

Spatial and Temporal Evolution of Sprite Streamers Derived from High-Speed Camera Data in Aircraft Observation Campaign

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The occurrence conditions of sprites streamers still remain to be an unsolved problem after the discovery of sprites. Though the detailed three-dimensional spatial structures and the temporal evolution of sprite streamers are the key parameters to clarify the occurrence conditions, these spatiotemporal characteristics are not clearly identified. In order to specify the detailed spatial and temporal evolution of sprite streamers, we have conducted the optical observation campaign using high-speed cameras from two jet aircrafts in summer US. In this campaign, we succeeded to capture sprite images for 28 events by the high-speed cameras with a sampling rate over 8,000 fps at each aircraft simultaneously. Using these image data, we have performed triangulation analysis to estimate the horizontal spatial distribution and vertical extent of sprite streamers. We have analyzed two types of columniform sprites; one is the columniform sprite with a preceding dense inhomogeneous halo, and the other is the columniform sprite with a preceding dim halo or without a halo. In the later case (dim halo plus columns), the following results are identified. (1) The longer the distance between sprite columns and the parent CG becomes, the higher the bottom altitude of columns becomes. (2) The longer the distance between sprite columns and the parent CG becomes, the slower the speed of downward streamer tips becomes. These results are first clear observational evident showing the horizontal spatial gradient of the quasi-electrostatic field produced by the parent CG discharge. At the presentation, we will show the electrical characteristics of the parent CG discharges derived from CMC waveforms and will discuss the possible mechanisms determining such spatial dependences.