Geophysical Research Abstracts
Vol. 12, EGU2010-2563, 2010
EGU General Assembly 2010

Modulation of ionospheric conductance and electric field associated with pulsating aurora

Keisuke Hosokawa (1), Yasunobu Ogawa (2), Akira Kadokura (2), Hiroshi Miyaoka (2), and Natsuo Sato (2)

(1) University of Electro-Communications, Information and Communication Engineering, Tokyo, Japan (hosokawa@ice.uec.ac.jp), (2) National Institute of Polar Research, Tokyo, Japan.

We present, for the first time, a quasi-periodic modulation of ionospheric parameters, associated with the occurrence of pulsating auroras, such as electron density, conductance, and electric field. In March 2008, simultaneous campaign-based measurements of pulsating auroras were conducted over Tromsoe (69.60N, 19.20E), Norway, using an all-sky TV camera (ATV) and the EISCAT UHF system. During an interval within this campaign period, pulsating auroras, with periods of 8-17 s, were observed by the ATV in the morning local time sector (approximatelly 05 MLT). In this interval, quasi-periodic oscillations were identified in the raw electron density obtained by EISCAT. The electron density at lower altitudes in the E region (95-115 km) was enhanced by a factor of 3-4 immediately after the optical pulsation became "on". The height-integrated Hall conductance was also elevated by a factor of 1.5-2 almost in harmony with the electron density variation. The response of the electron density and Hall conductance to the appearance of the pulsating aurora was almost immediate. However, both did not decrease to the background level promptly after optical pulsation ceased. This was primarily because it took a few seconds for the electron density to decrease through recombination with ambient ions at these altitudes. Interestingly, electric field measurements performed by the remote antenna at Kiruna showed that redirection of the electric field occurred when the pulsating aurora was "on". We propose a model in which the enhancement of Hall conductance within patches of the pulsating aurora caused charge accumulation at the edges of the patches, and the electric field was then modified by the resulting polarization electric field. An estimation of the electric field modulation with this model well reproduced the actual electric field observations carried out by EISCAT, which confirmed the validity of the model. These results imply that the ionization caused by high-energy electron precipitation associated with a pulsating aurora has a significant effect on the ionospheric conductivity and current system. This modification of the ionosphere may facilitate characterization of the morphological features of pulsating auroras. In particular, modification of the electric field would affect the spatial structure of pulsating aurora patches, such as their motion and shapes.