Contribution of solar wind parameters to the variation of ionospheric activity in the African equatorial zone

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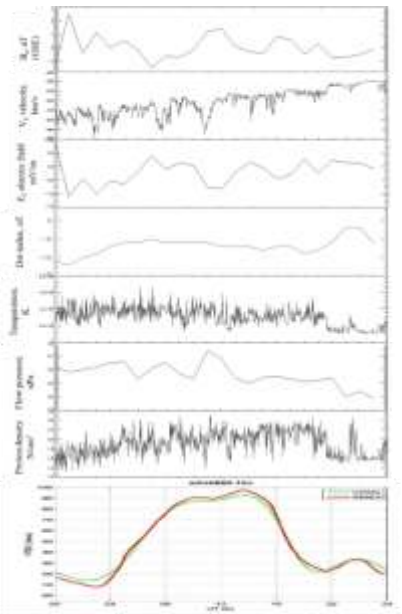
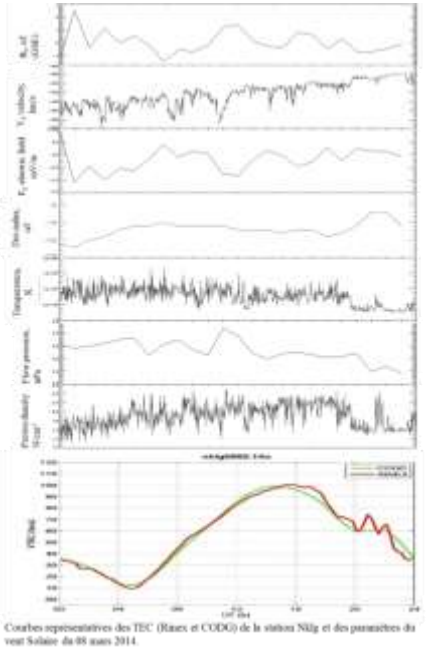
Abstract: Total electronic content of the ionosphere was determined from Rinex, CODG, DCB and YUMA files provided by ground receiving stations (adis (Ethiopia), bjco (Benin), mbar (Uganda), nklg (Gabon)). These files were used to plot the local TEC Rinex and global TEC CODG curves during geomagnetically quiet days of the year 2014 (08-09 March as well as 18-19 July), as well as the solar wind analysis parameters (fields interplanetary magnetic and electric forces, disturbance during solar storms (Dst), speed, temperature, pressure, proton density of the solar wind) to examine their contribution to the variation of ionospheric activity. The results made it possible to interpret the monthly and annual variations of the TEC. The TEC curves of the stations show a well-marked diurnal variation with maximums between 12 and 16h UTC and minimums between 0h-4h and 20h-24h. In March, these maxima are more pronounced than those of July. In March, there are small maximums on the TEC curves at night and at evening and very early hours that cannot be explained by sunshine. They are due in this equatorial zone in particular to the fountain effect by which the electric field ionizes the E layer of the ionosphere. This effect would be triggered by the combination of certain parameters of the solar wind. Indeed, the variation of pressure within the solar wind seems to be the cause of the variation of speed and temperature. Consequently, the parameters of the solar wind have a significant influence on the variations of the ionospheric activity observed.

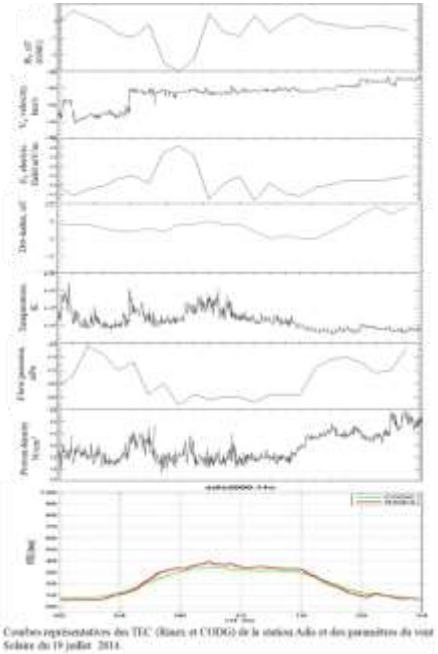
Key words: *equatorial ionosphere, total electron content, solar wind parameters.*



Courbes représentatives des TEC (Rinex et CODG) de la station Adis et des paramètres du vent Solaire du 08 mars 2014.

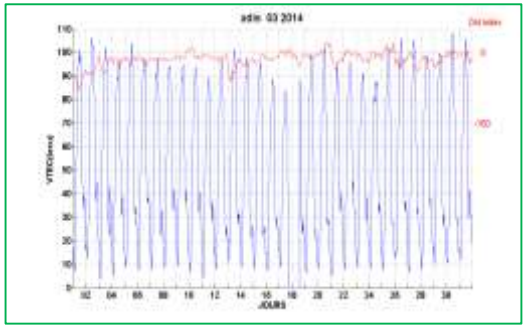


Courbes représentatives des TEC (Rinex et CODG) de la station Nklg et des paramètres du vent Solaire du 08 mars 2014.



Courbes représentatives des TEC (Rinex et CODG) de la station Adis et des paramètres du vent Solaire du 19 juillet 2014.

The TEC Rinex curves for the month of March on geomagnetically calm winter days (January to April) have larger peaks than those for the month of July on the geomagnetically calm days of summer (June to August). This shows the seasonal dependence of the ionospheric density. It appears from this analysis that for the month of March, the curves generally show a relatively high variation, which is accompanied by a fairly fast solar wind with fairly high temperatures. Sufficiently large pressures and densities not accompanied by sufficiently pronounced velocities and temperatures do not impact the variations of the TEC in a constant manner. This is not the case for the speed and the temperature which directly influence the variation of the TEC.



Procedure for automatically obtaining the daily and monthly TEC

We present using an algorithm, as shown in the figure above, the procedure for automatically obtaining the TEC depending on the time (UT: Universal Time). This algorithm shows us the TEC RINEX (local TEC) compared to the TEC CODG (global TEC). The one on the right gives from the daily text files the monthly TEC curves associated with the monthly Dst.