Electron energy budget in the polar ionosphere calculated from EISCAT radar data

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The electron fluxes precipitating at the top of the high latitude ionosphere contribute to the production of ionization, to the excitation of atmospheric constituents, and to the heating of the ambient electrons directly or by the secondary electrons. The initial precipitated electrons lose their energy by ionization creating the secondary electrons, by heating of the ambient electrons and neutrals until they are assimilated into the ambient electrons. The heated ambient electrons lose this energy to the neutral gas and ambient ions. Finally, the temperature gradient produced in the ionospheric plasma induces a heat flux. The budget equation determines the balance between the heating rate, the cooling rate, and the heat conduction for stationary conditions. The electron flux is estimated from the heating rate.

We have studied the energy budget of ionospheric electrons during the Halloween Storm of October/November 2003. The intensity of the cooling rate, and the heat conduction is quantitatively computed at each altitude in the ionosphere by EISCAT radar data. The heating rate is derived from remaining differences in the energy budget. We discuss the electron energy budget and the relationship between the heating rate and precipitating flux.