2019 Space Weather Activities in Ukraine

1. Ongoing long-term projects

1.1 Ionosat-Micro mission

Short description: long-term monitoring of thermosphere-ionosphere coupling; study of seismo-ionospheric connections

Current status: Assembly and testing should be finalized in 2020. Waiting for a launch opportunity.

1.2 Creation of an operational space weather centre

Short description: a centre to provide operational space weather services for customers in Ukraine, assist in transiting products to operation, popularize space weather and increase public awareness

Current status: first operational service (local geomagnetic forecast) deployed for testing in late 2019; daily reports delivered since 2018.

2. Instrumentation: space segment

PolyITAN-2-SAU continues its operation within QB50 project.

It is planned to begin the development of a geophysical class sounding rocket in 2020.

3. Instrumentation: ground segment

3.1 Upgrade and integration of existing assets

Vernadsky Antarctic Station (AIA): replaced analogue magnetometer and ionosonde with modern digital instruments – LEMI-025 and VSRPC.

Replaced analogue flux-gate magnetometer with LEMI-025 at Odesa magnetic observatory (ODE).

Replaced analogue Basis ionosonde with digital VSRPC ionosonde at Institute of Ionosphere in Kharkiv.

Added ADC to K-120-R VLF receivers in Kamianets-Podilskiy and Gorodok.

Upgraded many GNSS reference stations to operate in real time.

3.2 Installation and development of new assets

Installed LEMI-423 magnetotelluric stations in Malyn and Kamianets-Podilskiy.

It is planned to install a third K-120-R VLF receiver in 2020.

4. Development of operational capacities

It is planned to finalize the construction of a new operational room at Main Center of Special Monitoring in 2020, which will host, *inter alia*, a duty space weather forecaster.

A local geomagnetic forecast service entered test operations. It now provides near real time predictions of X, Y, and Z geomagnetic elements at Boulder magnetic observatory (BOU) with 3 hours lead time.

A regional ionospheric model for Central Europe was improved to include diurnal variations of NmF2 with hourly resolution. It is planned to further expand it with the inclusion of spatial distributions of ionospheric parameters, after which it will be adopted as the new national standard ionospheric model in Ukraine.

5. Notable scientific findings

Weak storms modulate ionosphere-plasmasphere interaction. See details in: *Kotov, D. V.* et al (2019). Weak magnetic storms can modulate ionosphere – plasmasphere interaction significantly: Mechanisms and manifestations at mid-latitudes. *Journal of Geophysical Research: Space Physics*, 124, 9665– 9675. https://doi.org/10.1029/2019JA027076