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Airglow measurement and modelling of OH* in the Earth's northern polar mesosphere during the October-November 2003 solar proton events

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The October-November 2003 solar proton events caused significant perturbations of the mesopause OH* airglow emissions that were observed with the satellite-borne grating spectrometer SCIAMACHY. These measurements are compared with results from atmospheric chemistry models. One and two dimensional simulations were carried out to investigate the impact of the highly energetic protons on the chemistry of the middle atmosphere in general and on the production of mesospheric OH* in particular. Ion pair production rates from Monte-Carlo simulations using GOES data for the solar protons' energy spectra were used to prescribe NOx and HOx production in the neutral chemistry model. The simulations show that the observed perturbations in the OH* emissions can be understood as a result of reactive hydrogen atoms liberated by precipitating solar protons within the northern polar cap region and subsequent formation of OH* via the reaction $H + O_3 \rightarrow OH^* + O_2$.