ABSTRACT

The Digital Portable Sounder (GPS) probes the ionosphere and makes real-time analysis of the data, by means of radio-wave transmission and reception. Furthermore, there are numerous satellites in orbit around the Earth carrying-out measurements of the ionospheric parameters. One of the most modern techniques for obtaining this data is the GPS (Radio Occultation) (RO). Using the above techniques it is possible to obtain the electron density profiles of the ionosphere. However, GPS is only sensitive to the ionosphere located above the maximum density peak, the upper ionosphere, located above the peak, is represented by a model. On the RO technique, using the FORMOSAT-3/COSMIC satellites, the profiles were inferred indirectly using the fade signal crossing the Earth’s atmosphere and undergoing refraction. The electron density is obtained by an Abel Transform of one of the 24 GPS satellites available at 800 km (mean) and released by one of the 6 COSMIC satellites at an altitude of 400 km. COSMIC and GPS profiles are atmospheric because they can be used to calculate a comparison study between the values of the electron density peak (NmF2) and height (hmF2) obtained by the two techniques. This method has been used to compare the FORMOSAT-3/COSMIC with the Digisondes, since it is of direct procedural and analyzed by the Brazilian-occultations. The FORMOSAT-3/COSMIC MISSION AND THE RADIO OCCULTATION TECHNIQUE

RESULTS

Comparison of FORMOSAT-3/COSMIC data with ionosonde for three Brazilian stations

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In Figure 3 we show some electron density profiles to compare qualitatively the two probes. We selected satellite data taken on November 19 (Long.: 49° W; Lat.: 12° S) from the all sky imager in the São João do Cariri, a location close to Fortaleza, and it shows the presence of plasma bubbles. This bubble occurred during a quiet night (k = 1.5) and it was used to determine ionospheric profiles. The satellite, instead, seems to represent well the ionosphere under plasma bubbles irregularities. The vertical sounding technique is not appropriate to detect plasma bubble. This results seems to confirm that under strong spread F conditions ionograms shall not be used to determine ionospheric profiles. The satellite, instead, seems to represent well the ionosphere under plasma bubbles irregularities.

CONCLUSIONS

Most of the profiles (only a few examples were shown here) seem to be showing the same structure despite of longitudinal, latitudinal or even time differences between them. In some cases, in the comparison between ionospheric peak parameters from F3/C and Digisondes, we observed that the maximum density NmF2 shall not be considered in almost all the profiles analyzed. As pointed out by KELLEY ET AL. (2009) this could be due to the capability of the Abel transform in determining NmF2 better than hmF2. The profile satellite taken on November 19, 2007 shows the presence of a plasma bubble over Fortaleza. The all sky image also shows strong density depatures. The satellite image shows the plasma bubble as a bright feature. During the occurrence of steep electron density irregularities the corresponding ionogram becomes very uncertain. But only looking to the image picture we could determine the existence of a plasma bubble. This bubble occurred during a quiet night and it is not part of the regular bubble development process that occurs under equinox and summer over low latitudes. It is well known that the vertical sounding technique is not appropriate to determine plasma bubble. This results seems to confirm that the ionosonde should not be used to determine ionospheric profiles. The satellite, instead, seems to represent well the ionosphere under plasma bubbles irregularities.

REFERENCES