Geophysical Research Abstracts, Vol. 7, 00793, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00793


# Origin of daily variation of surface ozone in the Kola peninsula

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Surface ozone concentration (SOC) in the Lovozero observatory (φ= 68.0 N, λ= 35.1 E) on the Kola peninsula for 2000-2002 is investigated; its monthly average daily courses and behaviour of its amplitude have been found. The geophysical station Lovozero is located in a forest tract in 5 kms from the Lovozero settlement. An industrial activity near the settlement is absent. The every minute ozone measurements were made by DASIBI - 1008 AH device and were registered by a data gathering system together with meteoparameters: temperature, pressure, speed and direction of wind, humidity, luminosity. The SOC data, measured at the station, represent background values for high-latitude atmosphere with a small level of industrial pollution. The maximal daily mean SOC values take place in April and reach to 40 ppb, and minimal ones occur in August - December and equal to 15-20 ppb. The diurnal variation is at the high at 14 - 16 hour of local solar time. The amplitude of daily variation is maximal in June - September, when its value reaches 10 ppb, and is minimal in winter months (1 - 2 ppb, at a level of estimation error). The characteristic qualitative law, following from the measurements in Lovozero, is that: the daily SOC variation is great, when the light intensity is great total for a day. During small light solar radiation the daily course is feebly marked. A daily SOC variation may be caused by a daily change of solar UV intensity, a change of ozone precursors concentration, change of thermodynamic parameters of the atmosphere, change of height of the mixing layer, daily change of dry deposition rate, daily variations of ozone transport velocity. The role of these factors has been investigated by numerical modeling. We use the simple one-box photochemical model, which supposes that the concentrations of trace gases are homogeneous in the mixing layer. This model presents adequately some basic characteristics of ozone distribution in background and polluted conditions. It describes chemical transformations of 9 trace gases: O3, NO, NO2, NO3, N2O5, HNO3, CH2O.3, PAN

(peroxyacetilnitrat) and HO2 in the mixing layer, where the concentrations of these gases are supposed as constants in altitude. They react with each other and with solar UV radiation in 33 reactions, presenting the basic interactions, which are realized in the near-surface atmosphere. The photodissociation rates of NO2 and NO3, the concentrations of hydroxyl OH and important ozone precursors CÍ3Ñ(Î)Î2 and RO2 are given as functions of local solar time. In illuminated period the bulk of volatile organic compounds (VOC) is injected, and hydroxyl is generated. Organic peroxyradicals are produced in reactions of hydroxyl with VOC. The maximal photodissociation rate was chosen equal to 610-3 s-1 resulted from the measurements on Spitzbergen for nitrogen dioxide. The dry deposition velocities for different species are used from the literary sources. They are independent from daytime and season with the exception of ozone. In summer months the model of dry deposition in Alaska, depending from daytime, is used for ozone. This dependence was exploited for researching of the influence of dry deposition velocity variations on ozone concentration. The simple model of the mixing layer, typical for the middle latitude atmosphere, is used. It is found in the numerical simulation that the diurnal variation of surface ozone concentration in Lovozero is determined by ratio of chemical sources and losses in interactions and dry deposition. Mainly the average daily SOC variation is caused by dry deposition and destruction of nitrogen oxide at night, and by change both photodissociation of nitrogen dioxide and concentration of the organic precursors, necessary for ozone generation in daytime. Amount of hydroperoxyle and peroximethyl radical, formed in the atmosphere, it is not enough for an explanation of observed SOC variability. The contribution of change of mixing layer height and of non-stationarity of dry deposition velocity is small value and can be noticeable only in summer months.