

Observation of the gradual increases and bursts of energetic radiation generated during winter lightning activity

Tatsuo Torii[1]; Takeshi Sugita[2]; Yasushi Muraki[3]

[1] JAEA-Tsuruga; [2] SSL, Inc.; [3] STEL, Nagoya University

Gamma-ray dose-rate increase associated with thunderstorm activities was observed on the ground in winter. To investigate the fluctuation profile during winter thunderstorms, the energetic radiation was measured by using four set of radiation detectors (LPRCs) which consist of four long proportional counters (2.5 m in length; 10 cm in diameter). These LPRC have a different response characteristic for the incident particle by mounting shield covers. It was also compared with the result measured at the same time by the environmental radiation monitors adopting an NaI scintillator / ionization chamber as a detector. Moreover, the electric field was measured at the same site by using a field mill. In the observation from December, 2006 to February, 2007, the count-rate fluctuation which seem to originate from thunderstorm activity observed by the LPRCs.

The features obtained by the measurement and the analysis of the counters are as follows:

(1) It was observed that the radiation intensity began to increase from before several 10 seconds in which the radiation burst is generated. In addition, this radiation burst and a transient fluctuation of electric field showing lightning discharge were generated simultaneously.

(2) From the observation results of the LPRCs with different responses to the kind and energy of incident particles, the gradual fluctuation is caused mainly by the irradiation of photons with energy of several MeV. Moreover, it was considered that the radiation burst attributed in the injection of high energy photons with the energy over 10MeV.

(3) The above result was confirmed in pulse-height distributions by a multi-channel analyzer (MCA) installed in the NaI detector system.