

Study of winter lightning by TLE observation network operated by high school and university

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A various investigation of sprites, one of frequent observable transient luminous events (TLEs) in the region from mesosphere to lower ionosphere, has been reported. Sprites are induced by a strong electric field attributed to the neutralization of a large amount of positive charges at the upper part of thunderstorm when positive cloud-to-ground (CG) lightning occurs. Many papers have suggested that the complex physics of sprite-induced CG lightning, termed parent CG lightning, causes various morphologies and lifetime of sprites and the time delay of sprite occurrence, which have been some of unsolved issues in the TLEs' studies. In addition, the major issue might be the largely different locations in horizontal between sprites and parent CG lightning, which often reaches about 50 km. On the other hand, sprites occur just above the luminous center of parent CG lightning according to satellite observations. It is expected that the luminous center of parent CG lightning over the thunderstorm is equivalent to the positive charges at the upper part of thunderstorm where the positive CG lightning starts. Few study, however, discusses the horizontal differences among the sprites, the luminous center of parent CG lightning over the thunderstorm, and the strike point of the parent CG lightning. Thus, we investigate the differences among them through an optical measurement, assuming that the position of positive charges at the upper part of thunderstorm is the luminous center of parent CG lightning over the thunderstorm in cooperation with high-school sprite observation network.

Keywords: Sprite, Winter Lightning, Thunderstorm