4th URSI AT-RASC, Gran Canaria, 19-24 May 2024

Statistical study of post-storm foF2 depressions observed in 2020-2023

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During geomagnetic storms, a large amount of solar wind energy entering the magnetosphere and significantly changes the state and structure of the Earth's upper atmosphere due to interaction of the ionospheric plasma with the neutral atmosphere. The ionospheric response to such disturbances can cause positive or negative phases of ionospheric storms, which lead to an increase or decrease of F2-layer critical frequency (*foF2*) and electron density (N_mF2), as well as the maximum usable frequency (MUF) for HF propagation on different distances. The decrease of *foF2* and MUF (*foF2* or MUF depression), in its turn, has significant impact on the HF ionospheric radio communication. In case of depressions more than 30% relative to median level for a given region, the space weather centers issue a warning of moderate depression; if the level exceeds 50%, a warning of severe depression is issued [1].

This study presents the results of statistical analysis of the impact of geomagnetic storms of different intensities on occurrence of *foF2* depression. For this purpose, the global maps of foF2 depressions calculated during 2020-2023 in Space Research Centre of the Polish Academy of Sciences (CBK PAN) within activity of PECASUS consortium [1] were processed and analyzed.

The dependence between the occurrences of *foF2* depression and geomagnetic activity level represented by *Kp* index was investigated. It is found, that the occurrences of *foF2* depressions (lower 30%) increased with growth of storm intensity. The threshold level of planetary K_p index, after which the occurrences of depression starts to increase was estimated. Estimates of the time interval when the probability of foF2 depressions is increased after the geomagnetic storm were made.

The obtained results might be useful for optimizing the criteria for issuing the advisories about post-storm depressions in national, regional and global space weather centers, in particular, the Regional Warning Center operating in CBK PAN in Warsaw.

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