Precipitation of high-energy electrons into the mesosphere associated with pulsating aurorae: Arase and EISCAT conjugate observations

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Wave-particle interactions with LBC near the equator cause electron precipitations with energies of about 1-100 keV, and pulsating aurora (PsA) is caused by intermittent precipitations. On the other hand, recent studies have shown that sub-relativistic/relativistic electrons with energies of several hundred of keV to several MeV are scattered by chorus waves, propagating to high latitudes along the field line and precipitate into the mesosphere at an altitude of 60-80 km simultaneously with PsA (Miyoshi et al., 2015, 2020, 2021). In this study, we investigate the high-energy electron precipitations during PsA events that occurred at Tromsø, Norway, from 02:00 to 06:00 UT on March 12, 2022, using data from the Arase satellite and EISCAT radars. Using the plasma wave data observed by Arase, we derived the pitch angle diffusion coefficient of electrons through interactions with whistler mode waves. The result indicates that the observed LBC causes the pitch angle scattering of electrons with 10-15 keV near the magnetic equator. The EISCAT observation showed electron density enhancement at 68 km altitudes and higher, which suggests that energetic electrons of 200-400 keV were precipitated (Turunen et al., 2009). The analysis of the pitch angle diffusion coefficients shows that such high-energy electrons can be scattered by LBC around 30 magnetic latitudes. Considering these analysis, we suggest that the pitch angle scattering by LBC along the field line causes wide energy electron precipitations from a few keV to more than 100 keV during PsA.