EUROMAP foF2 short-term (1-24)h prediction model based both on historical and real-time foF2 observations over the European region.

A.V. Mikhailov*[(1)], L. Perrone[(2)], V.N. Shubin[(1)]
[(1)]Pushkov Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation (IZMIRAN), Troitsk, Moscow 142190, Russia
[(2)]Istituto Nazionale di Geofisica e Vulcanologia (INGV), Via di Vigna Murata 605, Roma 00143, Italia

Abstract

A new EUROMAP foF2 model has been developed for short-term (1-24)h foF2 prediction over the European region.
It is based both on historical for 2-3 solar cycles hourly foF2 observations and real-time foF2 data available from 10 currently working ionosondes.
The input driving parameters are 3-hour *ap* indices (converted to $ap(\tau)$), effective ionospheric T-index, and real-time foF2 observations.
The prediction method includes local (for each station) regression storm models to describe strong negative disturbances under $ap(\tau)>30$ and training over previous 28-day models to describe foF2 variations under $ap(\tau)\leq 30$.
An aeronomic approach is used under $ap(\tau)\leq 30$ at the stations where real-time foF2 observations are not available. Index T is used to specify the background monthly median level.
In the case of strong negative disturbances (the descriptive regime when observed 3-hour *ap* indices are used) the EUROMAP model demonstrates on average the improvement over the IRI(STORM) model: 40% in Winter, 24% in Summer, and 39% in Equinox. The average improvement over climatology is 40-60%. In the majority of cases this difference is statistically significant ($\geq 95\%$) according to Student criterion.
In the case of strong positive disturbances higher latitude stations also manifest a significant difference between the two models but this difference is insignificant at lower latitude stations (Athens, Rome, Tortosa).
The substitution of 3-hour *ap* input indices for the predicted daily Ap ones (the forecast regime) somewhat decreases the prediction accuracy in the case of negative disturbances but practically has no effect on the foF2 prediction accuracy with positive disturbances.
The obtained results show a real opportunity to provide foF2 forecast with the (1-24) h lead time on the basis of predicted Ap indices.