

Section 4. Whistlers and VLF emissions

Routine observations of whistlers and VLF emissions have been continued as usual at Moshiri and Sakushima Observatories. At Kagoshima Observatory, the observation of whistlers stopped in June 1970 has been re-opened since June 1971.

All observing apparatus for whistlers and VLF emissions have been equipped completely in order to make preparations for the MONSEE (Monitoring of Sun-Earth Environment).

The whistler recording apparatus at Moshiri and Sakushima Observatories were renewed entirely by using analog and digital integrated circuits and long recording tape recorders of return operation, which can record whistlers observed during one week on a magnetic tape reel of 7 inches. All magnetic tapes recorded since June 1971 have been preserved unerasable. At Moshiri Observatory, in order to eliminate the interfering disturbances due to cross modulation between VLF waves, another loop antenna having a dimension of 50×20 square meters was built at the site 1300 meters apart from the observatory. Four channels of VLF emissions, 0.8, 1.5, 5 and 8 kHz were divided into two groups. Namely, the pre-amplifier of 5 and 8 kHz was connected to the old loop antenna having been formerly used for the observations of whistlers and all channels of VLF emissions, and another pre-amplifier of 0.8 and 1.5 kHz to the newly built loop antenna. Moreover, a loop antenna for observing only whistlers was also installed at the same site in order to reduce cross modulation. Consequently, the interfering disturbances have been remarkably reduced and observing data of good quality are being obtained.

The study on Cerenkov instability has been continued to explain the VLF emissions observed in middle geomagnetic latitudes during magnetic storms. It has been found that the dispersion and field polarization for the growing mode in a comparatively wide range around the nose frequency resemble well to those of whistler-mode wave for the case of no beam when the longitudinal velocity of an electron beam lies nearly around the maximum phase velocity of whistler-mode wave without beam.

It has been indicated that the polarizations of auroral hiss at 12 and 25 kHz are slightly different from each other. In 1970, at Syowa Station in Antarctica, the

observation of polarization at 50 kHz was added in order to investigate the differences of polarization in the receiving frequencies. As a result, considerable differences of polarization are found statistically between auroral hiss of 12 kHz and that of other frequencies (25, 50 kHz).

Electron density variation in the magnetosphere at a geocentric distance of about 1.5 earth radii were deduced from the whistler dispersion data at Wakkanai and Moshiri during one solar cycle from 1958 to 1968. It was found that the lower magnetosphere is less sensitive to the long-term variation of solar activity than the ionosphere. Moreover, the variation of occurrence rate of lower latitude whistlers has been found to correlate negatively with solar activity, which means that the ionospheric absorption is the more predominant factor for the occurrence rate than the duct formation.

The last site error observation was made at Moshiri from May to June, this year. A degree of improvement has been studied of fixing accuracy of the sources of atmospherics by using the correction curves obtained from the site error observations at three stations. An example of the results is presented in this volume.

In order to increase the success rate of fixing of the sources of atmospherics, data accessing process has also been improved as follows.

1. The 180° ambiguity has been eliminated in the process of triangulation, as a unidirectional direction finder has been used at Sakushima Station since October 1971.
2. The mapping of the sources occurring in narrow sectors along the direction of the base lines among three stations has become possible.
3. The number of plots has been greatly increased due to the improvement of the program for detecting coincidence of receiving time of atmospherics.
4. The correction curves for the three fixed stations have been introduced in the fixing program.

A test observation to increase the measuring accuracy for the bearings of nearby thunderstorms was carried out this summer at Moriya near Tokyo by using a new spaced-loop direction finder. Results obtained are now being analyzed to collect information for improving the system.

The satellite REXS is now under final test, being expected to be launched on the middle of August 1972.

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Publications

- Hayakawa, M., J. Ohtsu and A. Iwai : Characteristics of Dispersion and Occurrence Rate of Low Latitude Whistlers During One Solar Cycle, *J. Geomag. Geoelect.*, **23**, No. 2, 187-204 (1971).
- Hayakawa, M. and J. Ohtsu : Wave Interference Effect in Whistler Mode Reflection Coefficients from Model Lower Ionospheres, *J. Geomag. Geoelect.*, **23**, (1971) (in press as a short note, full paper in this volume).
- Hayakawa, M. and J. Ohtsu : Transmission and Reflection of Magnetospheric Whistlers in the Ionosphere and Lower Exosphere at High Latitude, accepted for publication in *Planet. Space Sci.*
- Nishino, M., M. Kashiwagi and A. Iwai : Error Investigation for the Location of the Sources of Atmospheric by Radio Direction Finders, this volume.
- Ohtsu, J. and M. Kashiwagi : Observational Results of Atmospheric Wave Form, Proceedings of IASY Symposium 1971 (in Japanese), *Inst. Space Aeronaut. Sci., The University of Tokyo* (1971).
- Tanaka, Y. : VLF Hiss Observed at Syowa Station, Antarctica
I - Observation of VLF Hiss.
II - Occurrence and Polarization of VLF Hiss During Disturbances, this volume.
- Tanaka, Y., M. Nishino and A. Iwai : Polarization of VLF-ELF Hiss at Syowa Station, Antarctica, this volume.

