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Evaluation of the performance of DIAS ionospheric forecasting models during disturbed conditions

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Nowcasting and forecasting products and services for the European region are regularly provided since August 2006 through the European Digital upper Atmosphere Server – DIAS (http://dias.space.noa.gr). Currently, DIAS ionospheric foF2 forecasts are based on the online implemetation of two models: i) the Solar Wind driven autoregression model for Ionospheric short-term Forecast (SWIF), which combines historical and real-time ionospheric observations with solar-wind parameters obtained in real time at the L1 point to issue ionospheric forecasts as well as alerts and warnings, and ii) the Geomagnetically Correlated Autoregression Model (GCAM), which is a time series forecasting method driven by a synthetic geomagnetic index. As the quantification of a model's prediction accuracy is a strong requirement for the operational use of the model, here we report on a metrics-based evaluation of both the SWIF's and GCAM's performance under disturbed ionospheric conditions. The evaluation tests are established on the comparisons against two simple prediction strategies, the median based and persistence predictions but also on the comparison against the empirical International Reference Ionosphere - IRI2000 which includes the empirical storm-time correction model STORM. The daily RMSE and the mean relative deviation are investigated as metric parameters to quantify the models' prediction error against actual measurements and their relative performance against other prediction strategies. All available observations obtained during selected disturbed periods for three different solar activity levels (maximum, moderate and minimum) over three European locations (Rome, Juliusruh and Chilton) were used in the validation tests. The statistical results determine each model's accuracy in providing ionospheric forecasts up to 24 h ahead in respect to the latitude of the observation point, the geophysical conditions and the prediction step. Moreover, the comparative analysis provide useful input for future developments either for adopting for operational purposes the method with the better performance per prediction step, depending on the current geophysical conditions and on the geographic location or for collecting important input for future comparisons regarding the assessment of the performance of space weather models.