

High energy radiation bursts observed in associated with lightning discharges

Satoru Yoshida[1]; Masahito Sato[2]; Tatsuo Torii[3]; Takeshi Morimoto[1]; Tomoo Ushio[1]; Zen Kawasaki[4]; Daohong Wang Gifu lightning group[5]; Nobuyuki Takagi[6]; Teiji Watanabe[6]

[1] Osaka Univ.; [2] Lightning research group of Osaka Univ.; [3] JAEA-Tsuruga; [4] Dept. of EEI. Eng. Osaka Univ.; [5] -; [6] Electrical and Electronic Eng., Gifu Univ

Recent studies have suggested radiation bursts on the ground are related to lightning activities. We believe these phenomena as a result of runaway breakdown (RB). In RB theory, high energy electrons of secondary cosmic rays are accelerated with radiating photons in the high electric field strength in a thundercloud. These electrons and photons make avalanches and trigger lightning discharges. However, there are few observations concerning radiation bursts just when a natural lightning discharge started. The reason is that most observation campaigns have been conducted during summer season. Therefore the initiation of lightning discharges is so high from the ground that energetic radiation can not penetrate air to the ground because of its short range. To detect energetic radiation efficiently, it is necessary to conduct observation campaigns where the lightning discharge occurs at low attitude. That is why we conducted lightning observation campaigns in Hokuriku, Japan, the coastal area of the Sea of Japan, during winter thunderstorm season to get further understanding of the relationship between the initiation of lightning discharges and radiation bursts. Our observation system consisted of main three detectors, high energy electron detector, radiation detector and VHF broadband digital intergerometer. First, the high energy electron detector has a plastic scintillator whose response ratio of high energy electrons to photons is quite high. Secondly, the radiation detector has an NaI scintillator designed for detecting both high energy electrons and photons. Finally, The VHF broadband digital interferometer enables us to visualize the path of the stepped leader of lightning discharges in three dimensions. These three detectors enable us to examine the relationship between the initiation of lightning discharge and radiation bursts on the ground. In this paper we report the result of the observation in Hokuriku, Japan.