Sq電流系中心の電子加熱現象解明のための観測ロケット実験速報－プラズマ波動観測－
Sounding rocket experiment to clarify electron heating phenomena in the Sq current focus - Plasma wave observation -

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In order to clarify electron heating phenomena in the center of Sq current focus in the winter ionosphere, the sounding rocket experiment S-310-44 was launched at 21:00 UT (12:00 JST) on January 15, 2016 at Uchinoura Space Center (USC). Plasma Wave Monitor (PWM) onboard the S-210-44 was successfully measured plasma waves in a frequency range from 300 Hz to 22 MHz along the rocket trajectory with apex altitude of 160 km, which is also confirmed to be near the Sq current focus by using data from magnetometer chain on the ground. The AC electric field was picked up with two antenna elements (EFD-ANT-1 and 2), and respectively amplified by two preamplifiers (EFD-Pre-1 and 2) of the Electric Field Detector (EFD). Then, two signals were fed to two PWM inputs (PWM-HF and PWM-VLF), respectively. The signal fed to PWM-HF was sampled at 81.92 MSPS and converted to spectrum in a frequency range from 20 kHz to 22 MHz with 400 frequency steps. The signal to PWM-VLF was sampled at 81.92 kSPS and converted to spectrum in a frequency range from 300 Hz to 20kHz with 400 frequency steps. These spectra were obtained every 125 msec. EFD antenna elements were stored on the ground and deployed at altitude of 85 km. So the altitude range from 85 km to 160 km are covered in ascent, and all altitude range below 160 km are covered in descent.
During the flight, the following phenomena were identified: (1) Harmonic emissions of lower hybrid resonance (LHR) were found in a frequency range from several hundred Hz to several kHz. Their frequencies changes depending on the ambient plasma density and likely on the ion compositions. They are enhanced at altitude around 100 km in ascent but not enhanced at the same altitude in descent. (2) Upper hybrid resonance (UHR) waves were not found in a frequency range around several MHz. In most previous sounding rocket experiment, UHR waves were found in altitude range higher than 200 km, and masked at altitude below 200 km by the artificial radio waves from the ground. In this experiment, the artificial radio waves were not so intense to mask the other emissions.
The LHR waves can be generated by various energy inputs. Baker et al. [2000] reported that LHR emissions were found in the sounding rocket experiment, and suggested that they are caused by the whistler waves from the thunderstorms on the ground. The enhancement of LHR only in ascent suggests that the energy source of LHR wave is localized in narrow area in E region of the ionosphere. Through the comparisons with data from the other instruments onboard the S-310-44 such as electron density and temperature (FLP), DC and AC electric fields (EFD), and currents (MGF), we will be able to discuss the energy source of the observed LHR waves in more detail.

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