



## **ES/EM computer simulation on the mesospheric optical emissions associated with lightning discharges.**

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There have been carried out a lot of works on the observations in different places in the world and the generation mechanisms of transient luminous emissions in the mesosphere and lower ionosphere. Especially, the sprites in the Hokuriku area of Japan(Japanese winter sprites) are recently detected, and the characteristics of Japanese winter sprites are found to be very different form those of the summer continental ones due to MCSs. The continental lightning triggers mainly a carrot-type sprite, while Japanese winter sprites are of simpler structures (column). We have recently found that the most important factors leading to the morphological difference of the summer-time and winter-time sprites in Japan, are the lightning charge height (ds) and current waveform.

However, the generation mechanisms are still poorly understood, and there have been lacking computer simulations on the brightness, delay time and luminescence duration time of sprites with respect to the parent lightning characteristics. In this paper we use the ES/EM code of computer simulation developed by Cho and Rycroft(1997). The final goal is to answer the question on the different brightness, delay time and luminescence duration time of sprites. This paper intends to answer the whole aspects of the sprite generation in Japan in summer and in winter. By changing the current waveform (Pseudo M-component) of the lightning (a current waveform with large continuing current together with an occurrence of M-component) and the parameter of sprites (brigthness), we will show what is the main factor in distinguishing the delay time and the luminescence duration time of sprites. As the conclusion of the present computer

simulation studies, we have found the following things. The most important factors leading to the morphological difference of the sprites (sprites halo, carrot sprites, and v-shape sprites) are the lightning height (ds) and current waveform, and secondly we suggest the importance of simultaneous occurrence of an M-component.