Ground-based observations of MF/HF auroral radio emissions at three stations

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We started ground-based observations of MF/HF auroral radio emissons about 10 years ago at two stations (The Husafell Station, Iceland, September 2005; The Kjell Henriksen Observatory, Svalbard, September 2008) and found multiple unknown properties of MF/HF auroral radio emissons, e.g. polarization features [*Sato et al.*, 2008, 2015] and existence of a higher frequency component [*Sato et al.*, 2012]. To make a next siginificant step for a futher understanding of MF/HF auroral radio emissions, we have installed a new dedicated instrumentation at the KAIRA (Kilpisjärvi Atmospheric Imaging Receiver Array) site in Kilpisjärvi, Finland (Latitude: 60.07 N, Longitude: 20.76 E) in the summer of 2018. It is a passive receiving system designed to realize a high-resolution spectral, interferometric and polarization measurements using 4 loop antennas and a software-defined radio (SDR) receiver, USRP™ (Universal Software Radio Peripheral). This SDR receiver can implement high-speed, flexible digital signal processing of RF signals and obtain high-resolution spectra pauselessly throughout the night in a wide frequency range up to 6 MHz. One of the main research subjects of this project is radio emission spontaneously emitted from aurora. There are long-known three types of MF/HF auroral radio emissions 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 and discovery of a natural radio emission between f_{ce} and $2f_{ce}$. Investigation into the generation of these emissions not only offers a tool of great promise for remote sensing of ionospheric plasma processes and parameters but also gives the foundation for understanding various radiation mechanisms that occur in planetary magnetospheres and plasma in space. In combination with the long-term continuous observations in Iceland and Svalbard and future EISCAT_3D experiments, observation with this new instrumentation will provide a first-time opportunity to reveal spatiotemporal variations of macro and fine structures of MF/HF auroral radio emissions associated with substorm evolution. In this presentation, we show detailed specification of this new instrumentation and some initial results.

References

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