

Solar-Terrestrial Investigation during the 2009 Equinoxes at Bipolar Conjugate Points with Global Positioning System

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Global Positioning System (GPS) had become an important tool for exploring the phenomenon in the near-Earth environment. This method is also able to provide an appropriate platform for the study of solar-climate relationships. Using the ionospheric total electron content (TEC) as a measure solar activity and atmospheric precipitable water vapor (PWV) as the terrestrial response, which are both derived from ground-based GPS receiver, the influence of solar activity on weather/climate change can be explained. This paper presents the characterization of TEC and PWV between the Arctic and Antarctic regions during the 2009 equinox. The relationship between upper and lower levels of the atmosphere to study the sun-earth coupling is observed at bipolar conjugate points through this event. Results showed that the variations of TEC and PWV have an asymmetrical response at the beginning of the equinox with a correlation coefficient are -0.70. Correlation coefficient between TEC and PWV at the onsets of the vernal equinox (VE) and autumn equinox (AE) was moderate with an R-squared of 0.61 and 0.60, respectively, which are all statistically significant at the 99% confidence level ($p < 0.01$), on average. This relationship reflects that the intensity of solar activity to expose the lower atmosphere through the conjugate points is appeared in accordance with the variation of the seasonal cycle of the Sun, where TEC and PWV have clearly shown an opposite relationship.