A study on low frequency radio bursts appearing on the dynamic spectra of HF waves obtained at Iitate

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Low frequency radio bursts appear in the lower frequency range of HF dynamic spectra obtained at Iitate. In general, this radio emission is impulsive with relative narrowband spectrum of a few megahertz. Possible source such as radio emissions from Jupiter, lightning, etc. has been examined. However, no basic features of the phenomenon such as the duration time of the pulse and strength etc. are clarified, and there has been no analysis of the occurrence probability based on a long-term, continuous observation.

In this study, in order to declare the characteristics and the radio source of the low frequency radio bursts, we analyzed data obtained by the Wideband Dynamic Polarimeter (WDP) system at Iitate Observatory for about one year. Radio signals, which are received by the log periodic antenna of the WDP system, are converted into left- and right- handed polarized components. Finally, radio spectra from 15 MHz to 40 MHz are obtained through a frequency sweeping technique, in which a full frequency spectrum can be obtained every 500 ms.

As a result of the analysis, it is found that intensity tends to decrease with frequency and, in many cases, pulse duration is shorter than 500 ms. These features are similar to that of spherics, which implies that the source of the low frequency radio bursts is possibly lightning. While spherics are the broadband emissions from VLF to SHF, the low frequency radio bursts have upper limit frequencies. It's suggested that they are determined by the reflection condition of the ionosphere such as plasma density and incident angle of the radio waves into the ionosphere and the low frequency radio bursts are lower frequency components of spherics reflected in the ionosphere.

In addition, it's shown that the low frequency radio bursts tend to appear the most frequently in the daytime of winter and in the early morning and evening of summer; on the other hand, atmospherics is often observed in the evening of summer and in the afternoon of winter. In order to demonstrate the radio source of the phenomena as lightning, it is required to explain this difference. Because the low frequency radio bursts also appear depending on a state of the ionosphere, it is important to take into account not only the difference in lightning between the regions but also temporal and spatial changes in the ionospheric plasma density. By identifying the mechanism of the low frequency radio bursts, it may be possible to obtain the condition of the ionosphere in wide region.