

Data assimilation into NeQuick

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NeQuick 2 is the latest version of the NeQuick ionosphere electron density model developed at the Abdus Salam International Centre for Theoretical Physics - Trieste, Italy with the collaboration of the University of Graz, Austria. It is a quick-run model particularly suited for trans-ionospheric propagation applications that has been conceived to describe the median behavior of the ionosphere.

To provide 3-D specifications of the ionosphere electron density for current conditions, different ionosphere electron density retrieval techniques based on the NeQuick adaptation to GNSS-derived Total Electron Content (TEC) data and ionosonde measured peak parameters values have been implemented.

In the present paper an overview of these reconstruction techniques will be given. Particular attention will be devoted to the recent results obtained in terms of data assimilation, where a procedure based on a minimum variance least-squares estimation has been implemented to incorporate ground and space-based (Radio Occultation-derived) TEC data into NeQuick 2, considered as a background model. In addition, to illustrate the effectiveness of the proposed assimilation schemes and to appraise the performance of NeQuick in reconstructing the 3-D electron density of the ionosphere, the results related to selected validation tests will be analyzed.

Specific examples will also be discussed to point out the importance of ionosonde-derived parameter values (like for example the critical frequency of the F2 layer) either as ground-truth measurement to validate the data ingestion procedures, or as assimilation data used to improve the model capability to reconstruct the ionospheric electron concentration for geographic areas where experimental data are available.