

Occurrence characteristics of terrestrial hectometric radiation observed by the Akebono satellite

Chiaki Ukai[1], Takayuki Ono[2], Masahide Iizima[3]

[1] Geophysics of Tohoku Univ, [2] Department of Astronomy and Geophysics, Tohoku Univ., [3] Geophysical Inst., Tohoku Univ.

1.Introduction

Terrestrial hectometric radiation (THR) was first identified by the observation of the Ohzora satellite (EXOS-C) (Oya et al.,1985). On the basis of many observation of results obtained by the Akebono satellite (EXOS-D), it has been found that THR is one of the typical planetary nonthermal electromagnetic waves which is radiated from the earth (Oya et al.,1990). In general, THR is observed in the polar upper ionosphere and usually shows diffuse broadband spectra in a frequency range from 1.0 to 5.0 MHz. Recent analysis of THR (Iizima and Oya, 2001) revealed that there are discrete components in the spectra of THR at two frequency ranges forming a harmonic relation each other, i.e., there are from 1.3 to 2.1 MHz (1.7 MHz band) and from 2.6 to 4.2 MHz (3.4 MHz band).

2.Present data analyses

To clarify the detail of properties of the occurrence characteristics of THR, a statistical study has been carried out by using all of the dynamic spectra of PWS data onboard the Akebono satellite in a frequency range from 380 kHz to 5.2 MHz within a period from January to June in 1990. Within the period of present data set (1091 paths), we have identified 287 samples of THR.

3.Results of the statistical analyses

The results of the present statistical analyses have shown that THR is mainly generated in two frequency ranges; they are located from 1.0 to 2.3 MHz and from 2.7 to 4.3 MHz.

The spatial distribution of the observed THR has revealed that THR is mainly detected in region of ILAT which is more than 50 degrees, and most frequently observed in the auroral zone. The distribution of the occurrence of THR in MLT has shown that the paths of the Akebono satellite concentrate in the MLT from 15 to 02 hour. These evidences show that the spatial distribution of THR has many common characteristics with auroral kilometric radiation (AKR). As for the occurrence altitude, THR has been observed at all altitude above 1000 km.

Comparing the occurrence features of THR with the geomagnetic activity index of Dst data, there is no specific correlation between occurrence of THR and the geomagnetic storms.

4.Conclusion

From the present statistical analysis of occurrence in the frequency range, it has been found that the fundamental (from 1.0 to 2.3 MHz) and the second harmonic (from 2.7 to 4.3 MHz) components clearly exist among the THR spectra. In particular, the existence of the second harmonic component suggests that nonlinear wave-wave interaction process is essential in the generation process. According to the spatial distribution of occurrence, it has been clarified that THR is another planetary radio emission from the earth which is generated by the precipitation of the auroral particles in a higher frequency range than AKR. It has also been suggested that the generation region of THR mainly exists below the altitude of 1000 km in the topside of polar auroral ionosphere where the strong UHR mode waves are generated by the auroral electron beams.