

Space Weather activities in Kazakhstan

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Kazakhstan multi-level complex for key space weather parameters measurements



The IGY-57 neutron monitor was transported from the Laboratory of Cosmic Ray Variation at al-Farabi KazNU at the altitude of 897 m above sea level (a.s.l.) to the Tien Shan mountains at the altitude of 3340 m a.s.l., located 28 km from Almaty.



Neutron Monitor 18 NM-64 at high mountain cosmic ray station (**3340 m a.s.l.**) (www.nmdb.eu)

Geomagnetic observatory "Alma-Ata" (**1300 m a.s.l.**)

Measurements of the solar radio spectra of the Sun in the range of 40 - 800 MHz from the CALLISTO spectrometer and the solar radio emission flux density at frequencies of 1.08 GHz and 2.8 GHz (**2700 m a.s.l.**)

All measurements are included in a common information system that displays real-time measurements with high resolution

Development of a prototype system for generating an alert signal about the beginning of a large proton enhancement in solar cosmic rays on Earth to warn about radiation hazards in spacecraft orbits

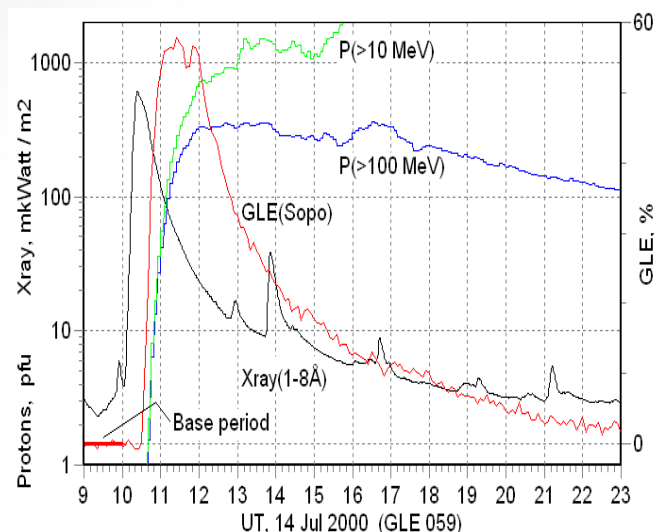


Illustration of time delays relative to flare onset for X-ray (1-8Å), ground-based and proton (>100 MeV and >10 MeV) enhancements using the July 14, 2000 event as an example.

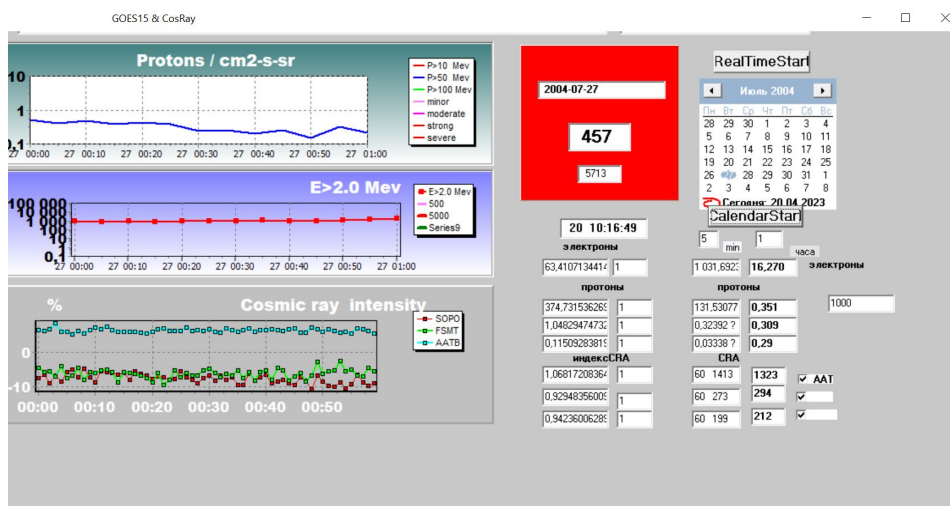
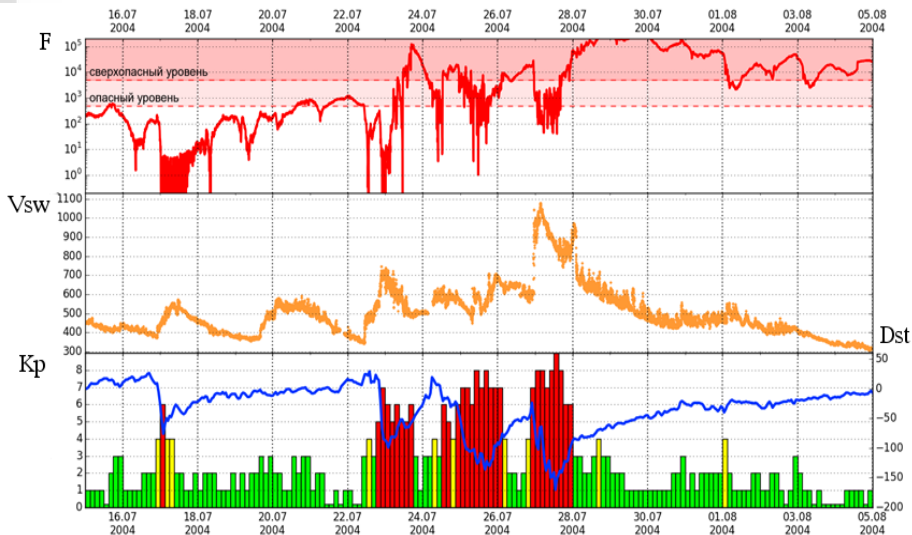
A prototype system for generating an alert signal about the beginning of a large proton enhancement in solar cosmic rays on the Earth was developed to warn about radiation hazards in spacecraft orbits. The page contains information about the current level of the alert signal: *GLE Warning* - an enhancement was detected simultaneously at 2 neutron monitor stations, *GLE Alert* - an enhancement was detected simultaneously at 3 or more neutron monitor stations. The *GLE Alert* level means that a large proton enhancement is expected in the coming minutes. In addition, the page contains graphs of the neutron flux enhancement coefficient for all available stations, a graph of the delay time of the arrival of neutron monitor data for the last day.



Web page of a prototype system for generating an alert signal about the beginning of a large proton enhancement.

Development of the disturbance index for the state of near-Earth space

The disturbance of the radiation situation in near-Earth space (NES) occurs due to an enhancement in the fluxes of charged particles of solar, magnetospheric and galactic origin. Therefore, to calculate the level of disturbance in the radiation situation, one should analyze, first of all, the fluxes of electrons and protons in NES and quantities reflecting secondary processes - indices of disturbance of cosmic ray fluxes at polar cosmic ray stations SOPO (South Pole, USA), FSMT (Ft. Smith, USA) and the mid-latitude station "Alma-Ata" (AATB). The intensity of charged particle fluxes is recorded on the GOES satellite. We use the data of $e > 2 \text{ MeV}$, $p > 10 \text{ MeV}$, $p > 10 \text{ MeV}$ and $p > 100 \text{ MeV}$ for the current hour.

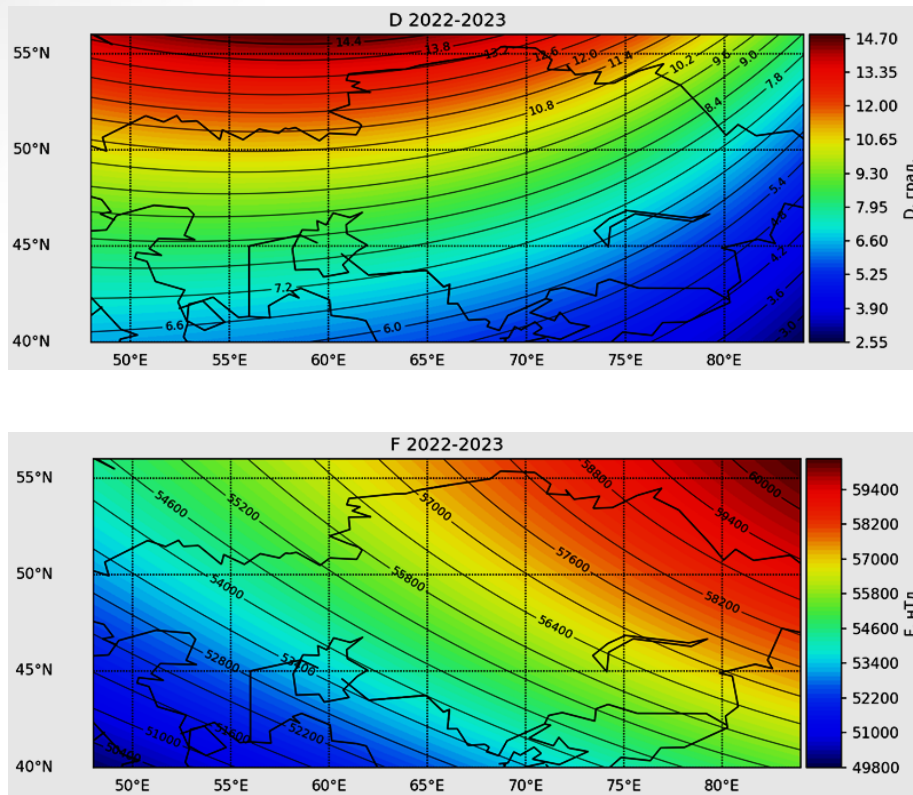


Information window of the NES disturbance calculation program

Behavior of the electron flux with energy $> 2 \text{ MeV}$, solar wind velocity and geomagnetic indices in the event of July 15 – August 4, 2004

During this extreme event, NES disturbance indices ranged from 2 (July 20) to a high of 3474 (July 30) and then dropped to 16 during the NES quiet on August 15, 2004

Assessment of the state of the geomagnetic field for the territory of Kazakhstan based on measurements from the Almaty Geomagnetic Observatory and international resources for the period 2022-2023



3D maps of the spatial distribution of geomagnetic field components for the Republic of Kazakhstan for the time interval 2022-2023

The characteristics of the geomagnetic field for the territory of Kazakhstan for the period 2022-2023 were calculated on the base of measurements of the Alma-Ata geomagnetic observatory and calculated using the international geomagnetic field models IGRF and WMM. For the Kazakhstan region, the geomagnetic field parameters (D, F, H, X, Y, Z) were calculated. Based on the calculated data, 3D maps of the D, F, H, X, Y, Z components of the geomagnetic field were constructed for the time interval 2022-2023. 3D maps constructed using international resources make possible to demonstrate the spatial heterogeneity of the geomagnetic field on the territory of the Republic of Kazakhstan.

Thank you for your attention !



Tamgaly-Tas Petroglyphs «Man-Sun» in Kazakhstan