GEOMAGNETIC OBSERVATION AND MONITORING OF GEOMAGNETIC INDUCTION AT NAGYCENK GEOPHYSICAL OBSERVATORY (NCK) – IAGA DIVISION 5. OBSERVATORY, INSTRUMENTS, SURVEYS AND ANALYSES

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1 Introduction

Besides regular geomagnetic observations and continuous data services for IGRF and main field modelling, the main objectives of the ground based electric and magnetic observations are monitoring the solar-terrestrial environment and development of models to specify and predict the state of the Sun-Earth system (space weather and climate). Measurements include the monitoring of geomagnetic field variation, ionospheric parameters, solar emissions and determination of solar wind and radiation environment parameters. Model developments are required for the propagation of coronal mass ejection and energetic particle radiation, interaction between the interplanetary medium and the Earth's magnetosphere, the filling and depleting of the radiation belts, ionospheric composition, density, diffusion and convection, induced electric fields.

2 Geomagnetic observations

Continuous observation of geomagnetic elements with control of the absolute observations started in 1961.

The observatory equipped with 3 sets of triaxial fluxgate magnetometers. The temperature variations of the triaxial fluxgates are maintained within 0.5°C between the weekly absolute observations. The fluxgate variometer sensors are aligned in *X, Y, Z* directions. For better time resolution one of them is run with 1 second sampling rate. Simultaneous low altitude satellite and meridional magnetometer array ($1.56<L<1.88$) measurements were used to interpret the controversial relation between space and ground ULF signal, evaluate the effect of the ionosphere on the transmission and study the field line resonance phenomenon and study the expected ULF precursors of seismic activity.

In the frame of the INTERMAGNET data service 10 second samples are used to provide minute values centred on the minute, by means of a 7-point cosine filter. Geomagnetic indices and transient events are also scaled from these data.

Protonmagnetometer (Overhauser- effect magnetometer) in $\Delta I/\Delta D$ configuration consists of two orthogonal sets of 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. ΔD and ΔI relative to the initial values (D_0, I_0) are calculated. $\Delta D/\Delta I$ proton magnetometer (DIDD) samples at 1Hz from which *F* (total force) and quasi absolute values of *D* and *I* are obtained. To ensure continuous recording a high stability torsion photoelectric magnetometer (type PSM-8711) is run as backup system. 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 exceptionally high parameter stability. The baseline variation never exceeds 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/'.

Baselines of the variometer systems are derived from absolute observations of F, D I. The standard instrument for absolute measurements are the proton magnetometer (type: GSM 19 of GEM

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Systems) and the new fluxgate theodolite. To determine the momentary angle of declination four observations (four null positions in the horizontal plane) are taken and it is repeated at least twice. 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 an Overhauser magnetometer. Absolute values of all geomagnetic elements are referred to the same pillar of the absolute hut. Observations are made weekly, occasionally more often. Baseline determination was improved by new Overhauser effect protonmagnetometer, a Theo 020A based DI fluxgate theodolite.

3 GIC recording

Continuous measurement of the geomagnetically induced currents (telluric currents) started in 1957. The value of the telluric data of the observatory lies in the exceptional length of data series. The long-term stability of the observations had been ensured by the reconstruction of the electrode system. This nearly sixty year long telluric recording forms an unique data set for statistical analysis of the long-term variation of the geomagnetic activity and its induction effect. Occurrence of high geomagnetically induced electric fields and their coincidence with the phases of solar activity is less clear than that of maximum magnetic activity. As the weights of variations with different periods are rather different in geomagnetic and earth-current indices, there are also differences between the two kinds of activities.

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