Statistical analysis of polarization features of MF/HF auroral radio emissions emanating from the topside ionosphere

Yuka Sato[1]; Takayuki Ono[2]; Atsushi Kumamoto[3]
[1] NIPR; [2] Dept. Geophys., Grad. Sch. Sci., Tohoku Univ.; [3] Dept. Geophys, Tohoku Univ.

Observations from the ground and space have revealed that the Earth is a distinct radio source. The terrestrial auroral ionosphere emits electromagnetic waves in the MF/HF ranges (about 1-6 MHz) as well as well-known intense auroral kilometric radiation (AKR) and auroral hiss in the VLF/LF ranges. Band-limited natural radio emissions are often observed in a frequency range of 1-4.5 MHz when satellites pass over the auroral latitudes during geomagnetic disturbances. These MF/HF auroral radio emissions are referred to as Terrestrial Hectometric Radiation (THR) and are regarded as a counterpart of auroral roar and MF burst which are observable from the ground. We statistically investigated polarization features of THR emissions using data obtained from Plasma Waves and Sounder experiment (PWS) mounted on the Akebono satellite in dynamic spectra (DS) and polarization (PL) mode operations. These two modes provide the spectra of signals picked up from two sets of 60-m tip-to-tip crossed dipole antennas in a frequency range from 20 kHz to 5.12 MHz with a time resolution of 2 sec. The PL mode observation provides the power spectra of right-handed (I_R) and left-handed (I_L) polarized components, whose rotation is viewed from the Z-axis of the satellite, which is perpendicular to the antenna plane and parallel to the spin axis. THR typically occurs in either or both of two frequency bands near 1.5-2.0 MHz and 3.0-4.0 MHz. The sign of axial ratio (I_L - I_R)/(I_L + I_R) of lower-band THR is opposite to that of upper-band THR which is simultaneously detected. The sign of axial ratio of THR emissions shows clear MLT dependence. For example, on the basis of PWS measurements in the southern hemisphere, lower-band (upper-band) THR appears as left-handed (right-handed) polarized in the night-side sector and right-handed (left-handed) polarized in the morning and afternoon sectors. The axial ratio can be applied to identify the propagation mode of the electromagnetic waves with the assumption that the source of the waves is in an altitude region lower than the satellite position in the night-side auroral latitude. The observed axial ratio is consistent with the idea that THR emissions in the lower and upper bands respectively correspond to L-O and R-X mode electromagnetic waves.