ANNUAL REPORT OF ISWI RELATED ACTIVITIES FOR 2017 IN KAZAKHSTAN

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During 2017 monitoring of key parameters for space weather continued using Kazakhstan's multi-level system measurements that produce database updates and diagnostics of the state of the near-Earth space environment. Results of space environment monitoring are accessible via the internet on the web-site of the Institute of Ionosphere (http://www.ionos.kz/?q=en/node/21) in real time. Kazakhstan's multi-level system of measurements includes: an experimental setup for obsrevations of cosmic ray intensity using a neutron monitor located at the high altitude cosmic ray station AATB; a magnetic observatory “Alma-Ata”; an optical interferometer for observing night sky emissions referred to as the Spectral Airgrow Temperature Image (SATI) instrument; an ionospheric sounder; a solar radio telescope for measurements of the solar radio flux at frequencies of 1.078 GHz (27.8 cm) and 2.8 GHz (10.7 cm) with 1-second time resolution; and a Callisto radio spectrometer (type eC37) [O.Kryakunova et al. Space Weather Studies Using Ground-based Experimental Complex in Kazakhstan. Sun and Geosphere. 2015. N10/2. P.177-181.].

Kazakhstan Space Weather Prediction Center operates daily (http://ionos.kz/?q=en/node/21) and issues short-term and long-term forecasts of the magnetic activities (Ap-indexes) and solar activity (F10.7) for 55 days, probabilistic forecasts of a large proton enhancement for 28 days, and forecasts of the fluence of magnetospheric electrons with energy> 2 MeV at geostationary orbit for 28 days. This information is provided to all interested organizations in Kazakhstan.

Features of the behavior of high-energy magnetospheric electrons in 1987-2015 were studied. The daily fluence of electrons was selected as the main characteristic of the behavior of electrons with energy > 2 MeV measured by GOES satellites at geostationary orbit, since it is closely related to malfunctions of satellite electronics. It is shown that the increases of high-energy magnetospheric electrons begins during major interplanetary and magnetospheric disturbances, but the beginning of the electron increase lags behind the disturbance by 1-3 days. Significantly increased solar wind speed is observed for 3 days before the beginning of the electron increase, reaching a maximum by the beginning of the observed increase in electron fluence. It is shown that the electron fluence is weakly linked to the level of geomagnetic activity on the same day, but was correlated with the Ap-index of geomagnetic activity observed 2-3 days prior. Fluence of high-energy magnetospheric electrons is closely connected with the solar wind speed, especially as observed 2 days earlier [A.V. Belov, O.N. Kryakunova, et al. Characteristic Behavior of High-Energy Magnetospheric Electrons from 1987 to 2007. Bulletin of the Russian Academy of Sciences: Physics, 2017, Vol. 81, No. 2, pp. 211–214. © Allerton Press, Inc., 2017. DOI: 10.3103/S1062873817020083 (http://link.springer.com/article/10.3103/S1062873817020083)].

In the field of research of the ionosphere, the behavior of the parameters of the F2 layer was compared with periods of nighttime enhancements of the electron concentration. Quantitative relationships between parameters of variations in the amplitude of the enhancements in NmF2 at the maximum of the layer and the altitude characterized by the maximum rate of enhancements in the concentration were derived. In addition, relationships between the amplitudes of the variations in the height of the maxima and the base of the layer, and the amplitude of variation of the half-thickness of the layer and NmF2 were also determined. High-resolution (profile) magnitudes of the enhancements in NmF2 were obtained, which showed that

the height of the maximum of the enhancements lies below the maximum of the layer (hmF), and the distance between the maxima increases with increasing hmF. On the basis of a comparison of the behavior over time of the parameters of nighttime enhancements, it is concluded that its characteristic features repeat the features described in Lynn et al. (2016)[1]. The observed compression and expansion of the F2 ionosphere as a major component of ionospheric variability for several types of ionospheric plasma disturbances was considered by the authors. These behavioral features include expansion and simultaneous rise of the layer, followed by its descent and at the same time compression, resulting in the formation of the maximum value of NmF2 at the moment of maximum compression. Thus, we extended the nomenclature of the perturbations of the F2 layer, the parameters of which, in spite of the different mechanisms of their generation, behave in the same way.

The 4th international school for young scientists from the CIS countries was held 24-30 September 2017 at Almaty, Kazakhstan with the theme “Problems of physics and astrophysics of cosmic rays". An invited talk, "Cosmic rays as a tool for diagnosing and forecasting of outer space", was presented by Olga Kryakunova at this meeting.

[1]Lynn, K. J. W., R. S. Gardiner-Garden, and A. Heitmann (2016), The observed compression and expansion of the F2 ionosphere as a major component of ionospheric variability, Radio Sci., 51, 538–552, doi:10.1002/2016RS006036.