Space weather and ozone layer of the Earth

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Fluxes of energetic particles moving from the sun during the periods of its activity is an important source of chemical compounds in the atmosphere of the Earth. Such additional production of NO and OH species may rapidly destroy ozone at high latitudes in chemical catalytic cycles in the atmosphere.

GCM and 3D chemical global transport-photochemical middle atmosphere models have been used for simulation of ozone, wind and temperature response to one of the strongest solar proton events (SPEs) of the 23^{rd} solar cycle. I was found that SPEs occurred in July 2000, November 2001; and October 2003 were the major SPE in 23^{rd} solar cycle. The response of ozone, circulation and temperature was investigated using 3D global models. It was assumed in the photochemical scheme that approximately one molecule of NO and two molecules of OH are produced for each pair of ions that are created. SPE–induced ionization rates have been calculated using high time-resolution satellite measurements of solar proton fluxes provided by GOES. In accordance with calculations the maximum of ionization rates occurred was localized in the mesosphere after SPEs. 3D photochemical calculations showed that ozone was partly destroyed in the mesosphere and stratosphere over both polar regions after SPEs of 4 November 2001, and 28 October 2003, but ozone response was found only over Northern pole after SPE of July 2000, and a weak negative response of ozone over South Pole (night conditions) was found in simulations. The results of model runs showed that SPE-induced ozone depletion leads to corresponding disturbances in temperature and dynamics mostly over high latitudes. So, cosmic weather determines the variability of ozone layer, which protects our life on the Earth.