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Modeling of the geomagnetic storm effects on the middle latitude ionosphere

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A model for nowcasting and forecasting foF2 disturbances at middle latitude ionosphere is proposed in this paper. The model is designed to introduce a storm-time correction factor to the output of any quiet-time ionospheric empirical model, taking advantage of the deeper understanding in ionospheric storm dynamics that is currently available and aiming at the operational use of such a model for space weather applications. The data analysis is established on interplanetary magnetic field (IMF) observations from ACE spacecraft, Dst records and foF2 critical frequency observations from several middle latitude ionospheric stations distributed in longitude around the earth. The modelling technique is established on the determination of the "storm onset" based on the IMF disturbances, on the determination of the type and the amplitude of the ionospheric response in each local time sector, on the estimation of the time delay of the ionospheric disturbance onset in respect to the storm onset, and on the empirical formulation of the ionospheric response in each local time sector. The proposed ionospheric storm time model is designed to scale quiet daily ionospheric variation taking into account the storm onset time in UT and the local time of the observation point. Preliminary validation tests give evidence for significant improvement over monthly median values. Moreover, the new model was proved able to capture the physical processes that governs the ionospheric storms onset and their temporal evolution during the first 24-hour.