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Comparative analysis of GPS-derived TEC estimates and foF2 observations during storm conditions towards the expansion of ionospheric forecasting capabilities over Europe

Ioanna Tsagouri, Anna Belehaki, and Panagiotis Elias

National Observatory of Athens, Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing, Penteli, Greece (tsagouri@noa.gr)

This paper builts the discussion on the comparative analysis of the variations in the peak electron density at F2 layer and the TEC parameter during a significant number of geomagnetic storm events that occurred in the present solar cycle 24. The ionospheric disturbances are determined through the comparison of actual observations of the foF2 critical frequency and GPS-TEC estimates obtained over European locations with the corresponding median estimates, and they are analysed in conjunction to the solar wind conditions at L1 point that are monitored by the ACE spacecraft. The quantification of the storm impact on the TEC parameter in terms of possible limitations introduced by different TEC derivation methods is carefully addressed.The results reveal similarities and differences in the response of the two parameters with respect to the solar wind drivers of the storms, as well as the local time and the latitude of the observation point. The aforementioned dependences drive the storm-time forecasts of the SWIF model (Solar Wind driven autorgressive model for Ionospheric short-term Forecast), which is operationally implemented in the DIAS system (http://dias.space.noa.gr) and extensively tested in performance at several occassions. In its present version, the model provides alerts and warnings for upcoming ionospheric disturbances, as well as single site and regional forecasts of the foF2 characteristic over Europe up to 24 hours ahead based on the assesment of the solar wind conditions at ACE location. In that respect, the results obtained above support the upgrade of the SWIF's modeling technique in forecasting the storm-time TEC variation within an operational environment several hours in advance. Preliminary results on the evaluation of the model's efficiency in TEC prediction are also discussed, giving special attention in the assesment of the capabilities through the TEC-derivation uncertanties for future discussions.