The chemistry of high altitude discharges

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Energetic electrons in transient luminescent events (TLEs) drive ionisation, dissociation and excitation of air molecules and atoms. The released reactive species initiate rapid ion-neutral reactions, and can cause chemical perturbations. Of particular interest is the liberation of atomic oxygen which can lead to a formation of ozone as well as the production of ozone depleting radicals such as nitric oxide. Due to the complexity of air plasma reactions, in general detailed models are required to assess the chemical impact of TLEs. While the chemistry of TLEs on short time scales has been investigated in some detail, not much is known about atmospheric effects on longer and larger scales.

We try to give an overview of the current understanding of the plasma chemistry of TLEs. The focus will be on model studies of sprite events. The different approaches to model streamer and diffuse TLE discharges will be discussed. Recent model results, uncertainties, and open questions will be outlined.