.1'	46599	23666	59°28.7'	23642	1067	40143
1995.5	A	2°39.5'	46618	23662	59°29.8'	23637	1098	40166
1995.5	D	2°40.2'	46614	23650	59°30.7'	23624	1101	40169
1995.5	Q	2°39.1'	46620	23672	59°29.1'	23647	1095	40163
1996.5	A	2°43.7'	46641	23673	59°29.9'	23647	1127	40187
1996.5	D	2°44.2'	46639	23667	59°30.4'	23640	1130	40188
1996.5	Q	2°43.4'	46643	23679	59°29.5'	23652	1125	40185
1997.5	A	2°48.2'	46667	23672	59°31.2'	23643	1158	40218
1997.5	D	2°48.5'	46665	23665	59°31.6'	23637	1159	40219
1997.5	Q	2°47.9'	46668	23677	59°30.8'	23648	1156	40216
1998.5	A	2°52.8'	46695	23665	59°33.0'	23635	1189	40254
1998.5	D	2°53.6'	46689	23647	59°34.3'	23617	1193	40259
1998.5	Q	2°52.5'	46697	23672	59°32.4'	23642	1187	40252

D and ***I*** in degrees and minutes; ***F***, ***H***, ***X***, ***Y*** and ***Z*** in nT.

Fig. 2. Table of EGMF annual mean values.

5. Program DaylyMeanValues (unit DAYMEANS.PAS).

This program serves to calculate the EGMF daily mean values. The input file is W*******+++.PAG, the output file – DM****.PAG of the daily mean values.

Data Report: Observatory Monthly and Annual Means - 2005
Date: 18-Sep-2006
Station Name: Panagjuriste IAGA Code: PAG; Country: Bulgaria (BG)
Sponsoring Institution: Geophysical Institute, BAS
Latitude: 42◦30.9' N; Longitude: 24◦10.6' E; Elevation [m]: 556
Elements Measured: DHZ

All days

Month	D	F	H	I	X	Y	Z
Jan	3◦21.0'	46893	23678	59◦40.4'	23638	1383	40476
Feb	3◦20.5'	46897	23693	59◦39.3'	23653	1381	40472
Mar	3◦21.0'	46898	23698	59◦38.9'	23658	1385	40470
Apr	3◦21.3'	46901	23702	59◦38.7'	23661	1387	40471
Sep	3◦23.9'	46911	23683	59◦40.7'	23642	1404	40494
Oct	3◦23.7'	46913	23698	59◦39.5'	23656	1403	40488
Nov	3◦24.0'	46916	23699	59◦39.6'	23657	1406	40491
Dec	3◦24.4'	46919	23702	59◦39.5'	23660	1409	40493
Mean	3◦22.6'	46906	23695	59◦39.5'	23654	1395	40482

Disturbed days

Month	D	F	H	I	X	Y	Z
Jan	3◦22.1'	46888	23659	59◦41.8'	23619	1390	40482
Feb	3◦21.4'	46892	23680	59◦40.2'	23639	1387	40474
Mar	3◦21.7'	46895	23689	59◦39.5'	23648	1389	40472
Apr	3◦22.2'	46897	23689	59◦39.6'	23648	1393	40474
Sep	3◦24.7'	46904	23660	59◦42.4'	23621	1408	40500
Oct	3◦24.2'	46910	23687	59◦40.3'	23645	1406	40491
Nov	3◦24.2'	46914	23694	59◦39.9'	23652	1407	40491
Dec	3◦25.1'	46917	23694	59◦40.0'	23652	1413	40494
Mean	3◦23.3'	46902	23680	59◦40.6'	23639	1400	40486

Quiet days

Month	D	F	H	I	X	Y	Z
Jan	3◦20.2'	46897	23688	59◦39.7'	23648	1379	40475
Feb	3◦20.0'	46900	23703	59◦38.6'	23662	1378	40470
Mar	3◦20.6'	46900	23704	59◦38.5'	23664	1382	40469
Apr	3◦21.0'	46904	23709	59◦38.2'	23669	1385	40471
Sep	3◦23.5'	46914	23696	59◦39.8'	23655	1402	40490
Oct	3◦23.4'	46914	23704	59◦39.1'	23662	1402	40486
Nov	3◦23.8'	46919	23705	59◦39.2'	23663	1404	40490
Dec	3◦24.0'	46921	23707	59◦39.1'	23666	1406	40491
Mean	3◦22.2'	46909	23703	59◦38.9'	23662	1393	40480

D and *I* in degrees and minutes; *F*, *H*, *X*, *Y* and *Z* in nT.

Fig. 3. EGMF monthly and annual mean values.

6. Program HourlyMonthlyMeanValues (unit HMMEAN.PAS).

This program serves to calculate the EGMF hourly-monthly mean values. The input file is W*******+++.PAG, the output file – HMMV****.PAG of the hourly-monthly mean values.

7. Program MinMaxKindexCindex (unit MINMAXKC.PAS).

This program serves to calculate the EGMF extreme values and to process, manually calculated K and C indices for *ONE MONTH*. The input file is R*******+++.PAG (the rough data), the output file – EXKC****.PAG of the extreme values, K and C indices and the temperature in the "Relative house".

8. Program AnnualMeanValues (unit ANNMEANS.PAS).

This program serves to calculate the EGMF annual mean values. The input file is MONTMEAN.PAG, the output file – ANNMEANS.PAG of the annual mean values.

9. Program MonthlyAndAnnualMeanPrintForms (unit AM-FORMS.PAS).

This program serves to show the EGMF annual and monthly mean values in a suitable format as a table. The input files are: MONTMEAN.PAG for the monthly mean values and ANNMEANS.PAG – for the annual means. The output files are: PAG****.MON with the monthly mean values, and PAG-ANN.ALL (***D*** and ***I*** in – degrees and ' – minutes) and PAG-ANND.ALL (***D*** and ***I*** in – degrees and tenth-degrees) – for the annual means (Fig. 2 and Fig. 3).

10. Program GeomagneticYearbookTables (unitGMY-TABS.PAS).

This program serves to work out the EGMF tables containing the EGMF H, D and Z hourly mean values and the tables containing their extreme values, K and C indices and the temperature in the "Relative house" in the same format as the Geomagnetic Yearbook was issued like a hard copy (till 1983). The input files are: W****+++.PAG and HMMV****.PAG for the tables containing the hourly mean values and EXKC****.PAG for the tables containing the extreme values, K and C indices and the temperature in the "Relative house". The output files are &****+++.PAG, where all symbols are described in item 3.

6. Conclusion

The organization of the Panagjuriste observatory geomagnetic data (hourly means, monthly means etc.) in a machine-readable form described above is a first attempt in this direction. We consider that this organization may be kept in the future even if the registration of the EGMF becomes digital. In this case the file R*******+++.PAG (the rough data) will not be generated. The output file from the digital equipment will be used instead. The program HourlyMeanValuesForOneMonth (units HM-MONTH.PAS and HMBEGEND.PAS) must be changed depending on the equipment output file format for obtaining the file W****+++.PAG. The software presented above can be used for carrying out the other files (the monthly means, the annual means etc.). Unfortunately, a new program must be elaborated for generating the files EXKC****.PAG containing the extreme values, the K and C indices and the temperature in the "Relative hose", because the

program described above creating these files uses the files R******++.PAG as input. The same has a bearing on the program GeomagneticYearbookTables (unit GMY-TABS.PAS) for creating the files of geomagnetic extreme values Yearbook tables – E******++.PAG. It uses the files EXKC****.PAG as input.

The data in machine-readable form are available since 1984 till 2002, and in hard copy - since 1956 till 1983 in the Observatory and in the Geophysical Institute or in the WDCs'.

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Обработка и организация на данните в Геомагнитна обсерватория – Панагюрище, получени от отчетите по аналоговите магнитограми

И. Бъчваров

Резюме. Описана е накратко историята на Геомагнитна обсерватория – Панагюрище от основаването ù до наши дни и начинът на обработка на геомагнитните данни там в миналото. Дадена е изградената в момента структура на тези данни в машиночитаема форма (Фиг. 1). Описани са файловете с тези данни и съвсем накратко програмите за персонален компютър, с които те се създават. Представени са някои от таблиците, които се изработват с тези програми. Подробности могат да се получат на телефоните и e-mail адресите, дадени в т. 2.