Geophysical Research Abstracts
Vol. 18, EGU2016-15772, 2016
EGU General Assembly 2016

The study of the midlatitude ionospheric response to geomagnetic activity at Nagycenk Geophysical Observatory

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Geomagnetic storms affect the ionospheric regions of the terrestrial upper atmosphere, causing several physical and chemical atmospheric processes. The changes and phenomena, which can be seen as a result of these processes, generally called ionospheric storm. These processes depend on altitude, term of the day, and the strength of solar activity, the geomagnetic latitude and longitude. The differences between ionospheric regions mostly come from the variations of altitude dependent neutral and ionized atmospheric components, and from the physical parameters of solar radiation.
We examined the data of the ground-based radio wave ionosphere sounding instruments of the European ionospheric stations (mainly the data of Nagycenk Geophysical Observatory), called ionosonde, to determine how and what extent a given strength of a geomagnetic disturbance affect the middle latitude ionospheric regions in winter. We chose the storm for the research from November 2012 and March 2015.
As the main result of our research, we can show significant differences between the each ionospheric (F1 and F2) layer parameters on quiet and strong stormy days. When we saw, that the critical frequencies (foF2) increase from their quiet day value, then the effect of the ionospheric storm was positive, otherwise, if they drop, they were negative. With our analysis, the magnitude of these changes could be determined. Furthermore we demonstrated, how a full strong geomagnetic storm affects the ionospheric foF2 parameter during different storm phases. It has been showed, how a positive or negative ionospheric storm develop during a geomagnetic storm. For a more completed analysis, we compared also the evolution of the F2 layer parameters of the European ionosonde stations on a North-South geographic longitude during a full storm duration. Therefore we determined, that the data of the ionosonde at Nagycenk Geophysical Observatory are appropriate, it detects the same state of ionosphere like the European ionosondes. Also we studied the prominent phenomena (e.g. TIDs-Travelling Ionospheric Disturbances), and plasma irregularities (e.g. spread-F) of the ionosphere in the function of geomagnetic activity. As we compared the occurrences of TIDs and spread-F phenomena on the quiet days with their occurrences on moderate and strong stormy days, we can see significant correlation between the magnitude of the Ae-index and the daily number of the occurrence of TIDs, but at the same time there is no definite connection between the daily number of the occurrence of spread-F phenomenas and the intensity of geomagnetic activity.