

NEW HARDWARE AND SOFTWARE COMPLEX FOR MONITORING AND ANALYSIS OF THE EARTH'S MAGNETIC ENVIRONMENT

A. Gvishiani^{1,2}, *S. Agayan*¹, *Sh. Bogoutdinov*¹, *M. Dobrovolsky*¹, *A. Grudnev*^{1,2},
*R. Krasnoperov*¹, *D. Kudin*^{1,3}, *R. Lukianova*¹, *V. Petrov*⁴, *A. Rybkina*¹, *R. Sidorov*¹,
A. Soloviev^{1,2}, *E. Vavilin*¹.

¹ Geophysical Center of Russian Academy of Sciences (GC RAS, Russia)

² Schmidt Institute of Physics of the Earth of Russian Academy of Sciences (IPE RAS, Russia)

³ Gorno-Altai State University (GASU, Russia)

⁴ Pushkov Institute of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation of Russian Academy of Sciences (IZMIRAN, Russia)

a.gvishiani@gcras.ru

Continuous and stable operation of modern complex technological systems is noticeably affected by electromagnetic processes originated from the interaction between the solar wind and the Earth's magnetosphere which form the phenomena of "space weather". Russian geomagnetic observatories and the low orbiting satellites of the SWARM mission carrying the high-precision magnetometers provide complex monitoring of geomagnetic environment and detection of anomalous events of various nature. Analysis of observatory and satellite data allows modeling the structure of the internal and external parts of the Earth's magnetic field. This report presents a new modern hardware and software complex developed for the efficient retrieval, storage, processing, and analysis of geomagnetic data with automatization of the majority of data management processes. The developed complex includes software modules for automated filtering of observatory data from technological noise and data verification with compliance with the INTERMAGNET standards, which enables production of quasi-definitive data. The complex also provides a sophisticated classification of the extreme geomagnetic phenomena and detecting extreme geomagnetic conditions, which may be hazardous for technological infrastructure and economic activity within the regions of Russia. The developed complex provides the online access to geomagnetic data (both, the initial and processed ones), information on extreme events and modeling results along with visualization on a video board and spherical screen.

This work was supported by the Federal target program of the Ministry of Education and Science of Russia, contract No. 14.607.21.0058, unique project identifier RFMEFI60714X0058, and is a part of the research aimed at creation of an experimental sample of hardware and software complex for monitoring and detection of extreme geomagnetic events using ground and satellite data.

References:

1. Soloviev A., Bogoutdinov S., Gvishiani A., Kulchinskiy R., Zlotnicki J. Mathematical Tools for Geomagnetic Data Monitoring and the INTERMAGNET Russian Segment // Data Science Journal. 2013. Vol. 12. PP. WDS114-WDS119. DOI: 10.2481/dsj.WDS-019
2. Gvishiani A., Lukianova R., Soloviev A., Khokhlov A. Survey of Geomagnetic Observations Made in the Northern Sector of Russia and New Methods for Analysing Them // Surveys in Geophysics. 2014. Vol. 35. No. 5. PP. 1123-1154. DOI: 10.1007/s10712-014-9297-8
3. Soloviev A., Dobrovolsky M., Kudin D., Sidorov R. Minute values of X, Y, Z components and total intensity F of the Earth's magnetic field from Geomagnetic Observatory Klimovskaya (IAGA code: KLI) / Geophysical Center of the Russian Academy of Sciences. 2015. DOI: 10.2205/kli2011min
4. Krasnoperov R. I., Sidorov R. V., Soloviev A. A. Modern Geodetic Methods for High-Accuracy Survey Coordination on the Example of Magnetic Exploration // Geomagnetism and Aeronomy. 2015. Vol. 55, No. 4. PP. 547-554. DOI: 10.1134/S0016793215040076
5. Gvishiani A., Lukianova R. Geoinformatics and Observations of the Earth's Magnetic Field: The Russian Segment. // Izvestiya, Physics of the Solid Earth. 2015. Vol. 51. No.2. PP. 157-175. DOI: 10.1134/S1069351315020044