

Numerical Calculation of Cosmic Ray Ionization Rate Profiles in the Middle Atmosphere and Lower Ionosphere with Relation to Characteristic Energy Intervals

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Abstract

Numerical calculations of galactic cosmic ray (GCR) ionization rate profiles are presented for the middle atmosphere and lower ionosphere altitudes (35-90 km) for the full GCR composition (protons, alpha particles, and groups of heavier nuclei: light L, medium M, heavy H, very heavy VH). This investigation is based on a model developed by Velinov *et al.* (1974) and Velinov and Mateev (2008), which is further improved in the present paper. Analytical expressions for energy interval contributions are provided. An approximation of the ionization function on three energy intervals is used and for the first time the charge decrease interval for electron capturing (Dorman 2004) is investigated quantitatively. Development in this field of research is important for better understanding the impact of space weather on the atmosphere. GCRs influence the ionization and electric parameters in the atmosphere and also the chemical processes (ozone creation and depletion in the stratosphere) in it. The model results show good agreement with experimental data (Brasseur and Solomon 1986, Rosenberg and Lanzerotti 1979, Van Allen 1952).

Key words: galactic cosmic ray ionization, middle atmosphere, lower ionosphere.