VLF/LF

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Study on natural harmonic VLF/LF waves in the polar region

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An interesting harmonic spectrum of natural VLF/LF waves has been observed at Syowa station in Antarctica. The frequency components of harmonic spectrum exist in the frequency rage of 10 kHz to 100 kHz. We have been investigating this harmonic VLF/LF spectrum, in order to clarify why such spectrum is observed.

First, we have an assumption that the origin of the harmonic spectrum is from the magnetosphere. We have calculated spectrum of whistler mode waves on the ground, which are injected from the magnetosphere. The calculation results give the 2 kHz and its harmonics, because the whistler mode waves resonate in the Earth-ionosphere waveguide. However, the harmonic spectrum does not extend over 10 kHz. Thus, the harmonic VLF/LF spectrum would not be generated inside the magnetosphere.

Second, we have an assumption that the origin of the harmonic spectrum is from the Earth such as sferics. We have theoretically calculated the frequency spectrum of a sferic. The calculation results give the harmonic spectrum similar to the observation. Furthermore, our calculation results show that the frequency components of harmonic spectrum almost do not depend on the horizontal distance. This suggests that the harmonic spectrum does not relate to wave propagation in the Earth-ionosphere waveguide. The harmonic spectrum would originate from the inherent spectrum of the sferic.

In this presentation, we will report the observation results of the harmonic spectrum and discuss the theoretical analysis on the origin of the harmonic spectrum.