Proceedings of the Research Institute of Atmospherics,
Nagoya University, vol. 27(1980) –Activity Report–

Section 5. Atmospheric Radio Noise and Thunderstorms

The measurements of statistical amplitude-frequency-spectra of atmospheric noise in ELF-VLF bands have continued over a year at Sakushima island. A long term variation has been obtained of the low time-percent electric field strength, V_{01}, for four frequencies, 2.5, 3.5, 5 and 8 kHz based upon the whole data measured in 1978 to 1979. A series of peak amplitude distributions of V_{01}s have been obtained for each of 6 timeblocks(4 hour length) of a day for each month of a year, based upon the whole of V_{01} values measured for individual 100 seconds time intervals. Remarkable characteristics of atmospheric noise in the frequency band considered is as follows: (1) the peak amplitude distributions of V_{01}s, approximately, can be represented by a log-normal distribution or a composite of two different log-normal distributions, (2) the median statistical amplitude frequency spectra display remarkable variation depending on months and time-blocks, (3) the source distance can be estimated in the range larger than about 1,000 km based upon the mode theory, i.e., by using the ratio of two V_{01}s values measured at 5 and 8 kHz, (4) the distance variation of sources can be described in the range larger than 1000 km by respective normal-distribution depending on months and time-blocks. The distance of influencing sources can be estimated to be the shortest in August, the longest in January.

A theoretical research has been made for the purpose of deducing ionospheric parameters based upon the measured statistical amplitude frequency spectra, on an assumption of the ionosphere model defined by the quantity, i.e.,

$$\omega_r = \omega_{r_0} \exp(\beta (h-h_0)),$$

By comparisons of the measured field at four frequencies of 2.5, 3.5, 5 and 8 kHz with the calculated ones, the ionospheric parameters, and h_0 and the source distance were obtained in an analogous way to the least square error method, which apparently, seem to display a reasonable diurnal variation except for that the derived source distances seems a

little short. Further research will be made for the purpose of obtaining more reasonable values of ionospheric parameters and source distance by considering the earths magnetic field.

An apparatus for measuring an impulsive noise within a narrow bandwidth was made at our institute, which was designed symultaneously to measure both an APD and CRD of the detected envelopes. The measurements of the impulsive noise originated from an electric-vehicles train on the New Tokaido Line were made with this apparatus using a vertical and horizontal dipole antennas. Both an APD and CRD were symultaneously measured at two frequencies, 50 and 100 MHz and successively every 200 seconds over several minutes length for individual trains. Based upon the analysis of these measured APDs and CRDs, the followings have become obvious: an APD and a CRD and the associated parameters i.e.,the average and RMS values of the noise amplitude and a low-time-percent electric field strength, V_{10}, can be grouped into three categories, respectively, each characterized by the train speed. A model to the particular impulsive noise has been presented, which says that the elementary section of overhead electric wire, dx, radiates impulses of various amplitudes in the time interval during which it comes into contact with individual pantographs of vehicles, the distribution of peak on which can approximately be represented by a power function of voltages with a power index value depending on the train speed. It was found that the short term variation of recieved field during the pass of train fits well the calculated fields-variations calculated based upon the model.Further, the inverse distance relations to the received noise fields were derived from the model in the direction perpendicular and parallel to the electric car tracks.

Nakai had a speech with a subject to "Requitement on instrumentation for the electrical measurement of the man-made noise" at the 3rd EMC symposium held at Rotterdam on May 1-3, 1979.

In Nov. and Dec.,1979, the cooperative observation for the Hokuriku winter thunderstorms was again done together with Hokkaido, Saitama, and Utsunomiya University as well as the one year ago. The electric field changes due to the lightning flashes were measured at five stations to deduce the charge locations and amouts of these dissipated by the ground flashes. A new system was developed for the data telemtering of field changes. A slave station was linked to the main station by a telephone line and the digitized data from the slave were recorded on magnetic tapes at the main station. The detail of the system is in this issue.The other equipment used in this observation was a wide-band tape recorder, 100 Hz to 2.5 MHz, to record the fine structures of field changes due to

return strokes.

Takeuti was invited by Uppsala University, Sweden during summer of 1979 for the cooperative study of the thunderstorms. It is found by the observation some conditions to produce positive ground flashes. It was also found that average rise time of field change due to the positive return stroke was a few hundred microseconds. This is hundred times longer than the average rise time of field changes due to the negative return strokes.

The some results on the positive ground flashes obtained by the cooperative studies with Sweden were reported at 15th European Conference on Lightning Protection held at Uppsala during June, 25-29,1979.

February 21,1980
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