



Modelling the ion chemistry of daytime sprite streamers

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Mesospheric electric breakdown events (sprites) are mainly nighttime phenomena. Therefore, the ion chemical impacts of sprites have commonly been studied for nighttime conditions. However, some daytime sprites have been detected. We present detailed model studies on the chemical impacts of daytime sprite streamers. For this purpose, a plasma chemistry model has been developed. It accounts for more than 90 species being relevant for the reactions in sprite streamers, and several hundreds of reactions. The effects of solar photons are considered by photolysis and photoelectron detachment processes. The model simulations indicate that the chemical impacts of daytime sprites differ in some respects from nighttime events. Due to photo-detachment of electrons from negative ions, the density of seed electrons during the daytime is significantly larger than at night. As a result, ionisation, dissociation and excitation rates are higher, and larger amounts of reactive radicals are produced. The effect of electron photo-detachment becomes important for the sprite ion chemistry after a few hundred milliseconds. Furthermore, the changing atmospheric background chemistry between night and day influence the longer-term effects, in particular in terms of nitrogen radicals.