

Variability of the undisturbed electric field in the south of Western Siberia: a case study on Tomsk

Pustovalov K.N. (1, 2), Nagorskiy P.M. (1), Oglezneva M.V. (1), Smirnov .V. (1)

(1) Institute for Monitoring Climatic and Ecological Systems SB RAS, Tomsk, Russia

(2) National Research Tomsk State University, Tomsk, Russia

e-mail: npm_sta@mail.ru

It is known that the unitary variation of the electric field potential gradient (Carnegie curve) is the global daily contribution of electrical activity in areas of disturbed weather. However, the contribution of regional and local factors can significantly affect the daily variations in the surface electric field in different regions of the globe. In this regard, the purpose of this work is to assess the variability of the electric field potential gradient under fair-weather conditions in the south of Western Siberia using the example of Tomsk.

The study was based on the data of measurements of the electric field potential gradient, performed at the geophysical observatory of the IMCES SB RAS using the Pole-2 and CS110 field mills. The time series of average minute values of the potential gradient for 2006–2020 was analyzed. When selecting cases corresponding to the fair-weather conditions, we used observational data on cloudiness and atmospheric phenomena in standard terms obtained at the Tomsk meteorological station.

The following main results are obtained. The variability of the potential gradient values in Tomsk under fair-weather conditions, in general, is determined by the lognormal distribution. The arithmetic mean and modal values of the potential gradient in Tomsk under fair-weather conditions are 282 and 252 V/m. As a whole for the year, the typical values of the potential gradient under fair-weather conditions, limited by the interval from the 25th to the 75th percentile, vary in the range of 161–372 V/m.

Estimates of the variability of the potential gradient under fair-weather conditions for different seasons of the year and for the cold and warm periods are obtained. In the seasonal course, the largest values of the potential gradient are observed in winter, and the smallest in summer. Its mean and median values in Tomsk are 301 and 267 V/m in winter, 301 and 278 V/m in spring, 290 and 263 V/m in autumn, and 225 and 218 V/m in summer. Typical potential gradient values for winter, spring, autumn and summer are 146–424 V/m, 190–387 V/m, 160–386 V/m and 146–286 V/m.

This research is supported by the Russian Science Foundation, a project No. 22-27-00482, <https://www.rscf.ru/en/27-00482>.