

QOS2016-191, 2016

Quadrennial Ozone Symposium of the International Ozone Commission

© Author(s) 2016. CC Attribution 3.0 License.

## **Observations of 2010 and 2011 winter-spring anomalies of stratospheric ozone and NO<sub>2</sub> over Moscow region**

A.N. Gruzdev (1), E.P. Kropotkina (2), S.V. Solomonov (2), and A.S. Elokhov (1)

(1) A.M. Obukhov Institute of Atmospheric Physics, Moscow, Russian Federation (a.n.gruzdev@mail.ru), (2) P.N. Lebedev Physical Institute, Moscow, Russian Federation

We analyze results of ground-based microwave measurements of stratospheric ozone vertical profiles over Moscow and data of stratospheric vertical profiles and stratospheric column abundances of NO<sub>2</sub> retrieved from twilight zenith-sky visible-wavelength measurements at the Zvenigorod Scientific Station located 50 km west to Moscow. Coinciding-in-time anomalies of ozone and NO<sub>2</sub> sometimes occur in winter-spring periods, and the two most significant of them occurred in early February 2010 and late March 2011. The former was associated with the major sudden stratospheric warming. The O<sub>3</sub> concentration at 25 km height doubled in the beginning of February 2010 and the NO<sub>2</sub> concentration tripled, compared to the concentrations on the day preceding the beginning of the warming. Relative to the January averaged values, the increase in stratospheric O<sub>3</sub> amounted 85% and stratospheric column NO<sub>2</sub> doubled. The negative O<sub>3</sub> and NO<sub>2</sub> anomalies observed in the end of March 2011 were caused by the latitude shift of the circumpolar stratospheric vortex to the European sector. Stratospheric O<sub>3</sub> concentration over Moscow decreased by a quarter while column NO<sub>2</sub> decreased twice, relative to averages for the ten-day period preceding the anomaly. Record values of the March 2011 negative anomalies over Moscow were a consequence of a significant deficit of ozone and nitrogen oxides inside the stratospheric circumpolar vortex in early spring 2011. On the whole, significant anomalies of stratospheric ozone and NO<sub>2</sub> over Moscow in a winter-spring period are related to the spatial-temporal evolution of the stratospheric circumpolar vortex. We discovered a strong negative correlation of the stratospheric contents of the species with the potential vorticity at the 850 K potential temperature level ( $\sim 10$  hPa) and a strong positive correlation with geopotential at different stratospheric levels in March-April 2011. Stratospheric O<sub>3</sub> and NO<sub>2</sub> in 2011 were also strongly correlated with each other, but the correlation was weaker in the winter-spring period of 2010.