

Implications of lightning processes for initiations of sprites and halos derived from ISUAL measurements

Toru Adachi[1]; Yukihiro Takahashi[2]; Alfred Bing-Chih Chen[3]; Han-Tzong Su[3]; Rue-Ron Hsu[3]; H.U. Frey[4]; S.B. Mende[4]

[1] RISH, Kyoto Univ.; [2] Dept. of Geophysics, Tohoku Univ.; [3] Cheng Kung Univ.; [4] U.C.Berkeley

In this work, we discuss lightning processes contributing to the production of sprites and halos. During the period from July 4, 2004 to June 25, 2006, the ISUAL payload on the FORMOSAT-2 satellite has observed more than 400 sprite events. Based on their morphology, we classify the observed sprite events into three categories: halo events, halo-streamer events and streamer events. By using the ISUAL/array photometer data, we estimate lightning processes playing essential roles in the production of each sprite event. In the halo events and halo-streamer events, return stroke is found to be the essential lightning process. On the other hand, it is found in the streamer events that the M-component (surges superimposed on lightning continuing currents) sometimes plays an important role in addition to the return strokes. Furthermore, concurrent ELF magnetic field data show that halo events are produced by both positive and negative lightning discharges while the halo-streamer events and streamer events are primarily produced by positive lightning discharges. The obtained results support recent theoretical expectation that the M components have the potential to initiate sprites during the continuing current stage [Yashunin *et al.*, 2007].