

Characteristics of sprite-inducing lightning discharges and their global distribution

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Sprites are recently discovered optical evidence of electrical discharges in the mesosphere and lower ionosphere induced by cloud-to-ground lightning discharges (CGs). We also used the optical data obtained from the ISUAL (Imager of Sprites and Upper Atmospheric Lightning) instrument on board the FORMOSAT-2 satellite launched on May 20, 2004. The ISUAL data provide us global occurrence distributions of sprites. To investigate the characteristics of global lightning activity producing sprites, the most useful method is to measure ELF electromagnetic waves radiated from CGs since ELF waves can propagate long distances with extremely low attenuation rates. Using ELF data, we can obtain information on electric characteristics of lightning discharges on a global scale. We have analyzed ELF transients associated with sprites observed by the ISUAL for a period from July 2004 to November 2005. We divided 106 sprites into three types: 22 halo events, 49 sprite streamer events, and 35 halo-sprite streamer events. It is found that 16 halo events (72.3 %) are generated by –CGs and these –CGs are concentrated over Caribbean Sea and South-East Asia. It is also found that sprite streamer-inducing CGs are positive (98.8%) except for 1 event and that CGs with the charge moment exceeding 1000 C·km are concentrated over Central Africa.