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Geomagnetic Storm and Substorm effect on the total electron content using GPS at subauroral latitudes

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The aim of this work is to characterize the ionospheric electron content variability during a geomagnetic storm and substorms during it. This study is based on the vertical total electron content (VTEC) computed from global positioning system (GPS). GPS stations located at sub-auroral latitudes are taken into account for analyzing the signatures of the current wedge formed during the substorm expansion phase. The study is focused on the geomagnetic storm befallen on April 6 and 7, 2000 (near the equinox). Because our study is based on tying the geomagnetic disturbances with the variability of VTEC in local time, the GPS stations are located at different geographic longitude. The main results are: a) when the geomagnetic storm starts between pre-midnight and dawn, a minimum of VTEC is recorded, lasting all the long day (ionospheric storm negative phase); also the nighttime electron content may decrease below the corresponding for quiet days; but near the 60ž of latitude the ionization polar tongue can be observed at noon, superimposed to the negative phase; b) the VTEC computed by GPS station, placed lower than 50ž, recorded a positive phase when the geomagnetic storm starts between dawn and noon, or a dusk effect if it starts at noon, while those located between 50ž and 60ž show a sudden increase and later sudden decrease to nocturnal values, c) when it starts between afternoon and sunset the ionospheric negative phase is recorded during the next day, and if the GPS station are located at higher latitude than 50ž the VTEC representation shows the nocturnal end of the ionization polar tongue. Expansion phases of substorms are shown as small VTEC variations recorded for a short time: decreases if the substorm happens between dawn and midday; enhancements during the fall of the ionospheric positive phase; nevertheless for

a GPS station near the foot of the field aligned current of the expansion phase the enhancement can reach the 20 VTEC in auroral regions.