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Ionization of the atmosphere caused by solar protons and its influence on ozonosphere of the Earth during 1994–2003

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Abstract

Satellite observations of solar proton fluxes in different energetic channels have been used to investigate proton activity of the Sun during 23rd cycle of its activity. Several maxima of solar proton intensity occurred in 1998, 2000, 2001, and in 2003, with a minima in 1999. Ionization of the atmosphere caused by several strongest solar proton events (SPEs) was calculated using energetic spectrums of solar protons. It was shown on the basis of the calculations that the revealed structure of ionization caused by different SPEs looks rather different from one SPE to another. The response of chemical composition (ozone and others) at 70°N to the strongest events was calculated using photochemical model. It was shown by photochemical calculations that ozone depletion in the stratosphere and mesosphere was strong not only after famous SPE in July 2000, but also after SPE in November 2001. Special focus was on SPEs that occurred during October–November 2003 period. The results of photochemical simulations has also shown that additional production of OH molecular by solar protons leads to water vapor increase in the middle atmosphere. Calculated increase equaled about 2% in the mesosphere after SPE in July 2000. At the same time, the last result needs additional investigations involving photochemical reactions with ions.

Keywords: Solar protons; Ionization of atmosphere; Ozone change

Article Outline

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References

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