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Section 5. Atmospheric Radio Noise and Thunderstorms

An apparatus is now under construction of measuring the environmental noise as well as the atmospheric noise. The former noise includes the power spectrum wider than the latter noise, i. d., one covering some tens kHz to some hundreds mHz. Much emphasis has been placed on the followings, we are able to measure sinchronously two different distributions, APD and CRD, for a given frequency, and such a measurement procedure can also be executed sinchronously on two frequencies, different or the same, with two different antennas. In the latter case, the directional characteristics of the noise may be investigated using the statistical method.

The data-reproducing (SFS) and its related data processions result in daily variations of the electric field V_n's with parameter of percent of n for each of four frequencies, 2.5 kHz, 3.5 kHz, 5 kHz and 8 kHz and the corresponding statistical frequency spectra, total 144 per day, in the form of statistical figurs and graphs. Though a general feature of theses parameter is now under investigation, a remarkable event caused by some solar burst, i. d., the most large and rapid variation of electric fields V_n's measured up to now is reported here: the rapid and large decreasements of V_n's commenced at about 10^h40^m on February 16, 1978 with maximum falls of 16 dB, 31 dB, 11 dB and 14 dB compared with the V_n's values just before its commencements in a elapse time of about $1^1/2$ hours on each of 8 kHz, 5 kHz, 3.5 kHz and 2.5 kHz respectively.

The procedure of obtaining an amplitude probability distribution from easily measured statistical moments (the average power, the average envelope voltage and the average logarithm of the envelope voltage) has been developed at the National Bureau of Standards. The particular procedure has been re-examined using individual APD on 8, 50, 125 kHz measured at Toyokawa and at the Sakushima Observatory. The conclusion is that: there are two main categories for the atmospheric radio noise, for one

of which the adequacy of the particular procedure has been verified very much, but, on the other hand, its direct application to the atmospheric noise for the other category has been found very unadequate. Based on detailed investigations by way of approximating individual APD in the second category by two straight sections and a circular arc section on a Rayleigh graph, it has been found that original graphs with some of parameters, A,B,C,X,L_d and V_d can be amended or expanded over the limits of their availabe ranges so as to be applicable to the atmospheric noise in the second category.

During the winter of 1977/78, the Japan-U.S. cooperative study for the Hokuriku winter thunderstorm was again done as well as the winter of 1976/77. Data of cloud flashes were analyzed by M.Nakano and he has found following facts: (1) The occurrence frequency of the cloud flashes is 77%. (2) Average duration is 330 msec. (3) Cloud flashes are preferentially due to ascending negative streamers on the contrary to descending positive streamers on summer thunderstorms. (4) The heights of positive and negative charges are estimated on the storm on Dec.2, 1977 respectively to be about 6 km and 3 km, which correspond to the temperatures $-30^{\circ}C$ and $-10^{\circ}C$. (5) Cloud flashes originate in the region of temperature of $-6^{\circ}C$ to $-10^{\circ}C$. (6) The electric charge carried by an initial streamer in the cloud flash is about 30 to 130 coulombs, and the average value is 63 coulombs. (7) The streamer velocity is the order of 10 km/sec, and it depends on the altitude of the initial streamer.

The Japan-U.S. cooperative study program was finished, however, we have done new cooperative study for the Hokuriku winter thunderstorms together with Hokkaido, Saitama, and Utsunomiya University in December, 1978. The data obtained are now under analysis.

In summer of 1978, T.Takeuti, M.Nakano and H.Ishikawa again observed the Swedish thunderstorms at Uppsala and Kiruna. We have found from the observation some conditions necessary to produce positive ground flashes as follows. (1) The height of the positive charge is low. (2) Wind shear in upper part of the thundercloud, i.e. the region of positive charge, is strong.

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Publications

Nakai,T.: On the Time and Amplitude Properties of the Electric Field near the Source of Lightning in VLF and HF Band, Raio Sci., Vol.12, No.3,389-396 (1977).

Nakai,T. and J.Frisius: The Random Scatter of Spectral Parameters of VLF-atmospherics,J.A.T.P.,Vol.40,61-71 (1978).

Nakai,T. and H.Ohba: Result of Measurement of APD for Atmospheric Radio Noise and the Predicting Method (CCIR), Trans. I.E.C.E of Japan (Vol.78,No.219) (1979).

Nakai,T.: On the Statistical Frequency Spectrum Near the Source of Atmospherics, to be submitted in 1979.

Takeuti,T.,M.Nakano,H.Ishikawa and S.Israelsson: On the Two Types of Thunderstorms Deduced from Cloud-to-Ground Discharges Observed in Sweden and Japan, J. Meteor. Soc. Japan, Vol.55, No.6, 613-616 (1977).

Takeuti,T.M.Nakano,M.Brook,D.J.Raymond, and P.Krehbiel: The Anomalous Winter Thunderstorms of the Hokuriku Coast,J.G.R. Vol.83, No.C5, 2385-2394 (1978).

Takeuti,T.,M.Nakano, H.Ishikawa and S.Israelsson: On the Anomalous Cloud-to-Ground Discharges Observed in Sweden,UURIE 103-78 (1978).

Takeuti,T.,M.Nakano,H.Ishikawa,S.Isrealsson and S.Lundquist: Preliminary Report on Thunderstorms Producing Positive Ground Flashes as Observed in Sweden, UURIE 113-78 (1978).