Ionospheric variation during pulsating aurora

*Keisuke Hosokawa¹, Yasunobu Ogawa²

1. Department of Communication Engineering and Informatics, University of Electro-Communications,
2. National Institute of Polar Research

We have statistically analyzed data from the European Incoherent SCATter (EISCAT) UHF/VHF radars in Tromso (69.60N, 19.20E), Norway to reveal how the occurrence of pulsating aurora (PsA) modifies the electron density profile in the ionosphere. By checking 5 winter seasons (2007-2012) observations of all-sky aurora cameras of National Institute of Polar Research (NIPR) in Tromso, we have extracted 21 cases of PsA. During these PsA events, either UHF or VHF radar of EISCAT was operative and the electron density profiles were obtained along the field-aligned or vertical direction near the zenith. From these electron density measurements, we calculated \( h_{mE} \) (E region peak height) and \( N_{mE} \) (E region peak density), which are proxies for the energy and flux of the precipitating PsA electrons, respectively. Then, we examined how these two parameters changed during the evolution of 21 PsA events in a statistical fashion. The results can be summarized as follows: (1) \( h_{mE} \) is lower (the energy of precipitation electrons is higher) during the periods of PsA than that in the surrounding interval, (2) When \( N_{mE} \) is higher (flux of PsA electrons is larger), \( h_{mE} \) tends to be lower (precipitation is harder), (3) \( h_{mE} \) is lower and \( N_{mE} \) is larger in the later magnetic local time, (4) When the AE index during the preceding substorm is larger, \( h_{mE} \) is lower and \( N_{mE} \) is larger. These tendencies are discussed in terms of the characteristics of particles and plasma waves in the source of PsA in the magnetosphere. In addition to the statistics of the EISCAT data, we carried out several detailed case studies, in which the altitude profiles of the electron density were derived by separating the ON and OFF phases of PsA. This allows us to estimate the true altitude profiles of the PsA ionization, which can be used for estimating the characteristic energy of the PsA electrons and better understanding the wave-particle interaction process in the magnetosphere.

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