Ionospheric forecasts driven by solar wind parameters: evaluation of the SWIF model performance

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The Solar Wind driven autorgressive model for Ionospheric short-term Forecast (SWIF) was developed in the National Observatory of Athens to support ionospheric forecasting services of DIAS (http://dias.space.noa.gr) and ESA-Space Situational Awareness Space Weather Service Network (http://swe.ssa.esa.int/). The model exploits real time observations of the interplanetary magnetic field (IMF) from L1 point to combine the output of two distinct forecasting algorithms: an autoregressive technique that is able to provide forecasts under all possible conditions and an empirical formulation of the ionospheric storm-time response. SWIF was originally designed to provide single site and regional forecasts of the foF2 critical frequency for the European region up to 24 hours ahead, as well as alerts for upcoming disturbances [1]. Figure 1 presents examples of ionospheric forecasting products generated through the implementation of the SWIF model. Recently the model was upgraded to expand its forecasting capabilities to the total electron content (TEC) ionospheric characteristic [2].

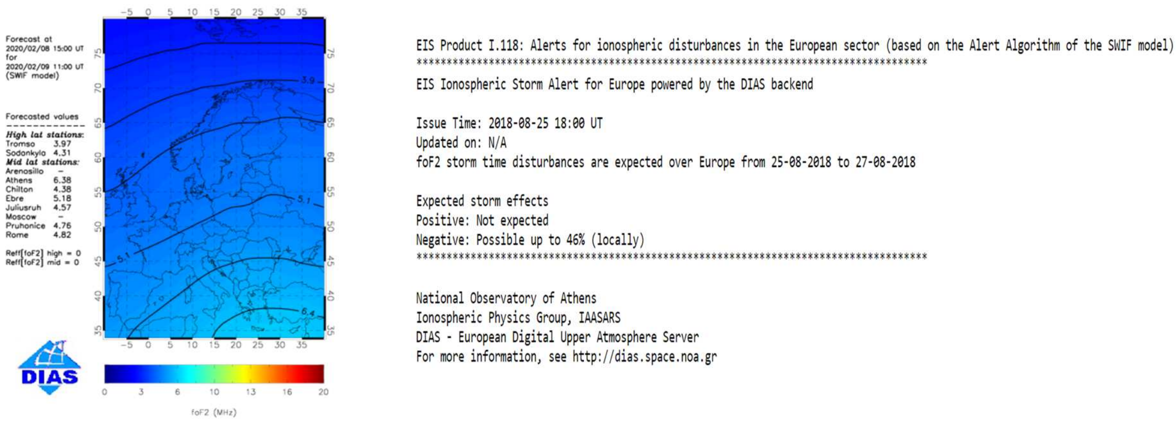

Figure 1: Examples of foF2 forecasting maps for the European region (left) and ionospheric alerts (right) provided by DIAS system through the implementation of the SWIF model.

SWIF's performance has been evaluated over a wide range of geomagnetically disturbed conditions in the last two solar cycles. The evaluation results provide evidence of successful performance under the occurrence of disturbances related to coronal mass ejections (CMEs), while the model's performance appears significantly lower in case of disturbances related to high-speed solar wind streams/corotating interaction regions (HSSs/CIRs). The latter indicates limitations to our present forecasting abilities and the requirement for more efficient drivers from solar wind environment and/or more sophisticated descriptions of the ionospheric response for forecasting purposes. This presentation aims to summarize relevant results, including also analysis of possible alternatives than IMF parameters, with an eye on the advantage these alternatives can bring in expanding the ionospheric forecasting window to several days in advance within operational environments. The analysis will be driven by present solar wind forecasting capabilities to account for realistic suggestions.

References

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[2] I. Tsagouri, K. Koutroumbas, and P. Elias, "A new short-term forecasting model for the total electron content storm time disturbances", *J. Space Weather Space Climate*, **8,** A33, 2018, doi: 10.1051/swsc/2018019.