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RESEARCH ARTICLE

Impact of Solar Activity on the Environment in March 2022

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ABSTRACT

Data from 64 stations of the global ionosonde network were used to estimate the correlation coefficient between the critical frequency of the ionosphere and its total electron content TEC during periods of high solar activity in March 2022. This coefficient in the vast majority of cases exceeded the value of 0.9, which indicates the interchangeability of these parameters in assessing the state of the environment. This assessment using the TEC parameter revealed a global positive ionization perturbation with a deviation of 30 to 100% from the month median at the end of the month, which can affect the operation of various space technological systems.

Introduction

Near-Earth space plays a huge role in human life. A large part of this space is occupied by ionosphere. On its condition depends the functioning of such technological systems as HF and satellite communication, satellite navigation, space-based radar and imaging, terrestrial radar surveillance and others [1]. The main ways to monitor ionosphere remain vertical and transionospheric sounding. Vertical sounding is carried out with ionosondes (HF receivers) and provides measurement of such parameter as critical frequency foF2, the maximum frequency reflected by the main layer F2 of the ionosphere. Transionosphere sounding is carried out by means of GPS-receivers and provides measurement of such parameter as total electron content TEC, which is the number of electrons in a column with the area of 1 m^2. The ionosonde network has a much smaller number of receivers than GPS receiver networks. Therefore, it is important to investigate how adequately both parameters describe the state of the ionosphere and how interchangeable they are. This is especially important during the intensification of solar and geomagnetic activity. Before the start of cycle 25, there were forecasts of its low solar activity and identity to cycle 24 [2], but the behavior of the Sun indicates a departure from such a scenario. An example is March 2022.

The aim of this paper is to evaluate the relationship between the ionospheric parameters foF2 and TEC during the period of high solar activity and to study the features of their behavior in this period on a global scale.

Materials and Methods

The data of solar and geomagnetic activity taken from the site (http://omniweb.gsfc.nasa.gov/form/dx1.html) are used in this work. The behavior of the F10.7 and Dst indices changes within a month in the following way (Figure 1).

One can see a burst of solar activity in the last four days of the month, while bursts of geomagnetic activity took place in the first half of the month. The analyzed

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- Total electron content
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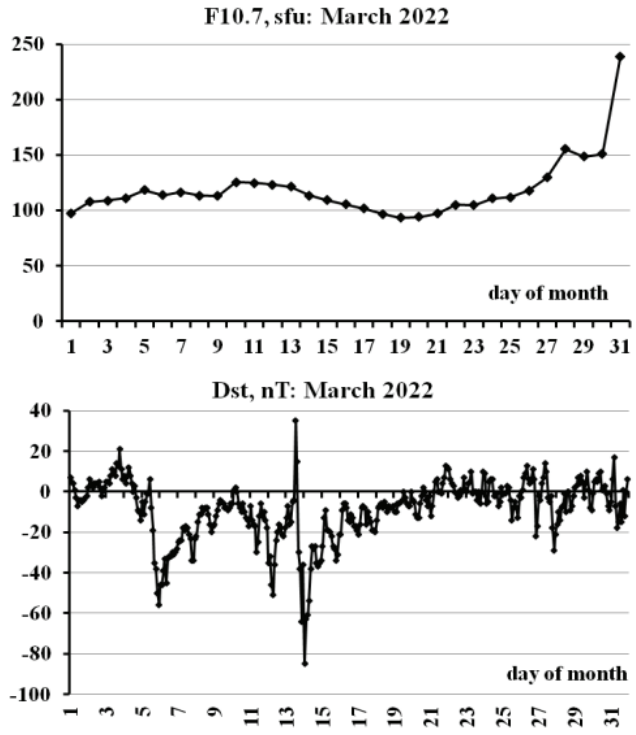

Figure 1 The behavior of the indices of solar F10.7 and geomagnetic Dst activity in March 2022.

series of foF2 data for 64 ionospheric stations were taken from DIDBase (www.Digisonde.com). The corresponding TEC values were calculated for the global JPL GIM map from the IONEX files on site (ftp://cddis.gsfc.nasa.gov/pub/gps/products/ionex/) with a step of 2 hours. The relationship between foF2 and TEC parameters was determined using the polynomial correlation coefficient of degree 2. The distributions of the parameters along certain meridians are most often studied; the longitudinal dependences are less often studied, although they are of greater interest [3]. In this paper, we study the ionospheric response in both directions.

Results

The results of calculations of the correlation coefficient ρ(foF2-TEC) for all stations show dependence on longitude (Figure 2).

It can be seen that in the vast majority of cases the coefficient exceeds the value 0.9. This indicates that the TEC parameter can be used to determine foF2. However, if we divide the entire longitude range (0-360°) into several sections (e.g., European, Southeastern-Australian, American), we can see a station with a lower coefficient in each section. These are the stations Tromso in the European region, Guam in the Southeastern region, Thule, Boa Vista, Sao Luis, and Fortaleza in the American region. The analysis shows that the reason is the lack of foF2 data. When comparing foF2 and TEC results, the foF2 frequency obtained as a result of direct measurements (unlike TEC) is considered as a reference, but due to ionospheric conditions and processing methods foF2 values can be absent. In this case at some stations the values of 30-31 March were absent. The missing values were reconstructed using the TEC values and the equivalent ionospheric thickness τ by method of [4]. An example shows the observational values of TEC and foF2 parameters and their medians (Figure 3). For foF2, in addition to the observational values foF2(obs) and medians foF2(med), the reconstructed values foF2(rec) are given.

One can see that the reconstructed foF2(rec) values

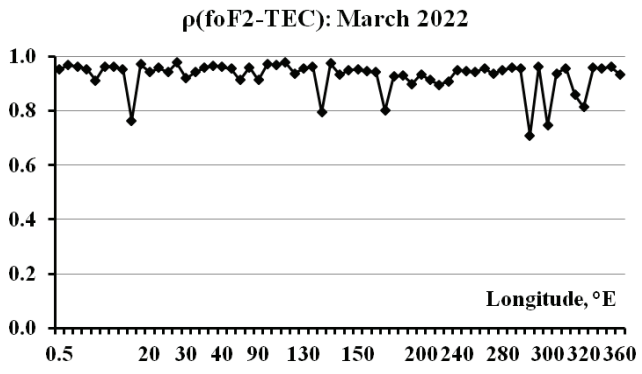

Figure 2 Longitudinal dependence of the coefficient ρ(foF2-TEC) according to data from 64 stations.

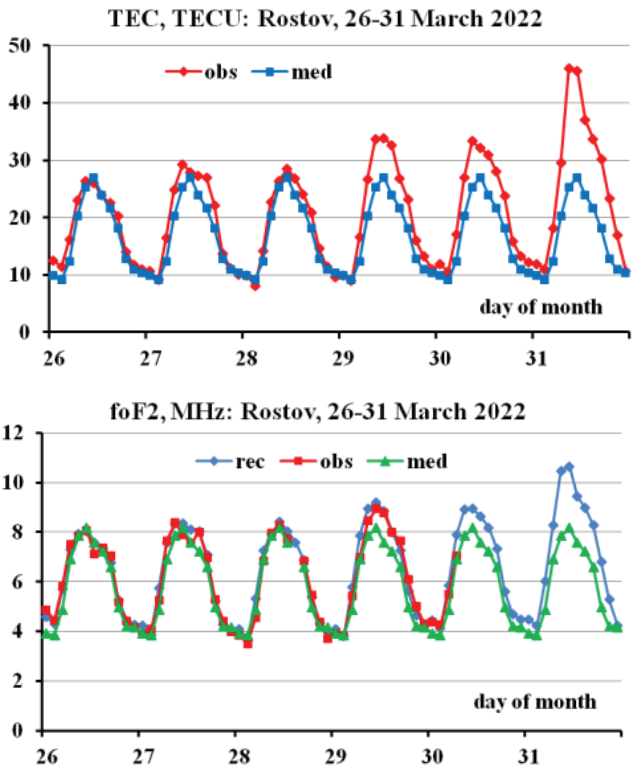

Figure 3 Example of reconstructed foF2 values on March 30 and 31 showing the positive perturbations.

correspond to the observed values when they are present. This suggests that the values obtained in 30-31 March are close to the real values. Thus, a complete picture of the foF2 variations at the selected points is obtained. This indicates that the lack of foF2 data can be made up for through TEC and TEC can characterize the state of the ionosphere on a global scale. The distributions along a certain meridian are most often used for investigation, the longitudinal dependence is less common, although it is of greater interest. Latitudinal and longitudinal TEC dependences allow us to reveal the peculiarities of the ionosphere response to various disturbances. The latitudinal dependences of TEC for the American meridian with longitude 90˚W for March 31, 2022 are presented for local times LT = 0, 10, 14, 18 (Figure 4). The latitude of schedules changes from 70˚ to -70˚ with step 5˚.

It can be seen that the positive perturbation has a global character. This is also confirmed by the longitudinal distribution of the maximum TEC values for latitude 40˚ N for March 31 and 28, when the F10.7 index value was much lower than the maximum value. This distribution is shown together with the median (Figure 5).

It can be seen that the positive perturbation effect is strongest in the European zone, least strong in the Southeastern and North American zones. The percentage deviations are 80-100% in the European zone, 40-80% in the southeastern and North American zones. On March 30 and 29, these values decrease to 50%, and on March 28 to 30%. Such deviations can lead to essential errors of positioning. The same distributions can be obtained for any latitude.

Conclusion

At the end of March 2022, there was high solar activity: the F10.7 index on March 28 increased 1.5-fold compared to the middle of the month in and almost 2.5-fold on March

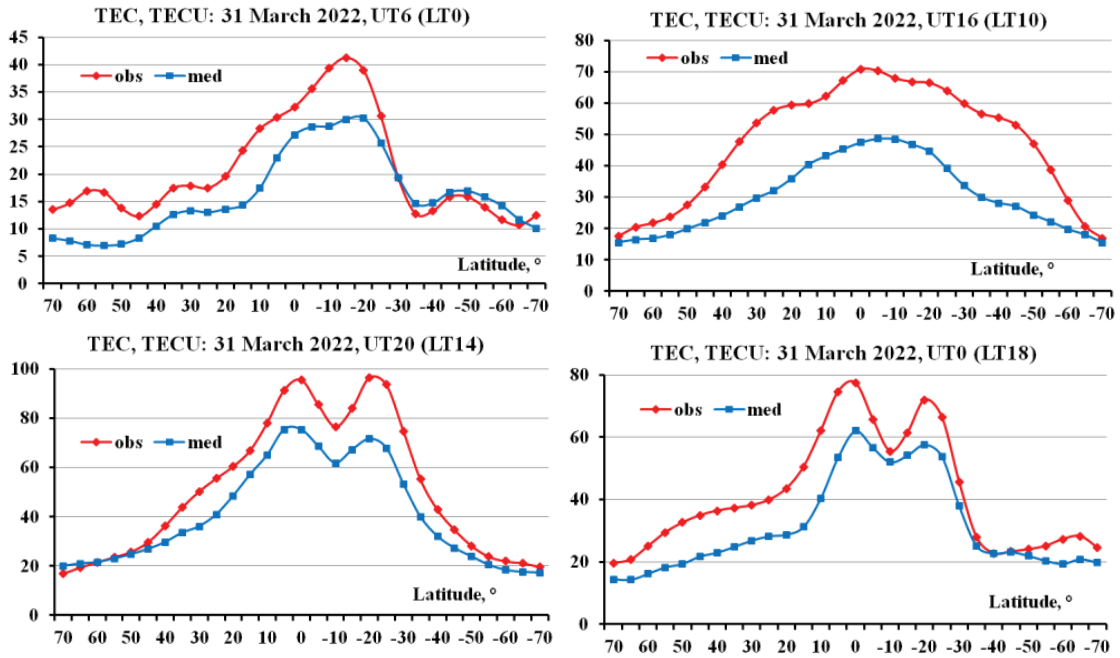

Figure 4 Example of a global positive ionospheric disturbance along the meridian 90°W.

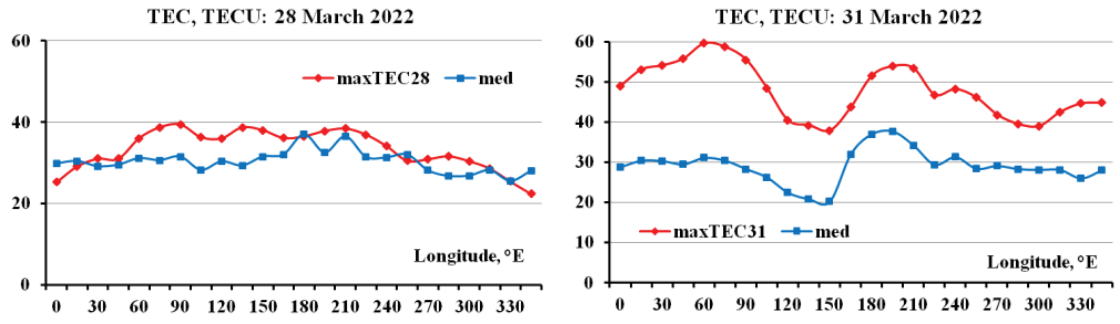

Figure 5 Global longitudinal positive effect at latitude 40°E.

31. The evaluation of connection between foF2 and TEC parameters according to data of 64 ionosondes showed the values of ρ(foF2-TEC) coefficients exceeding 0.9 in the overwhelming number of cases, which indicates the interchangeability of these parameters in describing the state of the environment. This indicates the possibility of using TEC for such a description. It is shown that on a global scale there was a positive perturbation of ionization of the ionosphere with deviation of parameter values from the median up to 100 %. Among other results one can see asymmetric response of the two hemispheres, blurring of the main ionospheric trough due to the appearance of auroral ionization, enhanced ionization in the crests of the equatorial anomaly, etc. In addition, as figure 1 shows, there were several geomagnetic disturbances in the first half of March. An analysis of the behavior of foF2 and TEC parameters shows that in most cases there was a classical behavior including the initial positive phase, the negative main phase and the recovery phase of the magnetic storm, but the disturbance amplitudes were small.

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References

1. Goodman JM. Operational communication systems and relationships to the ionosphere and space weather. AdvSpace Res. 2005;36:2241-52. doi: 10.1016/j.asr.2003.05.063.
2. Javaraiah J. Will solar cycles 25 and 26 be weaker than cycle 24? Solar Phys. 2017;292-172. doi: 10.1007/s11207-017-1197-x.
3. Chernigovskaya MA, Shpynev BG, Yasyukevich AS, Khabituev DS, Ratovsky KG, Belinskaya AYu, Stepanov AE, Bychkov VV, Grigorieva SA, Panchenko VA, Kouba D, Mielich J. Longitudinal variations of geomagnetic and ionospheric parameters in the Northern Hemisphere during magnetic storms according to multi-instrument observations. Adv Space Res. 2021;67(2):762-776. doi: 10.1016/j.asr.2020.10.028.
4. Maltseva OA, Mozhaeva NS. Empirical modelling of total electron content of the ionosphere. In Habib M, editor. Empirical modeling and its applications, Chapter 1. 2016. p.1-28. ISBN 978-953-51-2494-8.

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