

# MAGNETIC MEASUREMENTS AND DATA PROCESSING

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## Recording of geomagnetic variations

Geomagnetic variations are recorded by the ARGOS system. ARGOS (developed by the Geomagnetism Group of British Geological Survey) is a PC based automatic observatory equipped with triaxial fluxgate and a proton magnetometer in a DD/DI configuration. The fluxgate variometer sensors are aligned in X, Y, Z directions. 10 second samples are used to provide minute values centred on the minute by means of a 7-point cosine filter. Reported elements are: H (horizontal), Z (vertical), D (declination) and F (total force). From the year 1993 on the minute values are transmitted through the METEOSAT satellite to the Edinburgh Geomagnetic Information Node.

**Table I.** Main specifications of ARGOS used in Nagycenk Observatory

Device	Resolution	Dynamic range	Temperature coeff.
Triaxial Fluxgate			
Magnetometer	0.1 nT	$\pm 500$ nT/ $\pm 400$ nT	$\sim 1$ nT/ $^{\circ}$ C
Proton Magnetometer (ELSEC 820)	0.1 nT	10000–90000 nT	–

DI/DD coil system consists of two orthogonal sets of Helmholtz coils (proton head is mounted at the centre). Coils orientated so that one provides bias fields approximately perpendicular to F vector in the magnetic meridian and the other provides bias fields approximately perpendicular to F in the horizontal plane. DD and DI relative to the initial values ( $D_0$ ,  $I_0$ ) are calculated. DD/DI proton magnetometer is used in every tenth minutes from which F and almost absolute values of D and I are obtained.

Satellite transmitter, 6800 Series of Data Collection Platform, was supplied by Space Technology Systems. Power output to antenna (two linearly-polarised Yagi arranged to give circular polarisation) is 4 watts at 402 MHz. Data storage capacity is  $2 \times 40$  kbytes.

Timing is produced by the IBM clock corrected by the high stability crystal built in the Proton Magnetometer.

To ensure continuous recording a high stability torsion photoelectric magnetometer (type PSM-8711) has been run from 1 January 1998. Data along with telluric data are logged by a DR-02 type digital recording system. The PSM magnetometer records the H, D and Z component with an exceptionally high parameter stability. The baseline variation has never exceeded 1.5 nT/year. Maximum resolution is 3 pT, sampling rate applied is 10 s. Frequency response: 0.3 Hz to DC. Sensitivity to tilting: less than 10 nT'/.

Data are stored in the internal memory of the digital data logger DR-02. Both the PSM and the DR-02 was developed and provided by the Institute of Geophysics Polish Academy of Sciences.

### Absolute control, baselines

Baselines of the variometer systems are derived from absolute observations. Prior to 1989 the baseline was controlled by two QHM, one declinometer and one BMZ. From 1989 till the end of 1994 the standard instrument for absolute measurements was the vector proton magnetometer (NVP) constructed in Niemegk Observatory. In 1994 an Overhauser proton magnetometer (type: GSM 19 of GEM Systems) and a fluxgate theodolite (developed by the Danish Meteorological Institute) was purchased. Since then the standard instruments are the fluxgate theodolite for I and D and the Overhauser effect proton magnetometer for F.

To determine the momentary angle of declination four observations (four null positions in the horizontal plane) are taken and it is repeated at least two times. Generally the closer azimuth mark is used but it is checked regularly with the far azimuth mark. Inclination angle is determined in the plain of the momentary magnetic meridian in the same way as D. Total intensity is measured simultaneously with I-measurements on the next (F) pillar with the Overhauser magnetometer. Absolute values of all geomagnetic elements are referred to the same pillar of the absolute hut. Observation is made weekly, occasionally more often.

Absolute measurements are supplemented by quasi absolute baseline reference measurements. Declination, inclination and total intensity are determined by means of a proton vector magnetometer in every ten minutes.

### **Data processing and availability**

Sampling rate of magnetic variation data is 10s both for ARGOS and PSM. Minute mean values are produced with digital filter from the raw sampled data. According to the IAGA recommendation minute mean values are stored. Hourly means are calculated from minute means, yearly means are derived from hourly means. Final absolute values of H, D and Z field component are obtained from smoothed baselines.

ARGOS data are compared continuously to PSM data and gaps are filled.

Data are logged on floppy disk too. In addition to logging data to disk INTER-MAGNET V2.8 format satellite transmission packets are sent to DCP.

### **Presentation of the results**

- plot of hourly mean values of H, D, Z
- plot of daily mean values of H, D, Z
- tables of geomagnetic activity indices, K
- table of annual mean values of geomagnetic elements
- special phenomena: SSC, sfe

See CD (program Seenck.exe, menu item Magnetics).