Geophysical Research Abstracts
Vol. 18, EGU2016-17241, 2016
EGU General Assembly 2016

Trends in atmospheric heavy metals abundances over the Russian part of EMEP region in 1990−2012

Sergey A. Gromov and Elizaveta S. Konkova

Insitute of Global Climate and Ecology Roshydromet & RAS, Environmental Pollution Monitoring Division, Moscow, Russian Federation (sergey.gromov@igce.ru)

The European part of Russia is covered by two atmospheric environment monitoring networks established in the 1970s-1980s to monitor and evaluate anthropogenic pollution of regional/background natural environment. These are EMEP – European Monitoring and Evaluation Program of transboundary atmospheric pollutant transmission (under the UN ECE Convention on Long-Range Transboundary Air Pollution) and IBMoN – Integrated Background Monitoring Network of environmental toxic pollution (prior to 1990 under the UNEP/GEMS supervision, mostly for East European countries). IGCE laboratories operate as analytical centers for both networks. Historically, IBMoN was partly implemented at EMEP sites to support this international program with additional (optional) data. IBMoN datasets were selected for analysis of atmospheric heavy metal trends in the Russian territory of EMEP region for the last twenty three years due to more intensive operation up to now [1, 2].

Atmospheric heavy metals are collected at the remote sites with the air samples of atmospheric aerosols deposited on Petryanov's cellulose acetate filters through high-volume pumping during 24 hours. To measure lead and cadmium content, filters are transferred into the solution to determine total amounts by the Atomic Absorption Spectroscopy (AAS) with flameless atomization. Precipitation samples (collected monthly with acidic preserving) are directly injected into the AAS detection module after filtering. The sampling procedure, special processing and analytical techniques allow us to measure concentrations at substantially low levels [3, 2].

In this study we investigate the long term trends of lead and cadmium in air and precipitation at two stations, viz. Astrakhan Biosphere Reserve (46°N, 49°E) and Danki (Oka-Terrace Biosphere Reserve, 54.9°N, 37.8°E). Following the EMEP general recommendations, the evaluation was done for two continuous periods covering 1990−2001 and 2002−2012, respectively. We apply the common methodology recommended by WMO/EMEP Task Force for trend evaluation, implemented in software developed and distributed by EMEP [4]. This methodology allows approximation of apparent trends using the superposition of the exponential (main) and residual components obtained using the ad hoc trend regression model. We further use so-called reduction parameters to investigate quantitatively the nature of trends: The total over the period (R_{tot}) and annual average (R_{ave}), with the latter corresponding to increasing trend at negative values. Overall, temporal tendencies of airborne cadmium and lead demonstrate similar behaviour, however on top of different average concentration levels. For both species our analysis confirms the increase in air and precipitation abundances at the regional and remote sites over the European part of Russia for the period of 2002-2012.

References:

1. Gromov S.., and S.G. Paramonov, 2015. Current status and prospects for the development of integrated background monitoring of environmental pollution. Problems of Ecological Monitoring and Ecosystem Modelling, v. XXVI, N 1, p. 205-221.
2. Rovinsky F.Ya. (Ed.), 1989. Analytical review of environmental pollution with heavy metals in background areas of the CMEA member countries (1982-1989). Moscow, Gidrometeoizdat, 88 p.
3. Izrael Yu.A., and F.Ya. Rovinsky, 1991. Integrated background monitoring of environmental pollution in mid-latitude Eurasia. WMO Global Atmospheric Watch No 72, WMO/TD No. 434, 104 p.
4. MSC-East, 2015. Methodology of trend analysis of air quality data (http://www.msceast.org/documents/Methodology_of_trend_analysis.pdf).