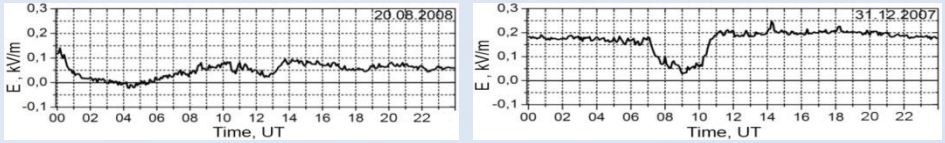
Impact of various sources of disturbances on the atmospheric electric field and the lower ionosphere

Valentina Antonova, Vadim Lutsenko, Galina Gordiyenko, Sergey Kryukov

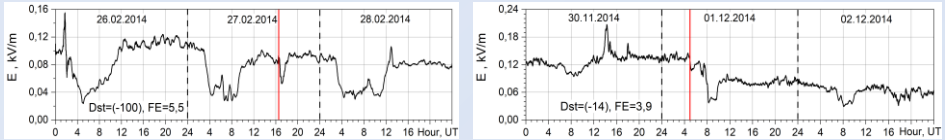
Institute of Ionosphere, Almaty, Kazakhstan E-mail: valanta@rambler.ru

Results of the study of the impact of various sources of disturbances on the atmospheric electric field and the lower ionosphere at the high-mountain Tien Shan station (3340 m above sea level) are presented.

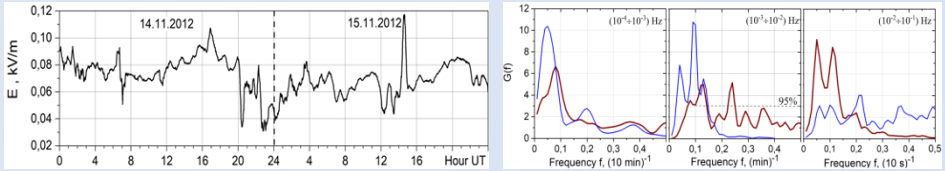
Possible impact of solar activity on the atmospheric electric field, thunderstorm activity and lower ionosphere was investigated. The investigation was based on the electric field measurements and ionospheric observations at Alma-Ata (Kazakhstan). The investigation showed a decrease in the atmospheric electric field (~ 40÷50 V/m) under "fair" weather conditions, fluctuations under magnetic storms and anomalous changes before and during significant and weak earthquakes. The study indicated a tendency for thunderstorm appearance with 1-2 days delay after impact of CMEs or HSSs events on the Earth magnetosphere. Noticeable changes in the lower ionosphere during the periods were found.



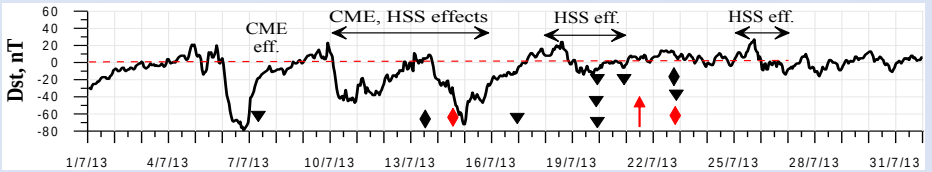
1. Diurnal variation of the electric field at the high mountain Tien-Shan station under «fair weather» conditions in summer and winter



2. Values of the atmospheric electric field after the CME 27.02.2014 and 01.12.2014

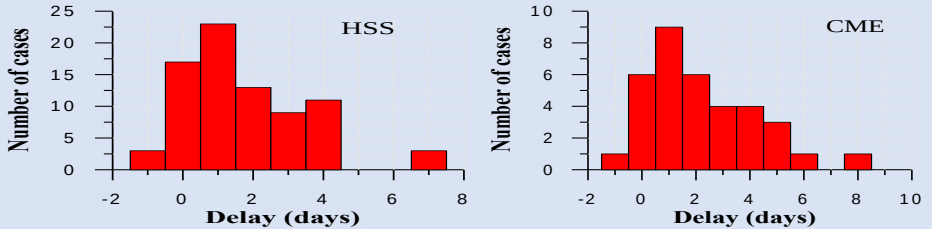


3. The values of the atmospheric electric field under the impact of the large geomagnetic storm (left panel) and power spectra of variations in the atmospheric electric field during magnetic storms (right panel, red color)



4. Variations of the Dst-index and the occurrence of thunderstorm activity in July 2013.

The figure below shows frequency of occurrence of the thunderstorm events as a function of time delay between observed thunderstorm and the arrival of geoeffective CMEs and HSSs to the Earth



5. Lightning occurrence as a function of time delay between observed thunderstorm and the arrival of geoeffective HSSs (left panel) and CMEs (right panel) to the Earth.

The results of a joint analysis of geomagnetic, solar and thunderstorm activity showed that there is a tendency for thunderstorm activity to appear during periods of increased geomagnetic activity (geomagnetic storms) with the highest probability in the recovery phase to the level of a quiet geomagnetic field, as well as during the impact of geoeffective coronal mass ejections on the Earth's magnetosphere (CME) and high-velocity solar wind streams (HSS) observed during the considered periods