

Plasma wave observations by the LFAS/WFC onboard the SS-520-3 sounding rocket

Takahiro Zushi^{*(1)}, Satoshi Kurita⁽²⁾, Keigo Ishisaka⁽³⁾, Yoshiya Kasahara⁽⁴⁾, Mitsunori Ozaki⁽⁴⁾, Satoshi Yagitani⁽⁴⁾, Yuto Katoh⁽⁵⁾, Takumi Abe⁽⁶⁾, Keisuke Hosokawa⁽⁷⁾, Yasunobu Ogawa⁽⁸⁾, Yoshifumi Saito⁽⁶⁾, Hirotugu Kojima⁽²⁾

(1) National Institute of Technology, Nara College, Nara, 920-1192, Japan, Email: zushi@elec.nara-k.ac.jp

(2) Research Institute for Sustainable Humanosphere, Kyoto University, Kyoto, Uji, 611-0011, Japan

(3) Toyama Prefectural University, Toyama, 939-0398, Japan

(4) Kanazawa University, Kanazawa 920-1192, Japan

(5) Tohoku University, Miyagi, 980-8578, Japan

(6) Institute of Space and Astronautical Science, Kanagawa, 252-5210, Japan

(7) University of Electro-Communications, Tokyo, 182-8585, Japan

(8) National Institute of Polar Research, Tokyo, 190-8518, Japan

It is known that ions in Earth's upper atmosphere are accelerated and escape into space at the polar cusp region. The SS-520-3 sounding rocket experiment was planned to understand the acceleration mechanism of escaping ions. Previous rocket experiments and satellite observations suggest that broadband extremely low frequency (BBELF) waves are involved in ion acceleration. For this reason, SS-520-3 is equipped with plasma wave and DC electric field instruments called the Low-Frequency wave Analyzer System (LFAS). The LFAS has two types of receivers that cover the different frequency ranges. WaveForm Capture (WFC) receives electric fields from 10 Hz to 10 kHz picked up by two orthogonal pairs of dipole electric sensors. Due to telemetry limitations, WFC performs only single-channel waveform observations until 330 s after launch, and dual-channels observations between 330 s and 630 s, when the rocket is expected to be near the apex height. In addition, WFC has a Software Wave-Particle Interaction Analyzer (SWPIA) to measure wave-particle interaction directly. SWPIA generates clock signals for synchronous observation of plasma wave and particle.

The SS-520-3 sounding rocket was successfully launched on November 4 2021 from Ny Alesund, Spitsbergen, Norway. During the flight, two receivers of the LFAS including the SWPIA were successfully operated. However, sensor problems caused two of the four sensor elements not to deploy and one to deploy later than planned. As a result, the LFAS observed electric field in an orthogonal monopole configuration. Figure 1 shows the waveform of the WFC ch1 and ch2 for a period of 20 s starting at 460 s. The large amplitudes that appear periodically are considered to be noise caused by the rotation of the rocket. At about 470 s, a broadband waveform different from the periodic noise was observed, and we consider it to be the BBELF wave. Several similar waveforms were obtained throughout the observation. In the presentation we will show an overview of the WFC results and a more detailed analysis of the BBELF waves.

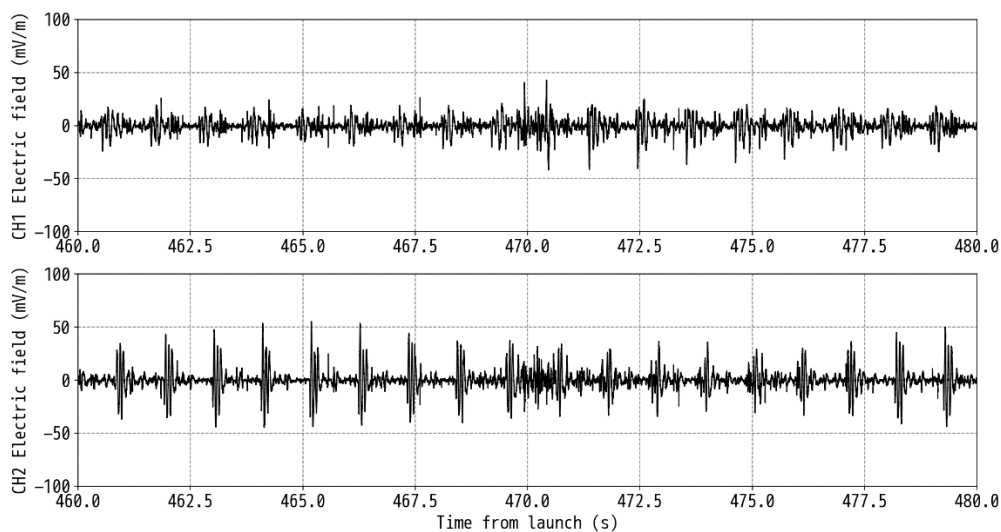


Figure 1. Waveform of the WFC ch1 (upper panel) and ch2 (lower panel) for a period of 20 s starting at 460 s.