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IONOSPHERIC DATA COMBINATION AS A WAY TO IMPROVE ELECTRON DENSITY ESTIMATIONS

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Several approaches have been made in the context of data assimilation in order to improve the estimates of electron density. The key point is to combine different types of data that offer complementary information, thus allowing to obtain a three dimensional description of the electronic content of the ionosphere. In this paper a data assimilation scheme will be proposed in which the complementarity of information will be given by the ground GPS data (horizontal variation) and vertical profiles derived from ionosonde data (vertical variation). The results of this assimilation scheme will be verified by an external source of data, the GPS data gathered from receiver onboard GPSMET, a low earth orbiter at 750km. This comparison will show the feasability of this assimilation scheme. Moreover it will be shown how this method is able to provide with valuable information about the topside ionosphere by means of comparison with the vertical profiles retrieved from Radio Occultations using Abel inversion. To do this the approach of Abel inversion based on a separability hypothesis will be explained, and it will be compared with the classical approach that assumes spherical symmetry.

Keywords: Abel inversion; data assimilation; electron density 3D description; GPS; GPSMET; ionosonde; separability assumption; spherical symmetry

1. Introduction

A 3D description of ionospheric electron density can be obtained by means of data assimilation. To do this several types of data can be considered, the point is to combine data that provide complementary information. The data from ground based GPS receivers allow to obtain TEC estimations with errors of a few TECU, besides there are extensive GPS networks worldwide. The disadvantage of this is that with this type of data represent quasi-null vertical resolution for electron density estimations. To obtain information of it GPS data from receivers onboard Low Earth Orbiters such as the GPSMET can be considered. In this case we can achieve vertical information on ionospheric electron density, but occultations only take place at specific local time for different locations. Another source of information may be the one derived from ionosonde data, because it provides with high resolution of electron density up to the h_mF2, nevertheless there is no information beyond this point and they are only local vertical profiles. By means of combining the strong points of one data type with the weak spots of the other, one may be able to obtain 3D estimates of ionospheric electron density.

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