GPS as a Solar Flare EUV flux-meter

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ABSTRACT

The capabilities of the Global Navigation Satellite Systems (GNSS), like the Global Positioning System (GPS), as ionospheric sounder, are well founded after an intensive development during the last 25 years (see two summaries for instance in Bust & Mitchell 2008 [1], and Hernández-Pajares et al. 2011 [2]). In this presentation we will show the last findings on a new application of GNSS ionospheric sounding: the indirect but accurate estimation of the Solar Flare EUV flux rate. Indeed, the short time scale of the Solar Flux increase during Solar Flares allows an accurate modeling of the phenomena by means of a simple First Principle based modeling of the atmospheric sudden overionization. This is true in particular for the EUV radiation, very geoeffective in the Earth ionosphere. Following this model, the ionospheric overionization associated with a Solar Flare should be able to be described by a linear function of the cosinus of the solar-zenithal angles on the illuminated hemisphere, being the slope (the so called GNSS Solar Flare Indicator, GSFLAI) directly dependent on the Solar EUV flux rate. The simultaneous and continuous global real-time measurements of dual-frequency GNSS carrier phases, provides a consistent and accurate proxy of the Solar EUV flux rate during strong, mid and weak Solar Flares. This has been shown after analyzing one Solar Cycle of global GPS data, comparing with direct EUV measurements from solar probes (more details can be found in Hernández-Pajares et al. 2012 and Singh et al. 2015). The advantages of this new GPS-based technique, regarding to the classical solar-probe ones (in terms of high accuracy and low budget), its usage for an absolute solar flare calibration (taking into account the distance to the solar disc), and the possibilities of contributing to study strong stellar bursts, will be discussed as well.

Key words: Solar Flares, Ionosphere, GNSS

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