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Joule heating rate at high latitudes

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The solar wind energy penetrating the Earth's magnetopause goes to ring current particles, plasmoids (eventually ejected away from the magnetosphere), plasma sheet heating, precipitating particles, and to Joule heating of the polar ionospheres. The role of Joule heating rate in the global energy budget has been estimated even as 50–60%. This study shows statistical properties of the Joule heating rate, electric fields and conductances in the high latitude ionosphere. The results are based on a unique one-month measurement made by the EISCAT incoherent scatter radar in Tromsø (66.6 cgmlat) from 6 March to 6 April, 2006. The data are from the same season (close to vernal equinox) and from similar sunspot conditions (about 1.5 years before the sunspot minimum) providing an excellent set of data to study the MLT and K_p dependence of parameters with high temporal and spatial resolution. An important outcome of the study are the fitted functions for the Joule heating rate as a function of electric field magnitude, separately for four MLT sectors and two activity (K_p <3 and K_p ≥ 3) levels. The results show that in the midnight sector, electric fields increase with decreasing conductance, whereas the opposite relationship holds on the dayside. The nightside behaviour is indicative of ionosphere-magnetosphere coupling in the vicinity of auroral arcs.