

Analysis of VLF Band Waves near the Sq Current System observed by S-310-44 Sounding Rocket

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The Sq current system is one of the ring current which occurs in the lower ionosphere in the winter daytime. It is caused the specific plasma phenomena such as electron heating and strong electron density disturbance. S-310-44 sounding rocket experiment was carried out to investigate the special phenomena near the Sq current focus, at 12:00 JST on January 15th, 2016. The rocket passed through the Sq current focus, and all the scientific instruments onboard the rocket worked successfully. In this experiment, the Electric Field Detector (EFD) observed the VLF band AC electric fields up to 6.4kHz in the altitude from 100km to 160km. We made the altitude profile of the electric field spectra, and found clear VLF band waves with the frequencies from 2kHz to 3kHz at the altitude about 100km. These VLF band waves are observed during only the rocket ascent. The Fast Langmuir Probe (FLP) observed that the electron temperature increase about 150K larger than the background in this region, and the frequency variation of the VLF band waves shows good correlation with the electron temperature as shown in Figure 1. According to the polarization analyses, the electric fields of the VLF band waves are oblique, not parallel to the magnetic field. The frequency range of this VLF band waves is consistent with the ion cyclotron frequency. These results suggest that the VLF band waves observed in this experiment are one of the ion cyclotron harmonic waves whose frequencies vary with the temperature ratio of the electron and the ion (T_e/T_i). We are going to investigate further the VLF waves observed by the rocket experiment, and clarify the heating mechanism of the electrons near the Sq current focus.

Keywords: Electric field, Sq current system, Sounding rocket measurement, Ionosphere

