

Proceedings of the Research Institute of Atmospherics,  
Nagoya University, vol.23 (1976) —Activity Report—

## Section 7. Magnetospheric Radio Emissions

In order to promote research activities concerning magnetospheric radio emissions and related phenomena, this section was established in April, 1975 and succeeded the study of VLF emissions, formerly conducted in Section 4.

Efforts have been directed to make clear the nature of mid-latitude VLF hiss associated with magnetic storms, and some important features of storm-time mid-latitude VLF hiss have been found. That is, they are not coming from high latitudes, such as the auroral zone, but are produced at lower latitudes in the magnetosphere, closely connecting to plasmopause location, and further they are possibly generated by electrons flowing in a ring current formed around the earth during a magnetic storm.

A recent study of mid-latitude VLF hiss observed by the Ariel 3 satellite and on the ground (Hayakawa et al., 1975) indicates that the morning hiss occur mainly outside the plasmopause, while the evening hiss are observed inside the plasmopause. From these findings a hypothesis is proposed about the generation mechanism of storm-time VLF hiss. For the morning hiss the mechanism seems primarily to be incoherent Cerenkov radiations, similar to the case of auroral hiss, of the electrons of low energy in quasi-trapped orbits, although some coherent mechanism may be necessary for enhanced intensity. And for the evening hiss it may be a cyclotron instability occurring in the bulge region of the plasmopause, by electrons with energies higher than those of electrons responsible for the morning hiss. This picture of evening hiss agrees well with the results obtained by the ground observations (Tanaka et al., 1974).

By making use of the ray tracing technique possible source locations for the storm-time VLF hiss are inferred, taking respectively realistic electron distributions of diffusive equilibrium type for the morning and evening sectors, with due regard to the electron density gradient and location of the plasmopause, and assuming that the source lies around the apex of dipole magnetic field lines, as is usually

thought. From this ray path calculation it is confirmed that the source should be located outside the plasmopause in the morning sector, while it should be located inside the plasmopause in the evening sector. (to be published next year)

Planning for the measurement of incident and azimuthal angles of auroral hiss at Syowa station in Antarctica is now going on in order to get further information about the relationship of auroral hiss to auroral display and precipitating electrons by using a new method originally developed for atmospherics. This method measures differences in arriving time of auroral hiss between a master station and each of two manless slave stations, suitably distributed around the master station. This observation will be started in next year as one of projections in Antarctica by the National Institute of Polar Research.

As a provisional test of this projected auroral hiss observation, a manless open station was constructed on a hill near the Moshiri station and the signal of VLF hiss received is being telemetered by a UHF radio link to the Moshiri station. A wind charger is used as a source of electric power supply to the apparatus on the hill. Performance conditions of the wind charger will be carefully examined through the winter of 1975 - 1976 to get information concerning whether the charger can be used in Antarctica or not.

A loop antenna with a ferrit-core is being designed through a wide experiment by Kashiwagi et al., and is to be used on board the prototype EXOS-B satellite for measurement of ELF-VLF electromagnetic waves.

At present, the working members in this section are J. Ohtsu, M. Hayakawa and M. Kashiwagi. However, M. Hayakawa went to Sheffield England in October, 1975 to study VLF emissions using Ariel 3 and 4 data and will stay there till October 1976 as a visiting lecturer under Professor T. R. Kaiser, University of Sheffield.

Owing to common interest in research field, Sections 4 and 7 are working together as a "Study Group of Magnetosphere".

November 26, 1975

- Jinsuke OHTSU -

**Publications ( 1974-1975 )**

- Hayakawa, M., Y. Tanaka and J. Ohtsu: Satellite and ground study of magnetospheric VLF hiss associated with the severe magnetic storm on 25 - 27 May 1967, *J. Geophys. Res.*, 80, 86(1975).
- Hayakawa, M., Y. Tanaka and J. Ohtsu: The morphologies of low-latitude and auroral VLF hiss, *J. Atmos. Terr. Phys.*, 37, 517(1975).
- Tanaka, Y., M. Hayakawa and J. Ohtsu: VLF hiss observed at a low-latitude ground station and its relation to drifting ring current electrons, *Rep. Ionos. Space Res. Japan*, 28, 168(1974).
- Tanaka, Y., M. Hayakawa and M. Nishino: Study of auroral VLF hiss observed at Syowa station, Antarctica: *Memoirs National Inst. Polar Res.*, in press.