# Electron density topside profile estimate with NeQuick model ingesting bottomside parameters

**Carlo Scotto[1], Bruno Nava[2], Loredana Perrone[1] and Marco Pietrella[1]**

[1] Istituto Nazionale di Geofisica e Vulcanologia, Rome, ITALY.
(E-mail: carlo.scotto@ingv.it, loredana.perrone@ingv.it, marco.pietrellangv.it)

[, 2] The Abdus Salam International Centre for Theoretical Physics, Trieste, ITALY.
(E-mail: bnava@ictp.it)

## ABSTRACT

The ground-based ionosondes only provide observations of the bottom-side ionosphere. The problem of real time estimation of the bottomside electron density profiles $N_e(h)$ from ionosondes has been addressed by a few programs among which the ARTIST system (Reinish et al., 2005), applied to the Lowell digisonde, is widely used.

A major issue is the determination of the topside $N_e(h)$. In the ARTIST this issue has been considered developing a real time model assuming an $\alpha$-Chapman distribution with a scale height $H_e$ derived from the measured bottom-side $N_e(h)$. This approach has the remarkable advantage of needing a limited number of parameters, namely the F2 peak electron density $N_{e[F2]}$ and the scale height $H_e$. A disadvantage is that the assumption of constant topside $H_e$ equal to that immediately below the peak, may determine unrealistic $N_e(h)$ topside function. For this reason other ionospheric topside profilers have been proposed and relevant works on this subject have been published (Stankov et. al 2010, Stankov et. al 2003).

The software Autoscala for the automatic interpretation of ionograms is also able to provide different ionospheric parameters, characterizing the shape of the $N_e(h)$ bottomside (Scotto and Pezzopane 2002; Scotto, 2009). These parameters can be usefully ingested into NeQuick model (Nava et al. 2008) to obtain a real-time modeling of the $N_e(h)$ topside.
The purpose of this work is to perform a preliminary study, having as ultimate goal the implementation of the real-time assessment of the topside of $N_e(h)$ in Autoscala program. For this goal a significant problem to be solved is inherent in the presence of the spread F. This problem has been tackled applying a recently developed routine, which discards ionograms showing such a feature. In this way has been possible to perform a comprehensive test including

different latitudes. The topside $N_e(h)$ estimation provided by NeQuick model has been compared with the correspondent electron density coming from Champ satellite measurements.

**Key words:** NeQuick, Topside Profile, Autoscala