ACTIVITY REPORTS

Section 1. Propagation of Atmospherics and ELF Radio Noise

Since the section 5 was newly established this year, one research assistant and one engineer have been supplied to the section 1 in place of the two persons (who removed to the new section).

The integrated field intensity of ELF atmospherics at frequencies of 600, 260, 100, 30 and 9 c/s have been recorded continuously at the Sand Dune Laboratory, Tottori University in the western part of Japan since last year. However it was found that the electric field received with a vertical rod aerial in earlier experiments was sometimes contaminated by meteorological conditions. Therefore, pick up coil aerials oriented in the NS and EW directions have been used since February 1965, and since then every record of the integrated field intensity of ELF atmospherics is concerned with the magnetic field. SEA phenomena associated with solar flares were found accidentally in May 1965, [13] and we were quite interested in discovering an SEA effect on ELF radio wave propagation. The enhancement of the field intensity at a frequency of 27 kc/s and the depression of it at a frequency of 10 kc/s were already known in the VLF region, but no observations had been made concerning the SEA phenomena in the ELF range. Enhancement of the field intensity has been found in the ELF range at every frequency, and, in particular, it has also been found that the rate of increase in level are greater at a frequency of 260 c/s than that of VLF region.

Simultaneous observations at both the origin and a site distant from the origin were carried out this summer as to waveforms of slow tails. These measurements were done jointly with the second section. Though it is quite natural that these simultaneous observations are necessary in order to make a synthetic study of the waveforms of atmospherics, it is not so easy technically to do so in the VLF range because the conventional recording system for the quick field changes at VLF can not be used for a long run because of the cost factor. On the other hand, the recording of the ELF waveform is not impossible by the use of magnetic tape recording techniques. This time the waveform of slow tail at the Sand Dune Laboratory whose distance from the origin exceeds 500 km and the static field change at the origin were observed simultaneously for one month. Because of the small chance of lightning discharges during this observation interval, it seems that the fruitful data will not be expected to be found. An extended programme of similar observations will be carried out next summer.

Additionally, another series of simultaneous observation was performed with a site selected in the extremity of the northern part of Japan and a second site at Chihama Sand Dune in the next Prefecture as usual. Observation was made for a few days in September. This was intended to investigate the latitude dependence of the cavity resonance frequency and the existence of ELF emissions in the frequency band of the order of 10 c/s. The data observed are now being analysed and studied.

The cooperative work concerning underground prospecting is also being done between the Department of Mining Engineering, Faculty of Engineering, Tohoku University and ourselves. Apparatus for measuring atmospherics which is available for measuring the ELF waveforms below 1 kc/s as well as the integrated field intensity at frequencies of 130 and 475 c/s was tentatively made in the last academic year. The apparatus for measuring waveforms in lower frequency range (0.1-10 c/s) has been also developed. The basic experiment is expected to be made employing this apparatus in Akita Prefecture, northern part of Honsyu, by the end of this autumn.

As regards the routine observations of ELF atmospherics at the Sand Dune Laboratory, Tottori University, remarkable progress is expected by the establishment of the Tottori Observing Station in this academic year (from April 1965 to March 1966), because an observation hut (prefab) solely for our use is to be built in one or two months in the vast area of the Sand Dune Laboratory.

The observation of the atmospheric noise level in the ionosphere was made by the rocket flight on 26th February 1965 by a study group directed by T. Kamada. Measurements were made at every 5 km in height up to nearly 300 km at frequencies of 0.5, 2, 3, 4, 6, 8, 10 and 21 kc/s.

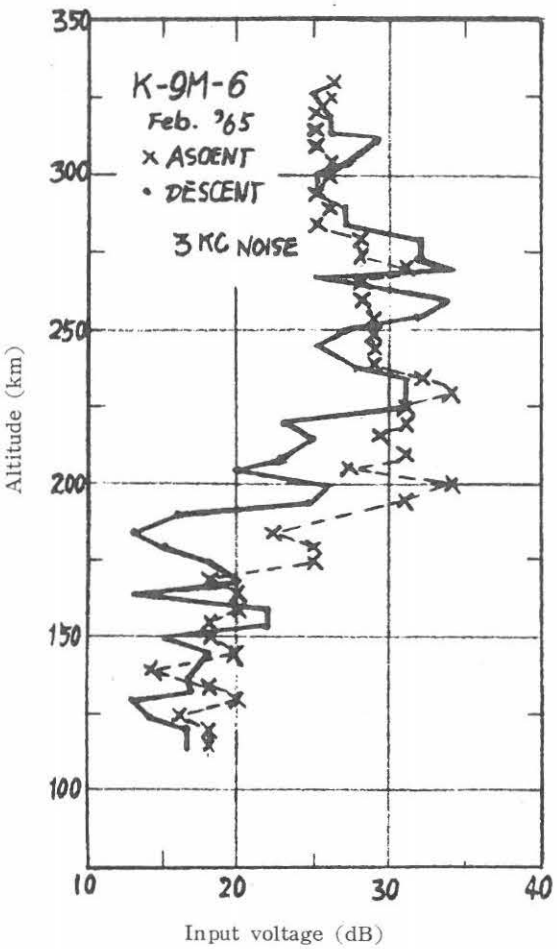

Fig.1. Atmospheric noise level profile at night at a frequency of 3 kc/s
(0 dB=1 μv)

Atmospheric noise was measured as to the input voltage of a receiver installed in a rocket, and it resulted briefly that the noise level in the ionosphere increased approximately with increasing height at every frequency as is shown in Fig. 1.

T. Kamada has left Japan taking part in the 7th Japan Antarctic Research Expedition. The field intensity of the cw emmited from transmitters, the frequency spectrum of VLF atmospherics and the intensity of the static field in view of the atmospheric electricity will be measured continuously on the boat for about four months.

The reflection coefficient of the stratified ionosphere was obtained by K. Sao during his sabbatical leave at King's College London as a research programme of the ELF wave propagation. In this case the lower layer of the ionosphere is essentially expressed in terms of the collisional frequency, and the upper one in terms of the imposed magnetic field. Numerical calculations are now being carried out by D. Ll. Jones of King's College, so results will be reported soon. Furthermore, in connection with this model of the ionosphere, an ELF propagation theory is being developed by Mrs. M. Yamashita.

Finally, it is to be noted that the cooperative science programme between Japan and U. S. concerning the ELF research is now being discussed at both sides. For our own part this was suggested by Professor Kimpara a few years ago, and a remarkable progress has been made by Professor Maeda, Kyoto University, since June this year. Up to now meetings for discussing this problem were held three times including small committee organised by K. Sao, and the forthcoming cooperative work between two countries is now being prepared and arranged.

—Kazuo SAO—

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Section 2. Sources of Atmospherics

Atmospherics source problem requests the knowledge in a wide field of geophysics including electrical discharge phenomena in the air, local meteorology relating to it, radio wave emission by the discharge, finally the global atmospheric electric circuit whose generator is the world wide thunderstorm activity.

Therefore our research activity has mainly been and will be directed for the time being toward the radiation of electromagnetic waves from lightning discharges with special emphasis on ELF atmospherics emission and on atmospherics source signals VLF through VHF. (4) (5)

Thunderstorm and atmospheric source signal observation expedition has been made without interruption for more than ten summers with some successful experimental results expanding our knowledges about the nature of lightning discharges as origin of atmospherics. (1) (3)

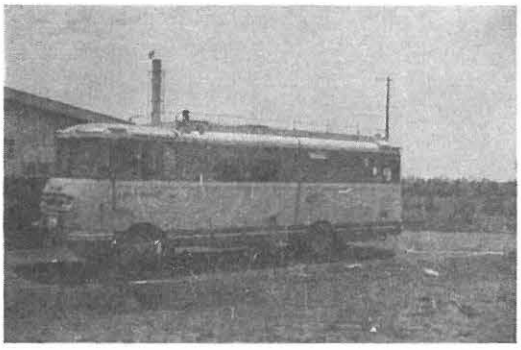

Fig.1. Mobile field site on working at Takasaki.

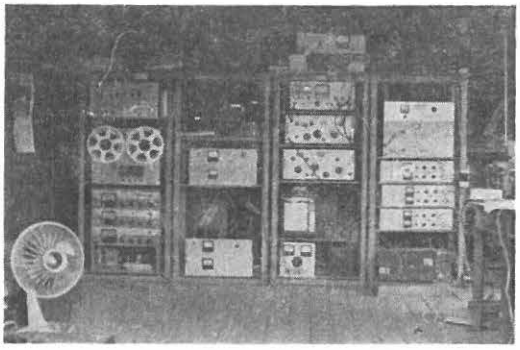

Fig.2. Interior view of a fixed field site at Funyu.