COMPARATIVE MEASUREMENTS BETWEEN THE GEOMAGNETIC OBSERVATORIES ADOLF SCHMIDT-NIEMEGK AND PANAGJURISTE

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Abstract. Comparative measurements between geomagnetic observatories Adolf Schmidt- Niemegk (Germany) and Panagjuriste (Bulgaria) are made. The measurements show that the levels of the both observatories are identical.

Key words: geomagnetic field, geomagnetic observatories

Introduction

The Panagjuriste (PAG) observatory geomagnetic level is controlled by repeatedly comparative measurements and by juxtaposing of the passing values of the geomagnetic elements in 02 UT with another geomagnetic observatories. The difference ΔF of the values of the geomagnetic field vector F, which is obtained by proton magnetometer F_{pm} and $F_{H,Z}$ calculated from the horizontal - H and the vertical - Z components is

$$\Delta F = F_{pm} - F_{H,Z} \qquad (1)$$

As we know after introduction of the absolute values of F by means the proton magnetometers in classical type observatories it is necessary to obtain only the horizontal intensity H and the declination D.

The level of the geomagnetic elements with classical methods of measurement is maintained in the geomagnetic observatory Panagjuriste [1]. The declination and the horizontal component are measured with magnetic theodolite "Mating und Wiesenberg" applying the Gaus-Lamon method. Three standards magnets providing deflection are used in the process of measurement. The periods of the oscillations are obtained automatically with electronic periodmeter with accuracy of 0,1 ms.

The inclination I_0 is measured by the earth inductor device "Mating und Wiesenberg" and vertical component Z_0 is calculated by the equation $Z_o = H_o tg(I_o)$, where H_0 is the horizontal component.

The probe of the proton magnetometer during measurements is placed near the

inductor device. The measured F values with the proton magnetometer are compared continuously with the calculated F values using H and Z data. The results show that the difference $\Delta F = F_{pm} - F_{H,Z}$ is $\leq 1nT$ for the all period after introduction of the proton magnetometers in the observatory.

The level of the geomagnetic elements in PAG observatory (Bulgaria) is controlled by bilateral comparative measurements with other observatories and mainly with geomagnetic observatory "Adolf-Schmidt" (NGK) Germany (Table1).

Table 1. Comparative measurements between geomagnetic observatories Niemegk (NGK) and Panagjuriste (PAG)

The analysis made in [2], [3], [4], [5] and the results presented in Table 1 show that the level of PAG is permanently constant. The difference between the measured elements carried out in the two observatories is in the accuracy interval of the comparative

Year of measurement	Obs. host	Operators	PAG - NGK			
			ΔD (min)	ΔH (nT)	ΔZ (nT)	ΔF (nT)
1963	NGK	K.Kostov	+0,42	0,0	0,0	-
1964	PAG	A.Graf W.Zander	-1,30	+3,2	-1,0	-
1966	NGK	K.Kostov	-0,43	+2,2	-	-
1967	PAG	A.Graf W.Zander	-0,02	+0,3	-5,6	-
1969	NGK	K.Kostov	+0,7	-0,8	-1,5	-3,0
1971	PAG	K.Lendning W.Zander	-0,80	+0,5	-2,0	-1,8
1974	NGK	K.Kostov	0,0	-0,4	+0,8	-0,3
1975	PAG	K.Lendning W.Zander	-0,48	+1,3	+0,3	+0,4
1976	NGK	K.Kostov	-0,04	-1,2	-	-0,1
1978	NGK	K.Kostov	+0,06	-1,1	0,0	-0,3
1980	NGK	K.Kostov I.Butchvarov	-0,02	+0,2	-	-0,4
1984	PAG	W.Zander E.Ritter	+0,11	+1,2	-	+0,7
1986	NGK	I.Cholakov, Ch.Georgiev	+0,18	+0,1	-	+0,3
1987	PAG	E.Ritter	-0,86	-2,2	-	-

measurements:

$$D_{PAG} - D_{NGK} = -0,15' \pm 0,20' \qquad (2)$$

$$H_{PAG} - H_{NGK} = -1,7 \text{ nT} \pm 0,5\text{nT} \qquad (3)$$

$$Z_{PAG} - Z_{NGK} = -1,2 \text{ nT} \pm 0,7\text{nT} \qquad (4)$$

Comparative measurements in 2003 year

The comparative measurements were carried out during of the Workshop on European repeat Station- Niemegk in 2003 year. The geomagnetic declination D was measured by magnetic theodolite "Shulce sus-545". The horizontal component H was obtained by three quartz H-magnetometers QHM-1, QHM-2, QHM-57 and the total intensity F - by the proton magnetometer PMP-5A. The measurement results give the declination difference (D_{PAG}-D_{NGK}) amounting to + 0° 00,23'. The horizontal component in geomagnetic observatory Niemegk measured by the quartz H-magnetometers differs from that in geomagnetic observatory "Panagjuriste" by -2.6 nT. The estimated difference of the total geomagnetic field vector - $\Delta F_{(PAG-NGK)}$ is +0.16 nT.

Results from the measurements provided in 2003 year:

1. Declination D, deg

22.II.2003	0° 38,50'
	38,31
	38,44
23.II.2003	38,44
	38,33

D_{PAG}	0° 38,40'
D_{NGK}	0° 38,17'

$\Delta D_{(PAG-NGK)} = +0° 00,23'$

2. Horizontal component H , nT

	QHM-1	QHM-2	QHM-57
22.II.2003	18733,4	18731,6	18732,0
	3,8	31,4	32,6
	33,0	31,2	31,3
23.II.2003	32.2	33,2	33,6
	32,8	31,8	32,0
	32,7	32,4	32,8

Mean	18733,0	18731,9	18 732,4

H_{PAG} = 18732,4 nT
H_{NGK}= 18735,0 nT

ΔH(PAG-NGK) = -2,6 nT

3. Total vector F, nT

	F_{PAG}	F_{NGK}	$\Delta F_{(PAG-NGK)}$
22.II 2003	48955,8	48955,8	0,0
	944,1	943,8	+0,3
	933,9	933,4	+0,1
	949,9	949,8	+0,1
23.II.2003	956,5	956,6	-0,1
	949,0	948,5	+0,5
	942,2	942,0	+0,2

$\Delta F_{(PAG-NGK)}$ = + 0,16 nT

4. Calculated vertical component Z, nT

$\Delta Z_{(PAG-NGK)}$ = + 1,0 nT $$Z = \sqrt{F^2 + H^2}$$

Conclusions

The comparative measurements carried out between both observatories during 2003 indicate that the Geomagnetic observatory located in Panagjuriste town (Bulgaria) maintains a constant level. This is confirmed by the measured elements and defined error values.

The accuracy of the measured absolute geomagnetic components values in PAG (Bulgaria) is about ± 1 nT and for the angle elements - ±0.1'.

The accuracy of using devices for comparative measurements for H is about ±2nT, and for F - ±1nT and for D - ±0.2`.

Therefore we can accept that the level obtained for geomagnetic elements in PAG is identical with that of NGK in the specified accuracy interval.

References

1. Cholakov I.,1989, Improvement of Geomagnetic measurements Method and its
    application onthe General Geomagnetic survey of Bulgaria - Epoch 1980.0, Bul. Acad. of
    Sci., 1989.
2. Cholacov I., Butchvarov I.,1995, Absolute geomagnetic level of geomagnetic observatory
    Panagurishte in the period 1934 - 1993, *Bul. Geophys*. J., **21**, ¹ 4,109 -114 .
3. Ritter E.,1987, Results of geomagnetic measurements between geomagnetic
    observatories in Europe, H.H.I - Report ¹ 21, Berlin, 1987.
4. Uhrynowski A., Zoltowski A.,1980, Adjustment of the standards of magnetic
    observatories in Central and Southeastern Europe, *Gerlands Beirt. Geophys*, Leipzig,
    89,1980.
5. Uhrynowski A., Ritter E., Standards of Magnetic Observatories in Central Europe,
    Gerlands Beirt. Geophys, Leipzig,,**99**,1990.

Сравнителни измервания между геомагнитни обсерватории Адолф-Шмид-Нимек и Панагюрище

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Резюме: През 2003 г. По време на Workshop on European repeat Stations бяха проведени сравнителни измервания между геомагнитни обсерватории Адолф-Шмид- Нимек (NGK) - Германия и Панагюрище (PAG) - България . Деклинацията на геомагнитното поле се измерваше с магнитен теодолит "Shulce sus-545". Хоризонталната компонента се измерваше с три кварцови H магнитометри QHM-1 , QHM-2 и QHM-57. Вектора на геомагнитното поле беше измерван с протонен магнитометър PMP-5A. Резултатите от тези измервания показаха, че разликата в деклинацията между двете обсерватории е D_{PAG}-D_{NGK} is + $0°$ 00,23`. Измерената с помощта на трите кварцови H магнитометри хоризонтална компонента в обсерватория Нимек се различава от тази в обсерватория Панагюрище с -2.6   nT .Установената разлика на тоталния интензитет между двете обсерватории е $\Delta F_{(PAG-NGK)} = +0.16$ nT. От резултатите получени при сравнителните измервания може да се направи извода, че нивото на обсерватория Паногюрище съвпада с това на Нимек в рамките на точността, с която са получени геомагнитните елементи.