QOS2016-238, 2016
Quadrennial Ozone Symposium of the International Ozone Commission

Tropospheric ozone columns from two urban ground-based FTIR stations – St Petersburg (Peterhof, Russia) and Paris (Creteil, France): comparison with correlative IASI and surface observations

Y. Virolainen (1), P. Chelin (2), D. Ionov (1), T. Fratacci (2), M. Ray (2), M. Eremenko (2), J. Cuesta (2), Y. Timofeyev (1), A. Poberovskii (1), F. Hase (3), J. Orphal (3), and J.-M. Flaud (2)

(1) St.Petersburg State University, 7/9 Universitetskaya nab., 199034 St. Petersburg, RUSSIA, yana.virolainen@spbu.ru, (2) LISA, CNRS UMR 7583, Université Paris-Est Créteil et Université Paris Diderot, Institut Pierre Simon Laplace, 94010 Créteil, FRANCE, pascale.chelin@lisa.u-pec.fr, (3) Institute for Meteorology and Climate Research (IMK), Karlsruhe Institute of Technology (KIT), Karlsruhe, GERMANY

Ground-based Fourier-transform infrared (FTIR) solar absorption spectroscopy is a powerful remote sensing technique providing information on the total columns and vertical distribution of various atmospheric constituents. This study reports measurements of tropospheric ozone columns, made by two urban ground-based FTIR stations, near St Petersburg (Peterhof station), and over Paris suburbs (named OASIS for “Observations of the Atmosphere by Solar absorption Infrared Spectroscopy”) using the same inversion code PROFFIT. Peterhof station is equipped with a high resolution (0.005 cm-1) IFS Bruker 125HR instrument [1]; Creteil site has a lower spectral resolution instrument, but even with mid-resolution (0.06 cm-1) the information provided by OASIS ozone retrievals is clearly relevant to monitor both tropospheric (from the surface up to 8 km) and stratospheric ozone amounts [2].
A daily comparison of ground-based FTIR measurements with tropospheric ozone columns derived from the space-borne Infrared Atmospheric Sounding Interferometer (IASI) over Paris and St Petersburg areas from 2009 to 2015 shows a good level of agreement (correlation coefficients close or superior to 0.7 over the whole period). The highest correlations are observed if we consider a temporal criterion (only 9h30 IASI data measurements of IASI) and during summer periods under conditions of higher surface temperatures and larger thermal contrast conditions.
Moreover, a qualitative comparison between in-situ surface ozone measurements and ground-based FTIR data clearly shows the two urban station’s capacity to observe diurnal tropospheric ozone variations, as well as ozone pollution episodes. In a next step, these data could help to improve the knowledge of free tropospheric composition by comparison with chemistry-transport models.

The Russian part of the study was supported by the Russian Foundation for Basic Research grant No. 14-05-00897 and by St.Petersburg State University grant No. 11.41.607.2016.

References

[1] Timofeyev, Y., Virolainen, Y., Makarova, M., Poberovsky, A., Polyakov, A., Ionov, D., Osipov, S., Imhasin, H. Ground-based spectroscopic measurements of atmospheric gas composition near Saint Petersburg (Russia), Journal of Molecular Spectroscopy, dx.doi.org/10.1016/j.jms.2015.12.007, 2015 (in press)
[2] C. Viatte, B. Gaubert, M. Eremenko, F. Hase, M. Schneider, T. Blumenstock, P. Chelin, J.-M. Flaud, and J. Orphal, Tropospheric and total ozone columns over Paris (France) measured using medium-resolution ground-based solar-absorption Fourier-transform infrared spectroscopy, Atmospheric Measurement Techniques 4, 2323-2331, 2011.