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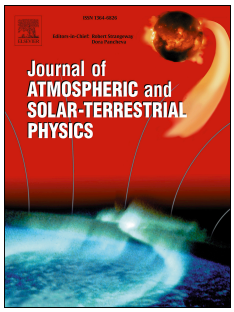

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Solar wind dependence of electric conductances and currents in the auroral zone

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Abstract

Based on 20 years-long data base of EISCAT incoherent scatter radar and IMAGE magnetometer observations in Scandinavia, we investigate statistically the ionospheric conductance variations in the dark nightside auroral zone. We focus on the relationship of precipitation-caused conductances with the variations of local equivalent current and global AL index, as well as on their dependence on the solar wind (SW) parameters. In terms of paired correlation, the main SW drivers for AL index and for the Pedersen and Hall conductances (Σ_P and Σ_H) are the SW merging electric field (characterized, e.g., with the Kan-Lee function, E_{kl}) and the solar wind velocity V_{sw}. The relative importance of these SW drivers varies. Whereas E_{kl} is the main driver of AL index, the role of V_{sw} increases for the conductances so that it outruns the E_{kl} as the main driver for the Hall conductance. Quantitatively this dependence is represented as $\Sigma_H = (7.7{*}V{+}1.75{*}V^2){+}(5.7{*}E{-}0.86{*}E^2){-}6.1$ Siemens, where E and V are E_{kl} and V_{sw} normalized with $< E_{kl} >= 0.79$ mV/m and $< V_{sw} >= 429$ km/s. The strongest influence of V_{sw} is, however, observed for the Hall-to-Pedersen conductance ratio $R_{HP} = \Sigma_H/\Sigma_P$, indicating solar wind velocity control of the electron acceleration. Physically the energization is a major factor which contributes to the large conductance values. On the nightside, local equivalent currents are significantly controlled by the local Hall conductance (CC=0.78)

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