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Comparison of spatio-temporal ionosphere profiles obtained from GNSS and ionosonde data during the severe ionospheric storm at 8th of September 2017

Anna Krypiak-Gregorczyk (1), Pawel Wielgosz (1), Wojciech Jarmolowski (1), Eren Erdogan (2), Andreas Goss (2), and Michael Schmidt (2)

(1) University of Warmia and Mazury in Olsztyn (UWM), Poland , (2) German Geodetic Research Institute of the Technical University of Munich (DGFI - TUM), Munich, Germany

The ionosphere plays an important role not only in space weather research, but also in geodetic applications. Therefore since the recent decades, space-geodetic techniques such as the Global Navigation Satellite Systems (GNSS) have been used for determining the ionospheric total electron content (TEC) on regional and global scales. This results in a number of approaches for ionosphere mapping based on GNSS data. They differ in both the usage of particular signals and data processing strategies. Due to the dynamic nature of the ionosphere, the temporal resolution of existing global ionosphere models is often insufficient to properly model storm time effects. In this contribution the performances of two high-resolution ionosphere models developed at the University of Warmia and Mazury in Olsztyn (UWM) and the German Geodetic Research Institute of the Technical University of Munich (DGFI-TUM) are studied. Both approaches, based on series expansions in terms of spline functions, are evaluated during the selected time intervals of severe geomagnetic storms. As the reference, we use data from another well-established source of ionosphere measurements, namely ground-based ionosondes. Therefore, we provide a comparison of spatio-temporal ionosphere profiles derived from GNSS and ionosonde data during the selected storm time interval.
The study uses data collected during the second strongest geomagnetic storm of Solar Cycle 24 that occurred on September 8, 2017. The results of time dependent TEC changes during the storm provided by UWM and DGFI-TUM are confirmed by NmF2 changes derived from the ionosondes. These analyzes confirm the good compatibility of both the UWM and the DGFI-TUM maps with ionosonde NmF2 data. This, in turn confirms, too, that our modeling approaches are suitable for studying the disturbed ionosphere; this contributing aims also on a better understanding of space weather.