

Numerical modeling of sprites: energetics of sprites and their chemical effects on the middle atmosphere

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Using our newly developed field and particle model, we have performed numerical simulations on the energetics and dynamics of sprites. We derived the non-Maxwellian energy distribution function of electrons accelerated by a large electric field in the middle atmosphere above thunderstorms. In addition to ionization, dissociation and excitation processes, photoionization processes due to EUV emission, which are caused by accelerated high-energy electrons, are included in this model. Temporal evolution of optical emissions is discussed, focusing our attention on the effect of photoionization processes, and the results are compared with observations. The temperatures of electrons estimated in the modeling are also compared with the results of observations. Further, by substituting the total amount of ions and atomic neutrals produced by individual sprite events into a 1-D chemical transport model, we will discuss the effect of sprites on mesospheric ozone chemistry.