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Section 5. Atmospheric Radio Noise and Thunderstorms

A statistical study on the change of vertical electric field-intensity near the source of atmospheric has been made since 1969 at Imaichi Observatory. The change of electric field-intensity near the source were measured in summer at two different frequencies of 3 and 90 kHz, 1970, and at three frequencies, 3, 50 kHz and 5 MHz, and on ELF band in 1971. The four statistical parameters, i.e., APD, CRD, OTID and PWD, have been obtained from the field-intensity data observed in 1970 and the results of analysis are reported in this volume. The field-intensity data for 1971 are being analyzed.

The two statistical parameters, i.e., APD and CRD of the atmospheric radio noise, have been measured at five different frequencies of 2.5, 3.5, 5, 7 and 10 kHz at Sakushima Observatory. The objective of this study is to get information on the change of APD and CRD with the frequency observed, and to establish a relationship between the behaviour of APD in VLF band and the source distance of atmospheric, which is expected to have some application to locate the source of atmospheric by a statistical method. We are planning to continue the measurement for several years.

A study of generating impulsive noise have been made by using an electronic computer based on the Monte Carlo method. The four statistical parameters of the synthesized noise, i.e., APD, CRD, OTID and PWD, have been obtained by using again the electronic computer. The following test has shown that the Monte Carlo method is useful for the investigation of noise characteristics. When a random series of impulses with a defined randomness in amplitude- and time-characteristics are applied to a receiver with a defined passband-characteristics, APD of the envelopes of instantaneous i-f voltage at the input of the receiver can be obtained by two different methods ; one of which is a mathematical analysis method and the other the Monte Carlo method. It has been found that there is a very good agreement between the two APD curves obtained by these methods.

Taking advantage of having abundant knowledge on the study of the atmospheric radio noise, we have extended our study to that of the man-made noise. A pilot study has been conducted to determine statistically the radiation characteristics of the automobile ignition noise in the VHF region. We must consider what sort of parameter will represent significant and useful information on the radio noise environment.

Statistical parameters such as APD, CRD, OTID, PWD and moments such as the quasi-peak, the rms voltage, the average voltage and the average logarithm of voltage were measured and the correlation among statistical parameters and others are now under discussion.

A nondirectional thunderstorm finder for the range within 200 km has been developed. The principle of the finder is to count the number of sferics exceeding a defined threshold value at a frequency of 90 kHz. In addition to the basic instrument mentioned above, a directional thunderstorm finder composed of two sferics receivers tuned at 3 and 80 kHz (T. Takeuti and H. Nakata, *Meteorol. Rundschau*) for the same range has been planned, which is now in construction.

The global thunderstorm observation is being continued with a network connecting the Research Institute of Atmospheric in Japan, Heinrich-Hertz-Institut für Schwingungsforschung in Germany, Waldorf Observatory in U. S. A., and Observatorio de Fisica Cosmica in Argentina. The first report by G. Heydt has been published and the second report by our group will be published soon. The topics of the second report is as to the global thunderstorm activity in winter of northern hemisphere.

Thunders were observed with four microphones spaced about 10 meters each other in summer 1970 at Imaichi observatory to find the channel shapes of the lightning flashes and their location in thunderstorms, and also some meteorological elements were measured with 3-cm radar and meteorological instruments to find the rainy regions and fronts which might influence the charge generation. A preliminary interesting result was obtained for the channel shape of the ground flash, in which the channels were not vertically straight in the cloud but they changed their inclination at an altitude of 3-4 km. This seems to be related with the accumulation of charges in the thundercloud. Because of the lack of useful data, we could not find the relationship among rainy regions, fronts and the location of flashes. The observations were made again in summer 1971, and the data are now being processed.

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Publications

- T. Takeuti and H. Nakata, Registriergerät für Gewitter im Umkreise von 200 km, submitted to *Meteorol. Rundschau*.
- T. Nakai, M. Nagatani and M. Nakano, On the Statistical Measurement of Vertical Electric Field-Intensity-Change on 3 and 90 kHz at the Source of Atmospheric, *Proc. Res. Inst. Atmospheric, Nagoya Univ.*, 19, (1972).