Examination of the ionospheric response to intense solar activity from September 6 to 10, 2017

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The ionosphere is a layer within the Earth's atmosphere that contains charged particles, whose characteristics are influenced by solar, external and other extraterrestrial ionizing factors. The ionosphere is divided into several layers and sublayers depending on their composition and physical characteristics.

Solar flares are strong explosions on the surface of the Sun, which are known to produce additional ionization of the Earth's atmosphere in the sunlit hemisphere. When the energy from the solar flare reaches the Earth, it performs additional ionization in the ionosphere, changing the density and location of its constituents. Extreme ultraviolet EUV radiation is absorbed in the higher altitudes of the E and F regions, while X-rays penetrate deeper into the ionosphere reaching the D region and causing additional ionization and absorption of electromagnetic waves (see e.g. Chowdhury et al. 2020, Barta et al. 2022, Buzas et al. 2023 etc.).

The International Reference Ionosphere (IRI) is a joint venture of the Committee of Space Research (COSPAR) and the International Union of Radio Science (URSI) to develop and improve an international standard for parameters in the Earth's ionosphere. IRI represents the average values of electron and ion densities for the altitude range of 50-2000 km (see Bilitza et al. 2016). In this paper, we examined the response of the ionosphere to intense solar activity in the period September 6-10, 2017. The IRI model was used in this research with the goal to examine the behavior of the ionosphere under the influence of intense solar activity in this specified period. Calculations were performed for M and X-class flares and included three ionosonde stations: Juliusruh (54.6° N, 13.4° E), San Vito (40.6° N, 17.8°E) and Pruhonice (50° N, 14.6° E). The initial modeling parameters used for given stations and periods before and after examined flare events were taken from site https://giro.uml.edu/didbase/scaled.php.

References

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