

2019 Space Weather Activities in Ukraine

Presented by **Aleksei Parnowski,**
Space Research Institute / Main Center of Special Monitoring

www.nkau.gov.ua
yd@nkau.gov.ua

8 Moskovska St.
Kyiv 01010 Ukraine
+380 44 281 62 00



www.spacecenter.gov.ua
ncuvkz@spacecenter.gov.ua

8 Moskovska St.
Kyiv 01010, Ukraine
+380 44 253 43 49



Current goals

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- Create an operational space weather centre
- Expand and integrate the space weather instrument network
- Develop plans to use available and future ground instruments to support international and national space missions



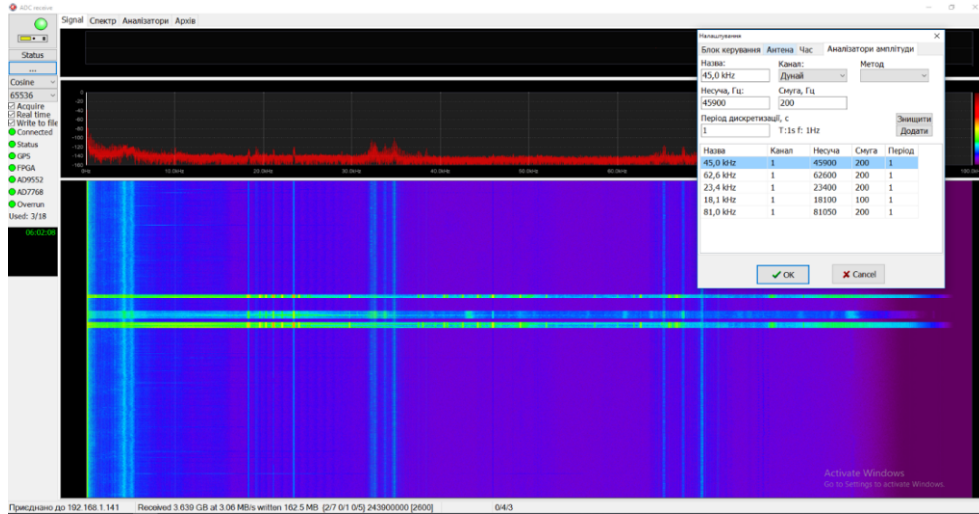
- Installed LEMI-025 1-second-resolution magnetometers at Odesa magnetic observatory and at Vernadsky Antarctic Station
- Installed VSRPC digital ionosondes in Kharkiv and at Vernadsky Antarctic Station
- Installed LEMI-423 magnetotelluric stations in Malyn and Kamianets-Podilskyi
- Expanded GNSS reference stations network
- Upgraded K-120-R VLF receivers in Kamianets-Podilskyi and Gorodok

- Frequency band 0-100 kHz
- Dynamic range 120 dB
- Noise amplitude 1-3 mV
- Distance to the source >10000 km

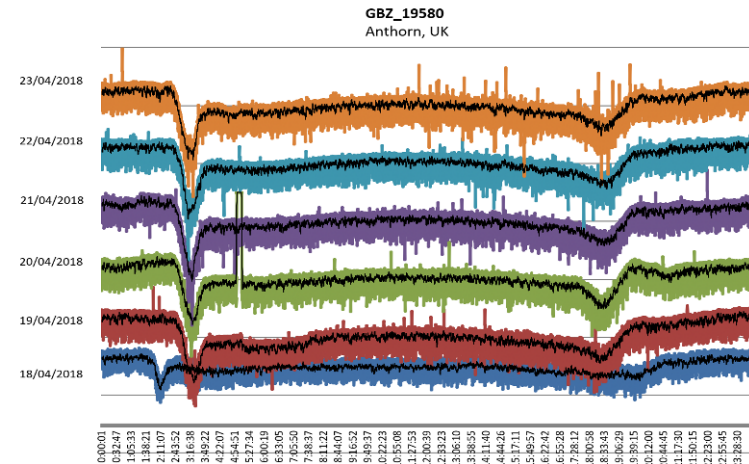
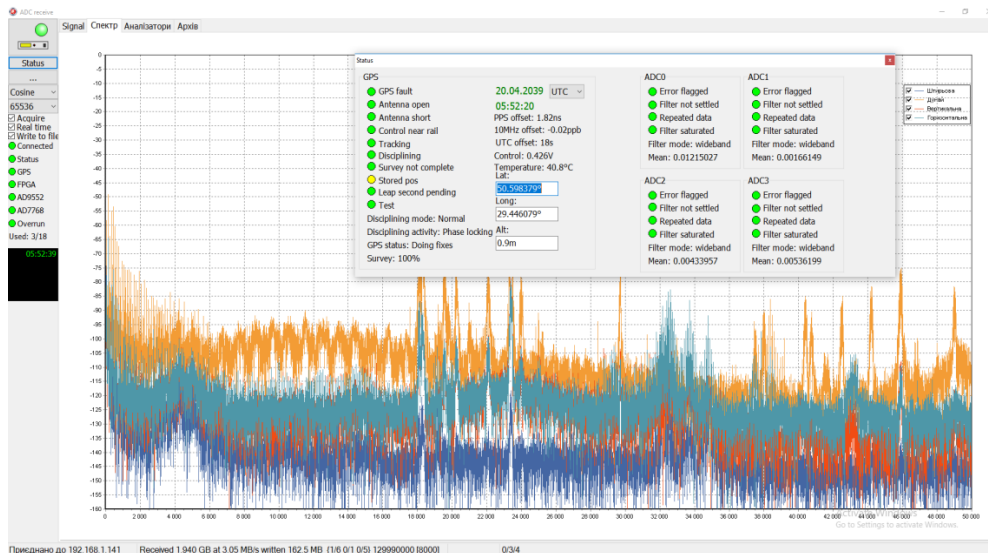




VLF method: software



Detection of ionospheric anomalies in the amplitude of the carrier frequency of the VLF station

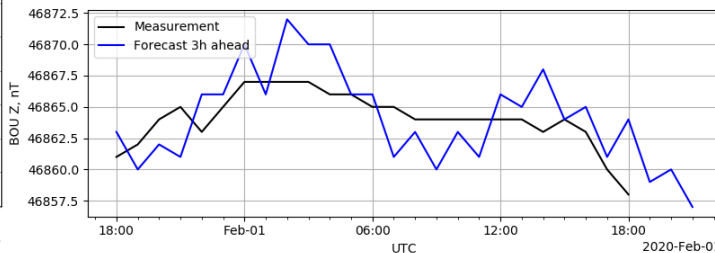
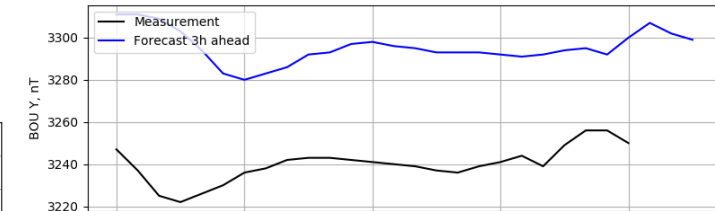
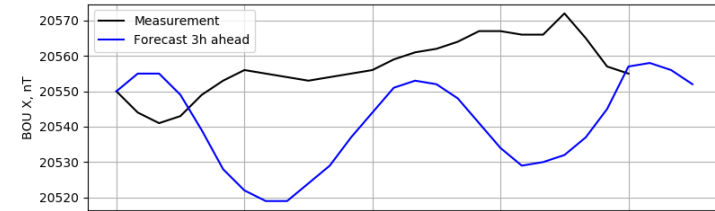




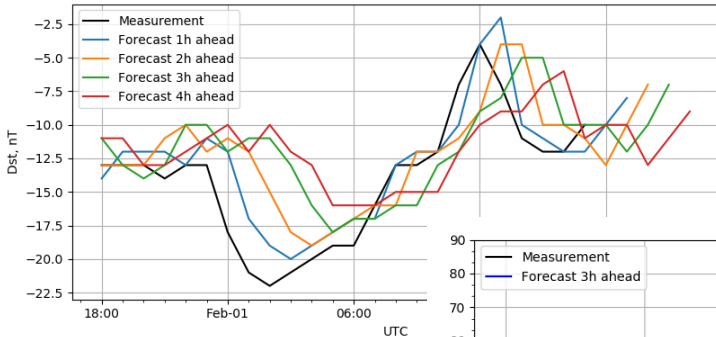
- Updated product, pre-operational phase
- Directly predicts magnetic components at a given observatory
- Lead time: 3 hours + propagation time from L1
- Currently deployed at Main Center of Special Monitoring for Boulder (USA) magnetic observatory
- Co-developed by Space Research Institute and Main Center of Special Monitoring

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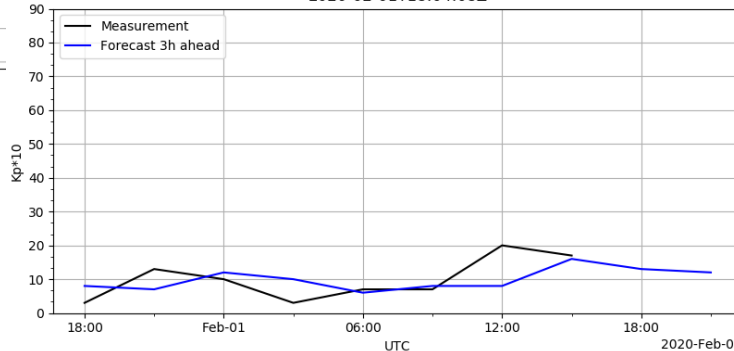


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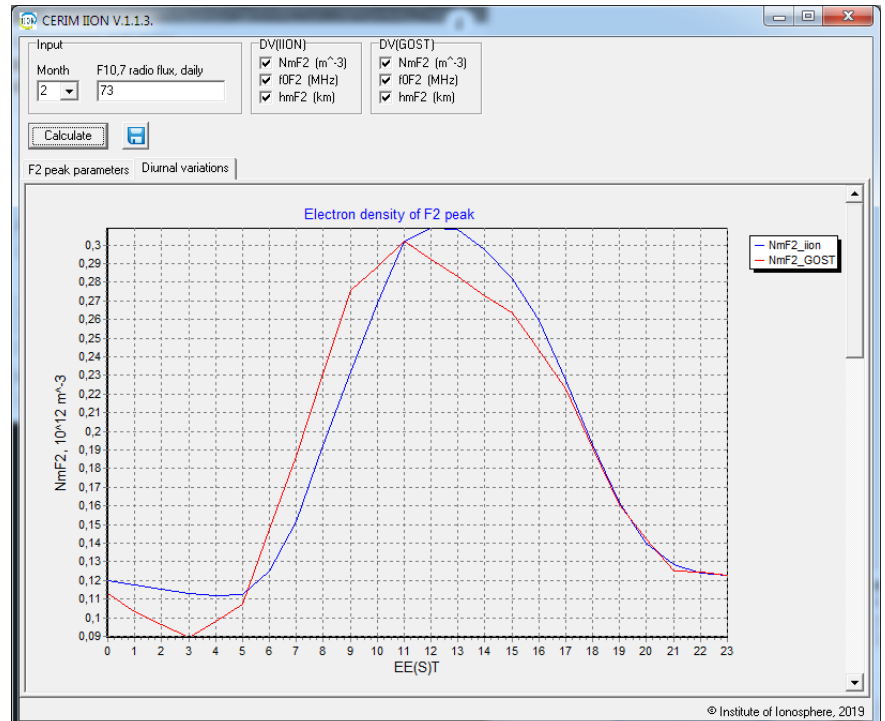
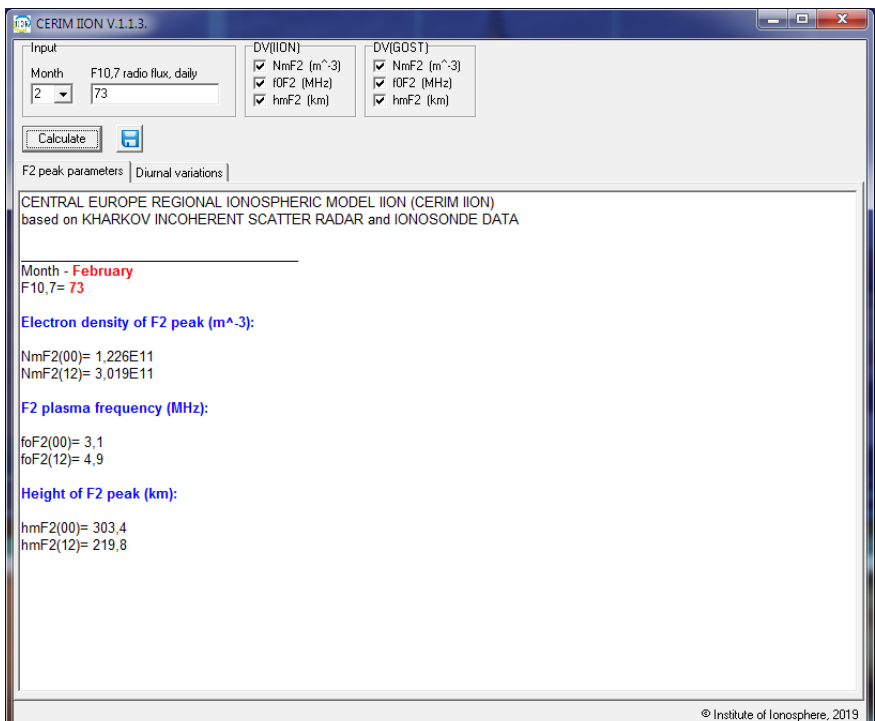
Kp (Potsdam)

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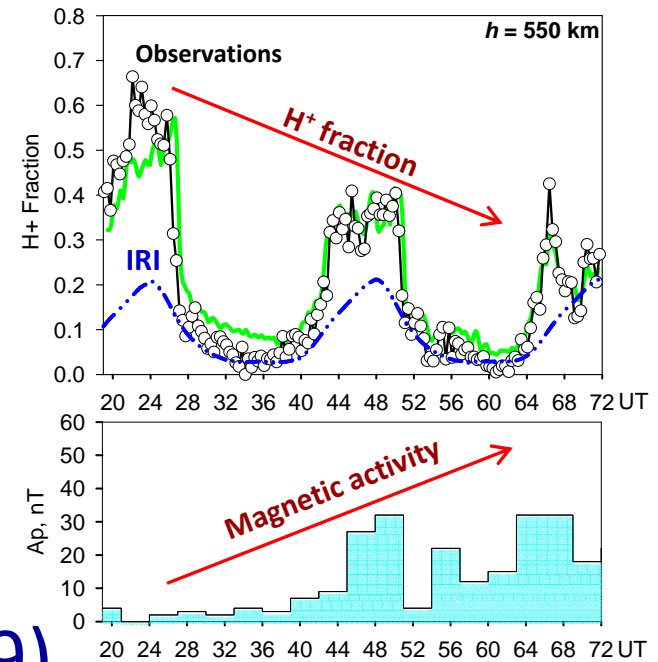
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- Updated product
- Provides:
 - peak values of critical frequency (foF2), maximum electron density (NmF2), and height of the maximum electron density layer (hmF2);
 - diurnal variations of maximum electron density (NmF2)
- Developed by the Institute of Ionosphere



- **Finding: Weak storms modulate ionosphere-plasmasphere interaction**
(Institute of Ionosphere)
- Enhancement of auroral activity increases O^+ density in the topside ionosphere, which cuts off H^+ flux directed to the ionosphere.
- See details in (Kotov et al. 2019)

Explains long standing issue with IRI topside ion composition



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>



- Finalize the assembly of Microsat spacecraft
- Finalize the construction of a new operations room at MCSM, which will host duty space weather forecasters
- Assemble and install the third K-120-R VLF receiver from spare parts
- Further expand GNSS network
- Design a geophysical class rocket for ionospheric studies

Thank you!

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+380 44 253 43 49