Daytime GNSS signal fading and scintillation associated with solar burst events

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Daytime GNSS data from Brazilian longitudinal sector were analyzed during some solar burst events of different intensities. These events were chosen using data from the RF solar observatories and the GOES X-ray flux. Even during low solar activity period, the bursts can occur with durations of a few tens of seconds up to few hours depending on the intensity. During these events, GPS, GLONASS, Galileo constellations and SBAS signals presented simultaneous fadings up to 5 dBs and 10 dBs in the L1 and L2 frequencies, respectively. The daytime S4 amplitude scintillation indices up to 0.4 were also simultaneously observed in all satellites signals. With the aim of understanding the physical mechanisms responsible for such abnormal GNSS signal behavior during these events, magnetometer and Digisonde data were also analyzed. Large variation in the magnetometer H component and in the ionogram parameters were observed compared to quiet time. During some of the analyzed events the ionospheric F layer base represented by ḥF presented large values following data gaps due to the total or partial absorption of the HF wave caused by the increased D region density due to the solar burst. Depending on the solar burst intensity and duration the GNSS receivers may fail to produce accurate navigation solution, thus making it important to study this kind of phenomenon. This work may contribute also to better understand the physics of the burst effects in the ionosphere and how to mitigate their effects on the positioning and navigation systems oriented by satellite.

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