IONOSPHERIC TOTAL ELECTRON CONTENT AND CRITICAL FREQUENCIES OVER NICOSIA AT SOLAR MINIMUM

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Abstract. This paper describes some of the results obtained by analyzing ionospheric vertical total electron content (vTEC) data set evaluated from nico $(35.1^{\circ}N, 33.4^{\circ}E)$ groundbased GPS station and its equivalent slab thickness, as well as the F2-layer critical frequency foF2 and propagation factor M(3000)F2 from nearby new DPS-4 ionosonde station Nicosia $(35.1^{\circ}N, 33.3^{\circ}E)$ during the period of extreme solar minimum. It reveals a number of unusual events, all of which exhibited some form of large short-lived storm-like vTEC and foF2 enhancements related exclusively on small-magnitude solar-terrestrial disturbances.

1 INTRODUCTION

Ionospheric vertical total electron content vTEC and the F2-layer critical frequency foF2, and their variability in space and time can have significant effects upon radio communications and navigation systems that have crucial nowcasting plus forecasting requirements (Skone et al., 2004)[1]. One of the features, which could be of serious concern in these considerations, has recently been observed over European sector during smallmagnitude solar-terrestrial disturbances in 23^{rd} solar cycle. It is an enhancement of the dayside ionospheric vTEC and foF2 values that can be as large as a factor of two or more (e.g. Cander and Ciraolo, 2010)[2]. By continuing this study during the period of extreme solar minimum in 2009, here we present some results on vTEC and foF2 sensitivity to a weak geomagnetic disturbance focused at the single location of the low mid-latitude ionosphere over Nicosia and discuss their consequences on ionospheric monitoring and modelling.

2 RESULTS

In 2009 solar activity was very low and geomagnetic field activity was most of the time at quiet level. Although it is very well known that when influential sources are essentially constant for a few days (e.g. intervals of geomagnetic quiet), the ionosphere is still variable, the extent of this variability in a few identified cases in our study was unusual. In this paper we describe only the results for the 20 - 22 November 2009 example. The vertical TEC values at ground-based GPS station nico for 20 (blue line), 21 (red line). and 22 (yellow line) November 2009 are displayed in Figures 1. It is to be noted that there were small differences between the vTEC values observed on 20 and 22 November. However, a stronger positive storm-like effect can be seen in the data at nico on 21 November from 0900 UT to 1500 UT. The vTEC is increased from 12 to 16 TECU (a total electron content unit is $10^{16} electron/m^2$ column density) during the 3-h period. At the same time, the foF2 is increased from 5.5 to 8 MHz over Nicosia (Figure 1). During the period in question, 20-22 November 2009, the solar activity was very low (F10.7=76). the Ak index values were 2, 10 and 6 respectively and there were no X-ray flares in M and X classes (http://www.sidc.be/products/bul). In conclusion, we emphasize that similar picture has appeared in most of the events that have been studied but not reported here (Cander and Haralambous, this Conference).



Figure 1: Daily values of vTEC with 5-min resolution over nico and foF2 with 15-min resolution over Nicosia during 20-22 November 2009

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