



## **Statistical Features of Nighttime Enhancements in the Electron Concentration in the F2 Layer Maximum of the Midlatitude Ionosphere in the 23 and 24th cycles of solar activity**

Beibit Zhumabayev, Artur Yakovets, Galina Gordienko , and Yuriy Litvinov  
Institute of Ionosphere, National Center for Space Research and Technology, Almaty, Kazakhstan

On the basis of the vertical sounding of the ionosphere in Alma-Ata (76 deg 55'E, 43 deg 15'N) during 2000-2014, the analysis of the occurrence probability of the nighttime electron concentration enhancements in the maximum of the F2-layer (NmF2) was performed. A comparison of parameters of very large enhancements observed in Irkutsk and Alma-Ata simultaneously was conducted.

During the period considered overall 2272 observation sessions were carried out, and in 1430 sessions, enhancements of NmF2 were observed. The entire data (2000-2014) were divided into two subarrays. The first one (2000-2003 and 2011-2014) corresponded to high solar activity, when the annual average Wolf numbers exceeded 50 ( $W > 50$ ). The second subarray (2004-2010) corresponded to the low solar activity, when the annual average Wolf numbers were less than 50 ( $W < 50$ ). Statistics of enhancement parameters was submitted for individual months and seasons: winter (December, January, February), spring (March, April, May), summer (June, July, August) and autumn (September, October, November).

There is a distinct seasonal dependence of the occurrence probability of enhancement appearance. The same features of the distributions for the high and low solar activity are the high occurrence probability near to 90% in January, February and November, December. In addition, a rapid decrease in the probability occurs from February to March, and a gradual increase from September to December. An evident maximum of the occurrence probability in the summer months takes place for high solar activity, while for the low activity the summer months are characterized by the minimum occurrence.

It is shown that the distribution of enhancement durations regardless of the level of solar activity have the same features. In winter and autumn, duration distributed over a wide range, with most of the enhancements lies in the range of 1 to 5 hours. For spring and summer months (April-August) the duration of the main part of the enhancement is in the range 1-2 hours. Comparing the amplitude increases obtained in Alma-Ata and Irkutsk for the same day showed a high probability that the sources of enhancements have significant spatial dimensions.