Effects of Solar Illumination on the Auroral Electrojet Intensity

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The present study investigates the dependence of the local auroral electrojet (AEJ) intensity on the solar illumination by statistically examining the northward geomagnetic disturbance in terms of the solar zenith angle (SZA) χ. It is found that on the day side, both westward and eastward electrojets (WEJ and EEJ) are more intense for smaller χ suggesting that the solar EUV-induced conductance is the dominant factor for the AEJ intensity. On the night side, in contrast, the χ dependence of the AEJ intensity, if sorted solely by the magnetic local time (MLT), is apparently different for stations at different longitudes and in different hemispheres. However, if additionally sorted by the dipole tilt angle ϕ, a consistent pattern emerges. It is therefore suggested that although ϕ and χ are correlated, the dipole tilt angle and SZA have physically different effects on the local AEJ intensity. The nightside AEJ, especially the WEJ, tends to be more intense for small $|\phi|$. Moreover, whereas the WEJ is statistically more intense when the ionosphere is dark, the EEJ is more intense when sunlit. The preference of the WEJ for the dark ionosphere extends widely in MLT from premidnight to dawn, and therefore, it cannot be linked exclusively with the substorms or be attributed to the previously proposed processes of the preferred auroral precipitation in the dark ionosphere. Instead, it may be explained at least morphologically in terms of the conductance enhancement due to the diffuse auroral precipitation, which is also prevalent from premidnight to dawn and is more intense in the dark hemisphere.

Keywords: Auroral electrojets, Solar illumination, Ionospheric conductance, Dipole tilt, Solar zenith angle, Diffuse aurora

