Absolute vector measurements based on the scalar Overhauser sensors POS

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Due to the high absolute precision (up to 0.2 nT) and stability (<0.05 nT per year), the scalar Overhauser magnetometer POS-1 found wide application in the magnetic observatories and hazard monitoring systems. We present new modifications on our magnetometers for measuring the vertical component (POS-3) or the full vector (POS-4) based on the switching bias fields methods [1]. We discuss the long-term experience in their testing at the magnetic observatories ARS (Arti, IGF UB RAS) and PET (Paratunka, IKIR FEB RAS). The absolute accuracy of the measurement of the vertical component of 10-30 nT is achieved. This can be improved to 1-3 nT by use of a self-calibration. This was tested by comparing with a Diflux based on the nonmagnetic theodolite Theo-010. The vertical system titanium frame based on Garrett's Ø110x260 mm solenoid provides long-term stability up to 2 nT/year. The solenoid vertical axis was controlled by spirit levels of 30 angular seconds and with the help of a new high-precision non-magnetic 2D inclinometer providing accuracy of up to 1 arcsec, resolution 0.1 arcsec, temperature range of -40 + 60 C.

The creation of a new small-sized solenoid and Overhauser sensor with dimensions 50x100 mm mounted directly on the theodolite telescope similar to DIMOVER [2] is presented in the report. The primary results of the test, showing a sensitivity to the field modulus of 0.02 nT and better than 0.3 nT component along the axis of the solenoid are presented. The technique of self-calibration is developed based on determining the angles of misalignment of the telescope axis and the solenoid when the absolute measurements of the components of the field are measured for different angular orientations. It is assumed that the developed magnetometer and non-magnetic theodolite will be promising for use at stations. We have developed a method of self-locking based on determining angles of misalignment of the telescope axis and the solenoid, when the absolute values of the field components are measured for different angular orientations. We believe that the developed magnetometer and non-magnetic theodolite will become candidates for use at geomagnetic observatories and repeat stations.

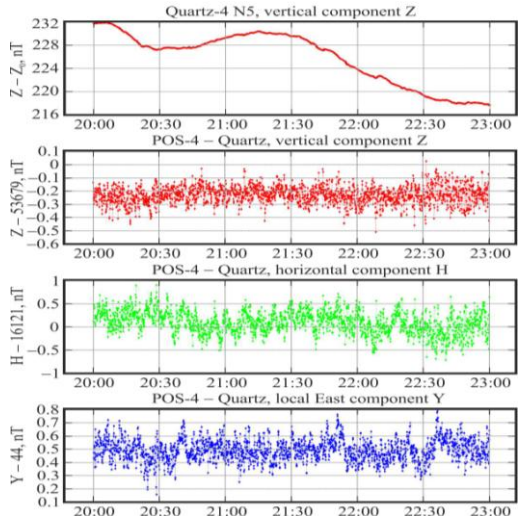

Figure 2: An example of Z variation made is Quartz-4 and POS-4 relative to Quartz

Figure 1: Vector magnetometer POS-4, POS-DIMOVER & non-magnetic theodolite

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