Sensitivity of chemical composition of the atmosphere of Mars to solar energetic particles: first results obtained by photochemical simulations.

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One-dimensional time-dependent photochemical model for the atmosphere of Mars was developed to investigate the response of chemical compounds to energetic particles, which reach this planet after solar proton events (SPEs). The interaction between oxygen, nitrogen, hydrogen compounds, except the main component (CO_2), have been included in the model jointly with vertical diffusion. Lower boundary was placed at the ground and upper boundary was fixed at 100 km. The numerical method based on the conception of "chemical families" was used for solving aeronomic part of the system of equations at each step. Photodissociation rates have been calculated several times during the day and were assumed zero during night condition. Climatological vertical temperature structure and photochemical calculations for middle latitudes (50^0) have been used. It was assumed that external forcing caused by solar protons is realized via ionization of CO_2 by energetic particles with generation some ions and production neutral compounds like CO and O. So, we have changeable full chemical system of the atmosphere of Mars during SPE. In order to calculate the ionization rates GOES data measured near the Earth were used after reducing corresponding fluxes of solar protons in accordance with the distance of Mars from the Sun. SPE of October 2003, which had pronounced effects in the atmosphere of the Earth, was took into account. It was shown in simulations that solar protons cause ionization about more than 10^9pairs of ions/($m^3 \bullet$ s) during first three days of SPE in a column from the ground to 100 km level. First results, which illustrate the transformations of chemical compounds vertical profiles are obtained in simulations.