Proceedings of the Research Institute of Atmospherics,
Nagoya University, vol.33(1986) –Activity Report–

Section 5. Atmospheric Radio Noise and Thunderstorms

An attempt has been made to derive the envelope amplitude probability distribution (APD) for automotive radio noise following the method similar to that found effective in deriving APD for atmospheric radio noise near thunderstorms. By taking into account the differences in characteristics between these two kinds of radio noises, APDs have been derived for (1) a single vehicle and (2) a large number of vehicles running on a roadway. Details are described in the paper with the subject "APD and IAD for impulsive noise: atmospheric radio noise from a near thunderstorm and automotive radio noise from a roadway".

Another attempt has been made to expand the model for automotive radio noise received with a vertical dipole antenna placed on the ground. The formula for the impulsive amplitude distribution (IAD) at the input of a narrow-band receiver have been derived for an elevated vertical dipole antenna when either a single or multiple motor vehicles are running on a roadway. A good fit has been obtained between the calculated IAD and measured CRD. Details are described in the paper with the subject "Automotive noise received with a vertical dipole antenna placed above and on the ground".

Noise generation has been investigated for the period during which bullet trains on the New Tokaido Line run an upward or downward slope, VHF noise envelope, the potential difference between two earthing points on the ground and the variation of the feed-line voltage being measured. It has been found that there exists a close relation between appearances of small-density, large-amplitude pulses at the intervals of a half period of the feed-line voltage and the turn off of the feed current to the main motors, and that the starting and ending times of VHF noise-burst appearing in the neighbourhood of the maximum value of the feed-line voltage depend on the polarity of the feed-line voltage. Details are described in the paper subject "On the generation of Shinkansen noise".

We observed thunderstorms and lightning at Fujioka, Gumma during summer of 1985 as a part of a cooperative project together with some universities. The thunderstorms were observed with our radar, the indicator of which was improved as followings. The output signals of the radar echo were stored on floppy diskettes and displayed on the color cathode ray tube with three colors corresponding to the radar echo intensities. The patterns of the radar echo were also printed out by the three color levels.

Electromagnetic field changes due to ground flashes were registered in transient memories by 10 ns sampling interval and were stored on floppy diskettes. We found from the records of field change that the fast rise times of return stroke currents were order of 100 ns coinciding with the results obtained by Krider et al.

NOx produced by lightning flashes were observed by means of optical spectral analysis for scaterring sunlight during thunderstorm periods.

In order to evaluate the effects of the wind shear and the height of the electric charges in clouds on the occurrence of the positive ground flash, a calculation was made under the assumption that the leader tip developed in the direction of the largest potential gradient. The results show that the occurrence of the positive ground flash increases with the horizontal displacement of upper positive charges. Kawasaki visited to Uppsala, Sweden in May, 1985 and he should stay until March, 1986 to study the electromagnetic field changes due to return strokes considering ground conductivity on propagating path. The results shall be reported in a conference to be held in June, 1986 in U.S.A.

We attended two international conferences during 1985. Takeuti reported on the electric field changes due to triggered flashes at the 6th International Symposium on EMC at Zurich. Kawasaki reported on the group velocity of lightning return stroke at the International Aerospace and Ground Conference on Lightning and Static Electricity at Paris.

February 27, 1986

-Taketoshi Nakai-

-Tosio Takeuti-

Publications (1984 –1986)

Kawasaki, Z-I., Y. Mizutani, T. Nakai and T. Takeuti: On the estimation of lightning return stroke current, Proc. Int. Conf. on Lightning and Static Electricity, Orlando, Florida, U.S.A.(1984).

Kawasaki, Z-I., M. Nakano, T. Takeuti and T. Nakai: Group velocity of lightning return stroke currents, Proc. Int. Conf. on Lightning and Static Electricity, Paris, France (1985).

Kawasaki, Z-I. and S. Israelsson: Calculation of lightning return stroke electric fields above finite conductive ground, International Conference on Lightning and Static Electricity, Dayton, Ohio U.S.A., in press (1986)

Mizutani, Y., Z-I. Kawasaki and T. Nakai: The estimation of a lightning return stroke current with the electric and magnetic fields measured on the ground, IEE of Japan, HV-84-27, 39-48 (1984)(in Japanese).

Nagatani, M. and H. Nakada: Real time color display of the radar return signals by a personal computer, Proc. Res. Inst. Atmospherics, Nagoya Univ., 33 (1986)(in Japanese).

Nakai, T.: Automotive noise from a motorway, Part 2, Analysis, IEEE Trans. Electromag. Compt., EMC-26, 175-182 (1984).

Nakai, T: Characteristics of impulsive noise from bullet trains, presented at XXXIst GEneral Assembly, URSI, Florence, 1984.

Nakai, T.: Automotive noise received with a vertical dipole antenna placed above and on the ground, IEEE Trans. Electromag. Compt., EMC-27, 119-125 (1985).

Nakai, T.: APD and IAD for impulsive noise; Atmospheric radio noise from a near thunderstorm and automotive radio noise from a roadway, Radio Science, in press (1986).

Nakai, T.: Measurement and analysis of impulsive noise from bullet trains, to be submitted.

Nakai, T. and H. Ohba: On the graphical method of drawing APD's for atmospheric radio noise, IEEE Trans. Electromag. Compt., EMC-26, 71-78 (1984).

Nakai, T. and Z-I. Kawasaki: Automotive noise from a motorway: Part I, Measurement, IEEE Trans. Electromag. Compt., EMC-26, 4, 169-174 (1984).

Nakai, T. and Z-I. Kawasaki: APDs and CRDs for noise from bullet trains in Japan, 1984 International Symposium on Electromagnetic

Compatibility, 1, 250-255 (1984).

Nakai, T., M. Nagatani and H. Nakada: On the generation of Shinkansen noise, to be submitted (in Japanese).

Nakano, M., N. Takagi, Z-I. Kawasaki and T. Takeuti: On the mechanism of a triggered lightning, IEE of Japan, HV-84-28, 49-52 (1984)(in Japanese).

Nakano, M., T. Takeuti, K. Funaki, N. Kitagawa and C. Takahashi: Oceanic tropical lightning at Ponape, Micronesia, Res. Letters on Atmospheric Electr., 4, 29-33 (1984).

Takagi, N., T. Takeuti and T. Nakai: Line constants of return stroke channels of lightning triggered with rockets, Trans. Iee of Japan, 105-B, 378-384 (1985)(in Japanese).

Takagi, N., T. Takeuti and T. Nakai: On the occurrences of positive ground flashes, IEE of Japan, HV-85-24, 55-65 (1985).

Takeuti, T.: Lightning, Kishokenkyu Note, in press (1986)(in Japanese).

Takeuti, T., Z-I. Kawasaki, K. Funaki, N. Kitagawa and J. Fuse: On the thundercloud producing the positive ground flashes, J. Met. Soc. of Japan, 63, 354-358 (1985).

Takeuti, T., M. Nakano, Z-I. Kawasaki and N. Takagi: Electromagnetic fields on the ground due to lightning strokes triggered with rockets and a tall chimney, VIth Symposium on EMC, Zurich (1985).