

INFLUENCE OF CME-DRIVEN GEOMAGNETIC STORM AT LOW LATITUDE BRAZILIAN SECTOR

Abstract

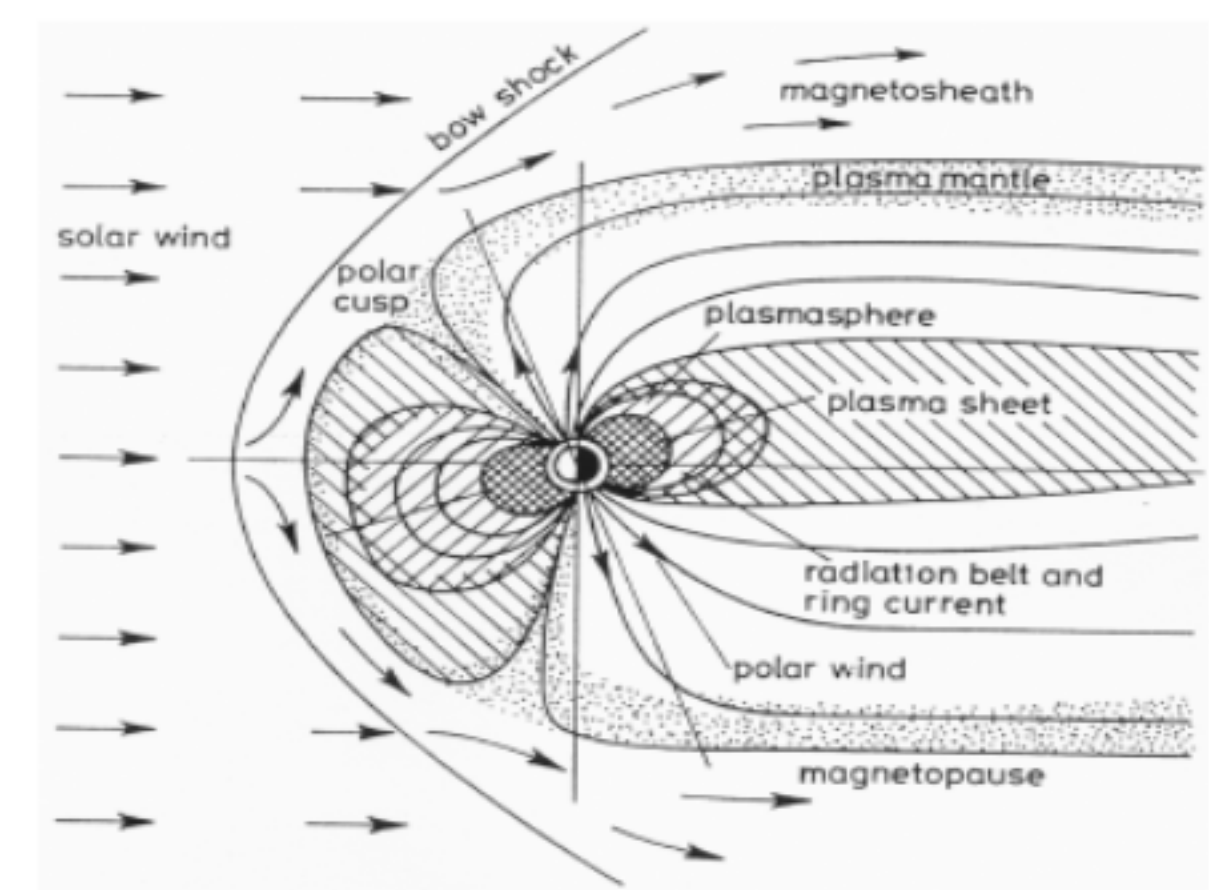
The geomagnetic perturbations in ionospheric parameters and total electron content (VTEC) were observed and compared with five quietest average days (5Q days). The analyzed CME-driven storm occurred on 28-31 October. The CMEs-driven storm peaked thrice in Sym-H values reaching at -200 nT on 29 October and -350 nT , -450 nT at around 00:00 UT, and 23:00 UT respectively on 30 October. The F layer of the current days observes a sudden uplift over the five quietest average days in the main phase but tends to move in phase during the recovery. The F layer shows a strong uplifting with a decrease in foF2 resulting in the generation of spread F during the storm phase. The "VTEC" observations at Cachoeira Paulista show unusually high TEC values at around 11:00 UT. This enhancement in TEC might be possible effect of the southward movement of the interplanetary magnetic field, which produces loading of the interplanetary particles in the magnetosphere-ionosphere, which intend increases the current system mechanism.

Methodology

The solar wind speed, in V_{sw} (km/s); interplanetary magnetic field (B_z) in (nT); the electric field (E_y) in (mV/m); symmetric disturbance index (sym-H; equivalent to Dst) in (nT); the auroral electrojet index (AE) in (nT) was considered. We analyzed ionograms taken from a Digisonde installed at the low latitude station, Cachoeira Paulista (22.5°S , 45°W , dip latitude 17°S) and Total electron content (VTEC) from GPS observations at Rio de Janeiro (28.8°S , 43.3°W , dip latitude 19.8°S) in October 2003. The average of the five quiet days, 5QD (based on the Kp index) was calculations. The ionospheric parameters, foF2 (F layer plasma density), hmF2 (F layer true height), and h'F, (F layer virtual height), were analyzed. The raw data was processed at 15mins intervals.

Introduction

The ionospheric storm which describes the variations in the ionosphere due to geomagnetic storm has received extensive studies due to the complexity of the physical mechanisms such as electric fields, neutral wind, and composition changes over the past decades. The strong interplay between the magnetospheric, ionospheric and atmospheric processes, are substantially modified during geomagnetic storms [1]. Ionospheric electrodynamics revealed that Prompt penetration fields produce remarkable effects in the ionosphere as EXB plasma drift is severely affected. The prompt penetration fields are produced during the southward turning of the interplanetary magnetic field. In the past decades, both theoretical and experimental studies have highlighted the characteristics of prompt penetration of magnetospheric convection electric field from high to low latitudes and the severe effects on low latitude electrodynamics [2]. The Earth's magnetosphere is deformed by the supersonic ionized plasma explosions during magnetic storms, as formed by the interaction of the solar wind with the Earth's magnetic field. Figure 1.0. indicate the reconnection process of magnetic field (IMF) and geomagnetic field.



Results

The sudden southward turning of the B_z at 06:10 UT on 29 October accompanied by a storm's sudden commencement marked the storm onset seen as a large intensification of the AE between the interval (06:00 to 00:00 UT). Sym-H shows variations during the growth and partial recovery of the two storms on 29 October. The first storm occurred between an interval of (06:10 to 10:00 UT) with dip Sym-H -200 nT and the two main storm phases, thus on 29 October between (20:00 to 00:00 UT) with dip Sym-H -350 nT until 30 October shown in Fig 2A. The possibility of neutral composition changes (O/N_2 ratio) contribution during storm time was also varify as depicted in Fig 2B. Based on O/N_2 data, it is possible to observe that during the storm, no significant neutral composition changes in South America that could create TEC changes were observed during this period.

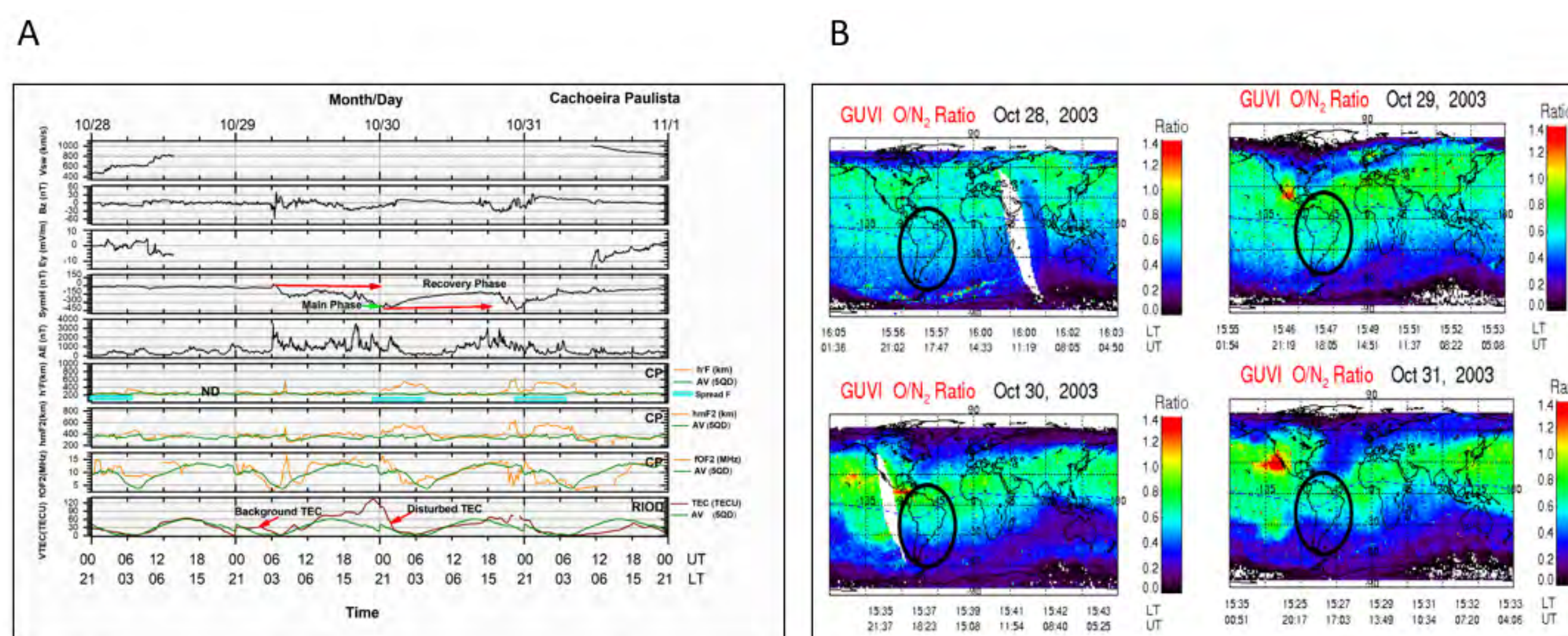


Fig. 2 A. The variations of V_{sw} , E_y , Sym H, AE indices and ionospheric parameters h'F, hmF2, foF2 and total electron content (VTEC) during the period 28-31 October 2003 observed at south crest of EIA (Cachoeira Paulista (CP)), Brazil. The average quiet-day variations of h'F, hmF2, foF2 (Olive line) including spread F bar and Fig B. shows the neutral composition changes (O/N_2 ratio).

Conclusion and perspective

- ▶ The "VTEC" observations at Cachoeira Paulista show unusually high TEC values at about 11:00 UT, in comparison to Sao Luis indicating the development of a strong fountain effect during the storm main phase.
- ▶ The F-region shows a strong uplifting with a decrease in foF2 resulting in the generation of spread F during the storm phase.

Referencias

- [1] Abdu, M. A. (1997). Major phenomena of the equatorial ionosphere-thermosphere system under disturbed conditions. *Journal of Atmospheric and Solar-Terrestrial Physics*, 59(13), 1505-1519.
- [2] Abdu, M. A., Sobral, J. H. A., De Paula, E. R., Batista, I. S. (1991). Magnetospheric disturbance effects on the equatorial ionization anomaly (EIA): An overview. *Journal of Atmospheric and Terrestrial Physics*, 53(8), 757-771