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Study of Ionospheric Disturbances Produced During Interplanetary Magnetic Field Oscillatory Event Using GNSS Observations

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Abstract

The solar wind has influence on the magnetospheric convection. Because of the variations of the interplanetary magnetic field (IMF) and solar wind dynamic pressures (PSW) can change the magnetospheric electric field and affect the mid- and low-latitude ionosphere through penetration process. Huang et al. (2002) studied quasi-periodic ionospheric disturbances using Millstone Hill radar observations and associated these disturbances with penetrating magnetospheric electric fields.

In our work, the vertical total electron content (VTEC) obtained from GNSS measurements shows the ionospheric variability during a transient and oscillatory event in the interplanetary magnetic field (IMF), consequently in magnetospheric electric fields. The global coverage of GNSS observations allows us to calculate the VTEC at distributed permanent geodetic stations with different geomagnetic latitudes and local times. Therefore, we can analyze the penetration of magnetospheric electric fields when the ionospheric conditions are different.

Our preliminary results show almost periodic variations in VTEC at stations close to the Millstone Hill radar. The calculated ionospheric disturbances are similar to those obtained in the electron density recorded in the radar. We implement numerical tools like Wavelet transform and Wavelet Coherence to study the oscillation of studied parameters and the cause-effect relationship between them. We conclude the relationship between the ionosphere and IMF is higher at mid-high latitudes and local times close to noon