Improvements in electron density definition in Autoscala program

C. Scotto(1), D. Sabbagh(1) (2), A. Ippolito(1) and V. Sgrigna(2)
(1) Istituto Nazionale di Geofisica e Vulcanologia, Via di Vigna Murata 605, 00143 Rome, Italy
(2) Università degli Studi Roma Tre, Dipartimento di Matematica e Fisica, Via della Vasca Navale 84, 00143 Rome, Italy

Abstract

A sketch of the Ne(h) model used by AIP is reported in Fig. 1. The model is based on the definition of some anchor points, which are reported in Fig.1 as A, B, C, D, E, and F.
In the previous version, the point D was assumed according to [1] model, in which the height (δhvE[base]), and the depth (δhvE[base]) of E valley were computed by polynomial with the solar zenith angle χ as variable. In this version the D point is: hvE = hmE[base] + hdeepE[base], where hdeepE[base and hdeepE[base] are assumed in a similar way to IRI model.

Making again reference to Fig. 1, it can be noted that the Ne(h) model, used in this work can be divided into the following two regions: 1) the bottom-side F2 profile, through the F1 layer to the top of the E valley (from A to C, in Fig. 1); 2) the E region (from C to F, in Fig. 1). The bottomside F2 profile of AIP is built on the basis of the formulation for the presentation of the F1 layer in the IRI Ne(h) from Reinisch and Huang (2000), where A is the fundamental anchor point, while the E region is modeled by defining the position of the four anchor points C, D, E, and F (see Fig. 1), which are joined by analytical functions. Here it is relevant to observe the criticity of the connection between the regions 1) and 2) mentioned above, connection which occurs at point C. In the 2009 version, the point C was firstly defined, then the parabolic connection between C and D was made, and finally was required the passage of the Reinish and Huang function [2], for the point C. This approach determined the onset of a cusp at point C. This cusp, was then smoothed with the introduction of a polynomial of degree 3, which ensured the continuity of the first derivative. In the version here presented, the algorithm operates in a different way: first is imposed the passage of the Reinish and Huang function [2] for C. Then, the points C and D are connected with a function whose parameters are chosen to have continuous first derivative in C and vertical trend in D. The function used is of the type :Ne(h) = (NmE-δNvE) + δNvE·[(h-hvE)/(hmE+δhvE-hvE)]α.

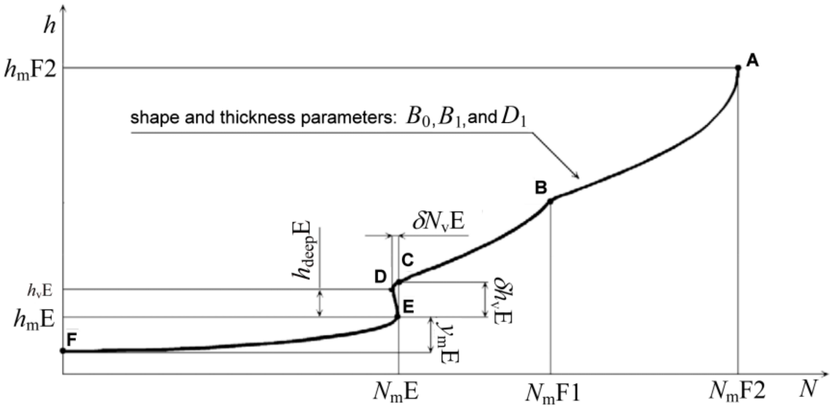

Fig. 1. The electron density profile model used in Autoscala. It can be divided in the following two regions: (1) the bottom-side F2 profile, through the F1 layer down to the top of the E valley (from A to C); (2) the E valley, and the E bottom side (from E to F).

1. Mahajan, K.K., Sethi, N.K., Pandey, V.K. The diurnal variation of E–F valley parameters from incoherent scatter measurement at Arecibo. Adv. Space Res. 20, 1781–1784, 1997.

2. Reinisch, B.W., Huang, X. Redefining the IRI F1 layer profile. Adv. Space Res. 25, 81–88, 2000.