

DEVELOPMENT OF AN OBSERVATION SYSTEM FOR SIMULTANEOUS MEASUREMENTS OF SPRITES AND HORIZONTAL LIGHTNING DISCHARGES

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Sprites are transient luminous events at an altitude range of 50 - 90 km, induced by cloud-to-ground discharges (CGs). Although sprites are considered as generated by quasi-electrostatic field caused by CGs, there are still many open questions on generation mechanism of sprites and related phenomena. For example, it is unknown what factors determine the horizontal structures and the time lags from parent CGs to sprites. Horizontal electric currents flowing in intra-cloud, inter-cloud, and cloud-to-ground discharges are considered to be an important factor related to these unknown problems as suggested by Cho et al. [2001] and Bell et al. [1997]. However, simultaneous observations of sprites and horizontal electric currents have not been carried out up to now.

In order to investigate the role of the horizontal electric currents in the generation mechanisms of sprites, we have developed a three-component dipole antenna system for electric field measurement of sferics. The three dipole antennas are oriented in vertical, north-south and east-west directions, respectively. We operated this antenna system and a two horizontal loop antenna system for magnetic field measurement at Iitate observatory(37.7°N,140.7°E), Fukushima in January 2003. Simultaneously, we observed sprites by an image-intensified CCD imager and a multi-anode array photometer at the same site. Further, we set up another two horizontal loop antenna system at Yamanashi Prefectural Science Center (35.40°N,138.40°E) to determine the locations of CGs. The frequency range of the electric field antenna system is from 10 Hz to 30 kHz and that of the magnetic field antenna system is 1 to 30 kHz, both covering the VLF range in which sferics have the highest spectral power. The electric and magnetic field data of sferics are recorded in the audio channels of VHS videotape.

We will present a detail description of the developed system and initial results of observations. Especially we will discuss how to identify horizontal electric currents in lightning discharges.