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Control of interplanetary solar wind sector polarity on changes in the ionosphere

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Solar sector polarity effects on the ionosphere may provide some clues in understanding of the ionospheric day-to-day variability. In this study, a solar-terrestrial connection ranging from solar sector boundary (SB) crossings, geomagnetic disturbances and ionospheric perturbations has been demonstrated. Superposed epoch analysis confirms that the increases in interplanetary solar wind speed within three days after SB crossings and the decreases in solar wind dynamic pressure and magnetic field intensity immediately after SB crossings. Furthermore, the interplanetary magnetic field (IMF) Bz component turns from northward to southward in March equinox and June solstice as the Earth passes from a solar sector of outward to inward directed magnetic fields, whereas the reverse situation occurs for the transition from toward to away sectors. For the same solar sector polarity there are opposite IMF Bz components between March and September equinox, and between June and December solstice. The F2 region critical frequency (foF2) covering about four solar cycles and total electron content (TEC) during 1998-2011 are utilized to extract how the ionosphere reacts to the interplanetary solar wind variations linkage of SB crossings. foF2 vary within the range of $\pm 15\%$ on average. The responses of the ionospheric TEC to SB crossings exhibit complex temporal and spatial variations and have strong dependencies on season, latitude, and solar cycle. This effect is more appreciable in equinoctial months than in solstitial months. In September equinox, relative variations of foF2 at noon are depressed at high latitudes and enhanced in low-equatorial latitudes during IMF away sectors.
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