

A study on parameters determining the types of sprites by using the QE model

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Lightning-induced transient luminous events in the mesosphere are known as sprites. These sprites are broadly classified into carrots, columns, halos and jellyfishes. However, no one still fully understands the relationship between the characteristics of causative lightning discharges and the types of sprites. Using our quasi-electrostatic (QE) model for sprites, we investigate the parameters that determine the types of sprites. We find that the initiation of electrical breakdown is strongly dependent on the charge moment and the peak current of lightning discharge. Consequently, we investigate the relationship between possible types of sprites and magnitudes of charge moment and peak current. It is clearly shown that three types of sprites, halos, carrots, and jellyfishes, have different dependences on the charge moment and the peak current. We will also discuss about the dependence of sprite occurrence on the background conditions of the mesosphere such as the electron and ion densities.