High-Latitude GPS TEC Changes Associated With Sudden Magnetospheric Compression

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ABSTRACT

The Earth's ionosphere is embedded in the "magnetosphere"; a cavity carved by the interaction of the high-speed solar wind and its "frozen-in" magnetic field with the terrestrial magnetic field. The solar wind is inherently non-steady, with its magnetic field, density, and flow speed varying on a range of time and amplitude scales. Variations in the solar wind and its magnetic field are known to be the major driver of variations in the high-latitude ionosphere. Using ionospheric total electron content (TEC) measured by Global Positioning System (GPS) receivers of the Canadian High Arctic Network (CHAIN), we provide clear evidence for a systematic and propagating TEC enhancement produced by the compression of the magnetosphere due to a sudden increase in the solar wind dynamic pressure. The magnetospheric compression is evident in the THEMIS/GOES data. Application of a GPS triangulation technique revealed that the TEC chnages propagated with a speed of ~ 6 km/s in the antisunward direction near noon and ~ 7 km/s in the sunward direction in the pre-noon sector. This is consistent with the scenario of increased ionospheric convection due to the magnetospheric compression. The characteristics of the TEC changes seems to indicate that they are due to the particle precipitation associated with the sudden magnetospheric compression.

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