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Short-term prediction of the foF2 critical frequency in the high latitude ionosphere for DIAS extending services

Ioanna Tsagouri (1) and Anna Belehaki (2)

(1) National Observatory of Athens, IAASARS/Ionospheric Group, Palea Penteli, Greece (tsagouri@noa.gr), (2) National Observatory of Athens, IAASARS/Ionospheric Group, Palea Penteli, Greece (belehaki@noa.gr)

Ionospheric forecasting products and services for Europe are provided routinely by the European Digital upper Atmosphere Server, DIAS (http://dias.space.noa.gr). These include alerts and warnings for upcoming ionospheric storm time disturbances as well as single station and regional ionospheric forecasts up to 24 hours ahead for the middle latitude European region. However, in order to meet the users' requirements, it is planned within the Space Situational Awareness Programme of the European Space Agency the extension of the DIAS forecasting services to cover the whole European region, including Scandinavia. To this effect, the Solar Wind driven autoregression model for Ionospheric short-term Forecast (SWIF) will be applied.
In the operational mode, SWIF combines historical and real-time ionospheric observations with solar wind parameters obtained in real time at L1 point from ACE spacecraft through the cooperation of an autoregression forecasting algorithm, namely TSAR with an empirical ionospheric storm time model, namely STIM that is triggered by solar wind disturbances detected by STIM's alert detection algorithm. The ionospheric storm time response is then empirically formulated taken into account the latitude and the local time of the observation point at the storm onset. SWIF's prediction efficiency was recently fully documented for the middle latitude ionosphere. As a first step towards the operational implementation of the SWIF for high latitude ionospheric forecasts, the work presented here includes the evaluation of the SWIF's performance over high latitude locations and under disturbed geophysical conditions based on historical data. For this purpose, all available high latitude foF2 observations obtained during a significant number of selected storm events occurred in the previous as well as the current solar cycle are analyzed in respect with the foF2 reference level and the model's predictions. The results verify the validity of STIM's storm alert detection algorithm for high latitude storm time predictions and drive necessary adjustments in the model's empirical expressions improving SWIF's efficiency to capture the direct response of the high latitude ionosphere to geomagnetic storm activity. The model's prediction efficiency is quantified through relevant metrics' estimations (i.e. RMSE, MRE and relative improvement over climatology).