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Dependence of premidnight field-aligned currents and particle precipitation on solar illumination

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In the present study we statistically examined the dependence of large-scale field-aligned currents (R1/R2) and particle precipitation in the premidnight sector on solar illumination at the ionosphere. The energy flux and average energy of precipitating electrons and ions are examined for downward R2 and upward R1 currents. Results are summarized as follows: (1) The R1 current density is larger in the dark hemisphere, whereas the dependence of R2 density on solar illumination is unclear; (2) For R1 currents, the electron energy flux is larger and the average electron energy is higher in the dark hemisphere; (3) In R2 currents the electron energy flux is significantly lower than in R1 currents, but a similar preference for the dark hemisphere is found. The average electron energy is similar between the two hemispheres; (4) For both R1 and R2 currents, ion precipitation is more intense and energetic in the dark hemisphere; (5) For a given FAC density, whether R1 or R2 currents, both electron and ion precipitation is more intense and energetic in the dark hemisphere. We estimated the height-integrated Pedersen conductivity from electron precipitation and solar illumination and found that in the dark hemisphere the absence of solar illumination is often overcompensated by more intense and energetic electron precipitation. The interhemispheric difference in electron acceleration may be interpreted in terms of plasma density in the acceleration region, which is known to be significantly lower in the dark hemisphere, and therefore electrons need to be more accelerated along the field line to carry imposed currents.

Ref. Ohtani, S., S. Wing, G. Ueno, and T. Higuchi (2009), Dependence of premidnight field-aligned currents and particle precipitation on solar illumination, J. Geophys. Res., 114, A12205, doi:10.1029/2009JA014115.

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