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THE ROLE OF AMMONIA IN ION KINETICS IN THE TROPOSPHERE UNDER COSMIC RAY EXPOSURE *)

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Information about the distribution of ion concentrations in the troposphere at altitudes up to 40 km is of significant theoretical and practical importance, as ion involvement in physico-chemical processes influences the dynamics of tropospheric and cloud charge formation. The goal of this study is to determine the altitude dependence of ion concentration formed in the troposphere under calm geomagnetic conditions under the influence of cosmic rays and radioactive gamma radiation from the ground in a humid atmosphere. The obtained results are necessary for controlling the processes of formation of layered thunderclouds and artificial stimulation of precipitation [1].

A kinetic model was developed to calculate ion concentrations, including 55 components and 160 reactions, using the KINET software package. The study demonstrated that cosmic ray ionization of air at altitudes from 5 to 35 km leads to the formation of plasma primarily consisting of ions $NH_4^+ \cdot NH_3 \cdot H_2O$, $H^+ \cdot (H_2O)_4$, and $O_2^- \cdot (H_2O)_2$. Ion concentration peaks are observed at altitudes of 10 to 15 km under conditions of minimum magnetic rigidity.

A significant effect of ammonia molecules on the concentration distribution of positive ions in humid air near the Earth's surface was found. The obtained results differ markedly from model calculations for dry air and allow for the creation of realistic models of cloud charging, complementing the findings in works [1-2], where estimates were made for dry air.

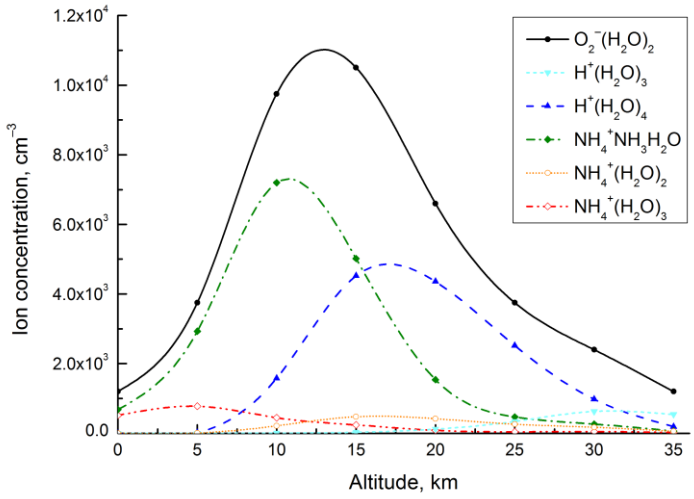

Fig. 1. Altitude dependence of ion concentrations at magnetic rigidity M = 0.6 GeV.

References

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