Information poster

Electric field and conductance control of electrojet currents in the auroral region

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The magnetosphere and solar wind are coupled to the ionosphere through the Earth's magnetic field lines. This coupling is described by various auroral phenomena such as the ionospheric electric field, particle precipitation and resulting enhanced conductance, and electrojet currents. The Imaging Riometer for Ionospheric Studies (IRIS) facility in Kilpisjarvi, Finland uses a 49-beam array to measure cosmic noise absorption which is a measure of particle precipitation and conductance. This instrument is used in conjunction with the tri-static electric field measurements from the European Incoherent Scatter radar (EISCAT) and magnetic perturbation measurements from IMAGE magnetometers representative of the electrojet currents in the E-region of the ionosphere. It is shown that the electrojet currents are controlled by both enhanced conductance and electric field but with the relative importance of these two factors varying with magnetic local time (MLT). The correlation between the current and electric field (absorption) is the highest near magnetic noon 12–15 MLT (midnight 00–03 MLT) as expected. It is demonstrated that the conductance-dominated region is wider than previously thought extending from 21 to 09 MLT, whereas the electric-field-dominated region is antisymmetric with respect to magnetic-noon-midnight meridian extending from 09 to 21 MLT. The extension of the conductance-dominated region to the morning sector is interpreted as being due to the high-energy electron clouds drifting from the midnight sector eastward around the Earth, towards the morning sector where they eventually precipitate. It is also shown that during periods of high current-electric-field correlation, the electric field and absorption exhibit an approximately inverse proportionality relationship, which can be explained by limitation of the electrojet current by the magnetospheric voltage generator.