

ORGANIZATIONAL PROBLEMS OF METROLOGICAL MEASUREMENT PROVISION OF EARTH'S MAGNETIC FIELD AND ITS VARIATIONS

V. T. Minligareev, V. N. Zabolotnov

Institute of Applied Geophysics, Russia

vns32@yandex.ru

Problem issues of the metrological assurance organization are briefly analyzed. Methods and means of reproduction and transmission of magnetic induction unit are considered. Suggestions about system calibration of observational magnetometers without interruption of their operation are given.

Current level of the usage of observation data over the Earth's magnetic field defines more stringent approach to the accuracy and reliability of measurements and it demands certain work in providing unity of measurements.

The measuring instruments of approved pattern, which have undergone the calibration according to federal law on provision of unification of measurements, are allowed in the sphere of state regulation. Measuring instruments before putting into operation and after repair have to undergo primary calibration and periodic one during exploitation.

State structure of metrological assurance for magnetic measurements is established in the country, which includes:

- The state primary standard of magnetic induction units, magnetic flux, magnetic moment and magnetic induction gradient, which takes place in FGUP "D. I. Mendelyev VNIIM" (St. Petersburg)
- The working standards of magnetic fields of required range, which is placed in VNIIFTRI Metrology center , FGUP UNIIM and other institutions.
- The normative documents, which define methodology and calibration instruments.

In correspondence with state calibration scheme GOST 8.030-92 [2] (the release of the standard is on approval) for the magnetometer calibration standard of 2nd and 3rd class are used. These standards are always immovable.

Such standards are expensive concerning engineering and exploitation. They apply for the primary calibration of magnetometers after their producing, repairing or for some tests. Most of the organizations use the existed metrological base of the Russian Federation but they can create their own base, which is suitable for their own tasks if it is justified from the view of economics.

Assurance of uniformity of measurements is characterized by the following peculiarities:

- Major distance of the stations – it can be several thousand kilometres;
- Hard-to-reach districts;
- Limited up-time;
- Considerable expenses.

The usage of stationary standard measure of magnetic induction for carrying out periodic calibration of proton and quantum magnetometers , magnetic inclinometers and declinometers is impossible due to the fact that they are immovable. This variant is not suitable for magneto-variation stations as it is connected with demounting of measuring

converter, their replacement; it causes pauses in magnetic measurements and is complicated and cost much.

The usage of movable standard measurements requires the creating of a movable standard magnetometer and measure of magnetic induction. The workings of FGUP “D.I.Mendelyev VNIIM”, FGU NPP “Geologorazvedka”, and “Kriomag” ltd can be used as examples.

The alternative variant is built-in verifying instruments in a magnetometer, which allow to calibrate magnetometers without demounting and replacement. The built-in standard contains a coil of magnetic induction together with measuring converter and controlled current source. The constant of magnetic induction is defined with the primary calibration. The built-in standard allows to apply it during the exploitation and to carry out remote control, what is significant in terms of far survey points and their great number.

The similar way is used in crystal variometers, in which built-in magnetic field sources (Helmholtz coils) are used in calibration. The standard measures of magnetic induction build in the modern flux-gate magnetic stations i.e. devices for control of magnetic variations of the Earth, designed at FGUP “D.I.Mendelyev VNIIM”, NII “Eletcromera” both in St-Petersburg. The stability of metrological characteristics was proven.

The programme of actions concerning assurance of uniformity of measurements on magnetic field on the Earth for observing network of Roshydromet should include the following:

- Pattern approval for measuring instruments of magnetic observations;
- Organization of calibration magnetic unit measuring instruments;
- Standardization of methods of absolute and variation changes;
- Creation of movable standard of magnetic induction for calibration of magneto-variation station;
- Creation of magneto –variation complex for carrying out of magnetic field observations with the help of built-in standard measures.

References:

1. Federal law №102-FZ from 26 of July 2008)
2. GOST 8.030-91