Studying the Dependence of Weddell Sea Ionospheric Anomaly on the Helio- and Geophysical Activity Using Median Time-Height Charts

Andriy V. Zalizovski* [1,2], Iwona Stanislawska [2], Volodymyr M. Lisachenko [1], Alexander V. Koloskov[1, 3]
(1) Institute of Radio Astronomy NASU, Kharkiv, Ukraine; e-mail: zaliz@rian.kharkov.ua
(2) Space Research Center, PAS, Warsaw, Poland; e-mail: stanis@cbk.waw.pl
(3) National Antarctic Scientific Center, Kyiv, Ukraine; e-mail: alexander.koloskov@gmail.com

Continuous vertical sounding of the ionosphere at the *Faraday-Akademik Vernadsky* station (65.15^{O} S, 64.16^{O} W) occurring since the late 50s discovered an ionospheric anomaly that now is widely known as a "Weddell Sea anomaly". The essence of this phenomenon is that the night values of the critical frequency of the ionosphere exceed the midday ones in the summer. The role of the thermospheric winds as the main driver of the anomaly has been explained long time ago (for the first time, probably, at [1]). The Weddell Sea anomaly is one of the brightest examples demonstrating how the dynamics of the neutral atmosphere can affect the main parameters of the near-Earth plasma.

We propose the technique for studying of this phenomenon by analyzing a median daily time-height charts of ionospheric parameters. Figure 1 shows the median value of the plasma frequency presenting in colors versus local time (the abscissa) and virtual height (the ordinate). Dependence of Weddell Sea Anomaly features on helio- and geophysical activity is analyzed by comparing the median height-time charts for different levels of flow F10.7 and local K indexes calculated within the 11-year solar cycle. Note, that the local K index for the *Akademik Vernadsky* location changes in line with the value of total energy of precipitated particles in Southern auroral region. The median chart for all data set (Fig.1 a) was compared with the charts for the days with different levels of indexes (Fig.1 b-e). As can be seen, the biggest nighttime F region ionization maximum is correspondent to low values of K-index and high values of F10.7 (Fig. 1 d). Most accurate inversion of diurnal variation of electron concentration in the F region is observed under the low values of K-index and low F10.7 flux (Fig. 1 b). The growth of geomagnetic activity decreases the nighttime ionization under the both low (Fig. 1 c) and high (Fig. 1 e) levels of F10.7 fluxes. It could be explained by destruction of the field of thermosheric winds supporting the nighttime anomaly, and/or by increasing the role of plasma drifts in comparison with wind impact.

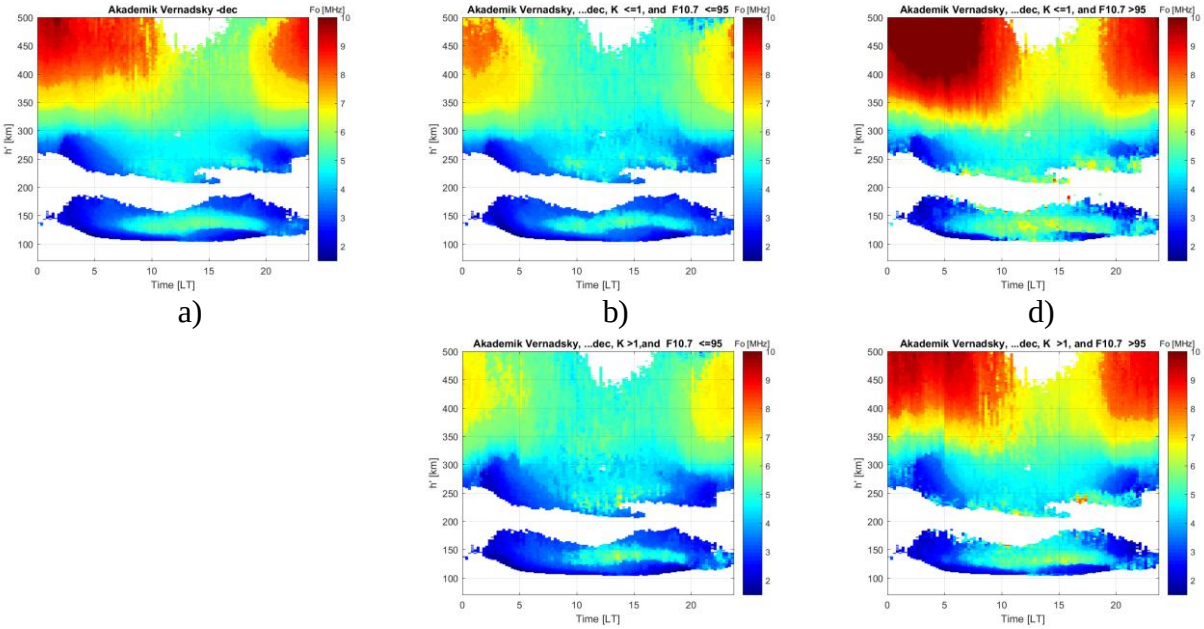

Figure 1. Median height-time charts of plasma frequencies over *Akademik Vernadsky* Antarctic station for Decembers 2007-2016: a) all data set; b) K < 2 and F10.7 < 95; c) K > 1 and F10.7 < 95; d) K < 2 and F10.7 > 95; e) K > 1; F10.7 > 95

1. Kohl H., King J.W. Atmospheric winds between 100 and 700 km and their effects on the ionosphere. J. Atmos. Terr. Phys. – 1967. – V.29. – P. 1045-1062.