

Study of longitudinal extent of magnetospheric ELF/VLF waves using three PWING ground stations at subauroral latitudes

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ELF/VLF waves are generated by electron temperature anisotropy in the equatorial plane of the magnetosphere, and propagate to the ground along geomagnetic field lines. The waves interact with electrons drifting longitudinally in the inner magnetosphere, and help accelerating them to relativistic energies. However the instantaneous longitudinal distribution of these waves has not been well understood. Yonezu et al. (JGR, 2017) investigated global extent of magnetospheric ELF/VLF waves by using simultaneous observations at three ground stations in auroral and subauroral latitudes at Athabasca (Canada), Kannuslehto (Finland) and Syowa Station (Antarctica). In the present analysis, we investigate local-time extent of the waves by using simultaneous observations at three stations with a magnetic local time separation of 2.5 hours at subauroral latitudes at Athabasca (ATH; 54.7N, 246.4E, MLAT: 61.3N), Kapuskasing (KAP; 49.4N, 277.8E, MLAT: 58.7N) in Canada and Gakona (GAK; 62.4N, 214.8E, MLAT: 63.6N) in Alaska. These stations use the same receiver antennas operated and installed under the PWING (study of dynamical variation of Particles and Waves in the INner magnetosphere using Ground-based network observations) project. Using these antennas with same specifications, we could obtain wave spectra of the same quality except for the local noise. We used two pairs of stations (ATH-KAP and ATH-GAK) for the analysis. The periods of investigation at ATH-KAP simultaneous observation and ATH-GAK simultaneous observation are from December 11, 2016 to May 8, 2017 (a total of 180 days) and from October 1, 2017 to November 30, 2017 (a total of 60 days), respectively. We investigated appearance of magnetospheric ELF/VLF waves every 10 minutes in the wave spectra at 0-10 kHz. The occurrence rates of ELF/VLF waves at ATH, GAK, and KAP are 16.4–21.7%, 20.6% and 8.9%, respectively. The rates of ELF/VLF waves simultaneously observed at two stations for ATH-KAP and ATH-GAK pairs are only 4.0% and 8.9%, respectively. We defined the longitudinal extent of the ELF/VLF waves by dividing the period when waves were simultaneously observed at two stations by the period when waves were observed each station. The estimated longitudinal extent for ATH-KAP and ATH-GAK are ~20-40% and 40%, respectively. These values indicate that the ELF/VLF waves are localized in longitudes compared with the longitudinal extent of high-energy electrons drifting in the dawn sector. The longitudinal extent of ELF/VLF waves becomes maximum in the morning sector and minimum in the dusk-premidnight sector. In the presentation, we report more detailed characteristics of the longitudinal extent of ELF/VLF waves and results of statistical analysis of simultaneous observation at three stations and discuss their implication on the plasma dynamics of the inner magnetosphere.

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