



Study of solar flare effects on positioning accuracy over west Africa

O. K. Obrou⁽¹⁾, A. S. Mahie⁽¹⁾, and J. N. Yao⁽¹⁾

(1) Laboratoire de Physique de l'Atmosphère, Université Félix Houphouët Boigny, 22 BP 582 Abidjan 22

The sun is the main source of space weather. A solar flare can be defined as the sudden and explosive release of energy (10^{19} - 10^{25} J) from a localized active region of the Sun usually near a complex group of sunspots, mainly in the form of electromagnetic radiation across the entire spectrum [1]. When this radiation propagates towards the Earth, it affects the electrodynamic of the upper atmosphere such as the so-called ionosphere. The ionosphere is a medium subject to solar-terrestrial interactions and its disturbed conditions can affect the trans-ionospheric transmissions of radio waves. The Global Navigation Satellite System (GNSS) rely on signal propagation through the ionosphere are affected by the sudden variation of this propagation medium.

The current work is the study of the positioning accuracy during a solar flare event. The work covers 2014 and 2017, two years of low and high solar activities respectively and 22 selected cases of X and M class of solar flare. Data used are those of sixteen (16) GNSS stations located in west Africa (Ivory Coast, Benin, Senegal, Ghana, Burkina Faso) together with X ray and EUV data recorded by the GOES satellite. The positions of the station have been inferred with the GNSS Laboratory Tool (gLAB) [2].

The results show a rapid variation of the time rate of change of the TEC that is perceived within a time shift of 12 mn. The time rate of change of TEC reach in some cases 86 TECu. The positioning accuracy is more important in height than in horizontal plane.

References

- [1] N. Gopalswamy, "The Sun and Earth's Space Environment". *Proceeding of the 2009 International Conference on Space Science and Communication*, Negeri Sembilan, Malaysia, 5-10.
- [2] M. Hernández-Pajares, J. Juan, J. Sanz, P. Ramos-Bosch, A. Rovira-Garcia, D. Salazar, J. Ventura-Traveset, C. López-Echazarreta, and G. Hein, "The ESA/UPC GNSS-Lab Tool (gLAB)", in *Proceedings of the 5th ESA Workshop on Satellite Navigation Technologies: Multi-GNSS Navigation Technologies The Beginning of a New Age (NAVITEC 2010)*, ESA/ESTEC, Noordwijk, The Netherlands, Dec. 2010. [Online].