Dependence of the Auroral Electrojet Intensity on the Solar Zenith Angle and Dipole Tilt

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The present study investigates the dependence of the local auroral electrojet (AEJ) intensity on solar illumination by statistically examining northward geomagnetic disturbances in the auroral zone in terms of the solar zenith angle SZA. It is found that on the dayside, both westward and eastward electrojets (WEJ and EEJ) are more intense for smaller SZA suggesting that the solar EUV-induced conductance is the dominant factor for the AEJ intensity. On the nightside, in contrast, the SZA dependence of the AEJ intensity, if sorted solely by the magnetic local time (MLT), apparently depends on the station longitude and hemisphere. However, if additionally sorted by the dipole tilt angle DTA, a consistent pattern emerges. That is, although SZA and DTA are correlated, the SZA and DTA have physically different effects on the AEJ intensity. The nightside AEJ, especially the WEJ, tends to be more intense for smaller |DTA|. Moreover, whereas the WEJ is statistically more intense when the ionosphere is dark, the EEJ is more intense when it is sunlit. The preference of the WEJ for the dark ionosphere prevails widely in MLT from premidnight to dawn, and therefore, it cannot be attributed to the previously proposed processes of the preferred monoenergetic or broadband 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.