PEM09-P10 Room:Convention Hall Time:May 27 18:15-19:30

Ground-based observation of fine structures of MF/HF auroral radio emissions

SATO, Yuka[1*] ; OGAWA, Yasunobu[1] ; KUMAMOTO, Atsushi[2] ; UENO, Genta[3]

[1]National Institute of Polar Research, [2]Graduate School of Science, Tohoku University, [3]The Institute of Statistical Mathematics

The terrestrial auroral ionosphere is a natural source of electromagnetic waves in the MF/HF ranges (up to 6 MHz) as well as well-known intense VLF/LF emissions (auroral kilometric radiation and auroral hiss). In the MF/HF ranges, three types have been identified at ground level: auroral hiss, medium frequency burst (MFB), and auroral roar. In addition, recent studies have resulted in ground-level detection of auroral kilometric radiation [LaBelle and Anderson, 2011] and discovery of a natural radio emission between f_{ce} and $2f_{ce}$ [Broughton et al., 2014]. Previous studies have also shown that observation of fine structures open new frontiers for these auroral radio emissions [e.g., LaBelle et al., 1995; Shepherd et al., 1997; Ye et al., 2006; Bunch and LaBelle, 2009]. In August 2008, we installed new instrumentation referred to as Auroral Radio Spectrograph (ARS) at Kjell Henriksen Observatory (KHO) in Svalbard (latitude 78.15^{o}N, longitude 16.04^{o}E, 75.2^o magnetic latitude). ARS consists of magnetic loop antennas whose size is 2.7 m $\times$ 6.0 m and two types of receivers: ARS-S and ARS-WF. The former is designed for the continuous measurement of wave spectra with a time resolution of 1 sec, and the latter is designed to obtain waveform data digitalized by an A/D converter with a sampling rate of 10 M samples/s (Nyquist frequency 5 MHz). Using ARS-WF, we succeeded in the first simultaneous measurements of structured $2f_{ce}$ auroral roar and optical aurora during 1710-1750 UT on February 1, 2011. In this event, the structured $2f_{ce}$ auroral roar showed temporal evolutions in frequency band width (300 Hz at minimum) and frequency drift rate (15 kHz/s at maximum). However, because ARS-WF recorded a series of 8 M samples (i.e., only 800-msec data) once every 40 sec, it was difficult to capture the entire temporal evolution of the structured auroral roar. In order to solve this problem, we carry out development and trial manufacture of a new receiver using USRP^{TM} (Universal Software Radio Peripheral). Such software-defined radio (SDR) receiver can implement high-speed, flexible digital signal processing of RF signals. This new receiver is designed to obtain higher-resolution spectra of RF signals pauselessly throughout the night in a wide frequency range up to 6 MHz. It is installed at KHO in Svalbard in March 2015. In this presentation, we also show detailed design of this receiver and some initial results.