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Predawn ionospheric heating observed by Hinotori satellite

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Predawn ionospheric temperature has been known to increase with conjugate sunrise. This paper presents the onset time of predawn ionospheric heating and heating rate at around 600 km height globally using Hinotori electron temperature data for magnetically quiet ($K_p < 4$ and $Dst > -50$ nT) medium to high solar activity conditions. The analysis of the data shows that the onset of predawn ionospheric heating occurs at nearly the same solar zenith angle (SZA) of the conjugate point at low latitudes where the geomagnetic field line is shorter than about 5000 km. However, at higher latitudes with longer field lines, the conjugate SZA decreases with increasing field line length. In addition, the heating rate decreases with increasing field line length until the field line becomes about 5000 km long, and the rate remains nearly constant for longer field lines. The conjugate SZA increases with increasing solar activity (F10.7) until F10.7 reaches about 200, and the conjugate SZA remains nearly constant for higher F10.7. The observations indicate that the photoelectron flux causing predawn ionospheric heating is attenuated by scattering in the high-altitude (>600 km) ionosphere and plasmasphere.

Keywords: ionosphere, photoelectron, plasma heating, electron temperature