

# HALO AND ELVE FORMATION IN THE AXIALLY SYMMETRIC PLASMA-CHEMICAL SELF-CONSISTENT MODEL

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We developed the axially symmetric plasma-chemical self-consistent model to describe an influence of halos and elves on the chemical balance of the mesosphere and lower thermosphere as well as the optical emissions in different bands. The model takes into account 61 chemical components and considers 267 chemical reactions (see [Evtushenko et al., 2013], [Evtushenko and Mareev, 2011]) to describe chemical perturbations. An isolated cloud-to-ground discharge is considered as a source of the electromagnetic field on the heights of the mesosphere and lower thermosphere. A temporal profile of the discharge current consists of the return stroke and continuous current components, so both the slow transient (quasistatic) electric field caused by the Maxwell relaxation of the charge disturbance and fast transient (electromagnetic pulse) are calculated [Davydenko et al., 2011]. An influence of the distance to the discharge, altitude and lateral scale of the charge region, and temporal profile of the discharge current on the chemical balance and optical emission of the atmosphere are considered. To get the electron temperature dependence on the normalized electric field, the freeware solver of Boltzmann equation BOLSIG+ is used [Hagelaar and Pitchford, 2005]. Initial values of chemical components are obtained from the latest version of WACCM. It is shown that the chemical balance of the atmosphere disturbs only slightly during the halo and elve development. The model emission rates of the halo and elve in the first and second positive bands of nitrogen are in a good agreement with the observations.

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