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Parameterization of the model of electronic-vibrational kinetics of the excited products of O_2 and O_3 photolysis in the middle atmosphere of the Earth

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The new model of O_2 and O_3 photolysis in contrast to previous models takes into account energy transfer between the electronically-vibrationally excited singlet levels of oxygen molecules and the vibrationally excited levels of the oxygen molecules in the ground state. More than 100 chemical reactions with participation of O_2, O_3, N_2, CO_2 molecules and O(^{3}P) atoms are taken into account in the model. The sensitivity of the model to variations of the main atmospheric components of the mesosphere and lower thermosphere and also to rate constants and quantum yields of reactions, in which these components participate, was studied. A group of key reactions was found, and the parametrical model of O_2 and O_3 photodissociation on basis of this group of key reactions was created for (a) the direct problem (calculations of the vertical profiles of [O_2($a^1\Delta_g$, v$\geq$0)] and [O_2($b^1\sum_g^+$, v$\geq$0)]), (b) the inverse problem (retrieval of vertical ozone profiles from intensity of Atmospheric (0-0) at 762 nm and IR Atmospheric (0-0) at 1.27 μm bands of O_2 emissions) and (c) the energy transfer problem between electronically-vibrationally excited levels of O_2 molecules.