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Solar wind driven autoregression model for short term ionospheric forecast

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The accurate ionospheric predictions especially during periods characterized by solar and geomagnetic disturbances support the reliable performance of several applications including HF communications, and satellite positioning and navigation systems. Despite the long history, the ionospheric forecast remains an unsolved and a challenging problem since the empirical methods which are widely used in practice are based on the quite poor correlation of the ionospheric disturbances with various geophysical indices. Based on recent advances in ionospheric storm dynamics which correlate the ionospheric storm effects with solar wind parameters such us the magnitude and the orientation of the interplanetary magnetic field (IMF) and on the availability of these parameters in real time by the ACE spacecraft from the vantage L1 point, a new ionospheric forecasting method was recently developed and is proposed in this contribution. The proposed method is based on the fusion of two diverse techniques: i) an autoregression forecasting algorithm capable for real time ionospheric predictions up to 24 hours ahead during all possible ionospheric conditions, namely Time Series AutoRegressive (TSAR) model and ii) an empirical method for predicting the onset and for scaling ionospheric response during geomagnetic storms based on the solar wind parameters, namely Storm Time Ionospheric Model (STIM). STIM's predictions are provided from 18 to 40 hours ahead. The cooperation of the two methods introduces the Solar Wind driven autoregression model for Ionospheric short term Forcast (SWIF), which presents clear advantages since it is capable to provide alerts and warnings for impending ionospheric disturbances as well as ionospheric forecasts for prediction horizon significantly greater than 24 hours ahead. Validation tests are also

carried out to verify the reliability of SWIF’s estimates over Europe.