



Shift of Atmospheric Mercury Depletion and Enhancement Events in the Arctic

Fidel Pankratov (1,2), Alexander Mahura (3), Julia Korpusova (4), and Victor Milukov (5)

(1) Research and Production Association “Typhoon” of Roshydromet, Obninsk, Russia (pankratov@rpatyphoon.ru), (2) Institute of Northern Environmental Problems, Kola Science Center RAS, Apatity, Russia, (3) Danish Meteorological Institute, Research and Development Department, Copenhagen, Denmark (ama@dmi.dk), (4) Health Care Institution Center of Hygiene and Epidemiology, Obninsk, Russia (gcorpus@mail.ru), (5) Taurida National V.I. Vernadsky University, Simferopol, Crimea (victor.milyukov@crimea.edu)

Most of mercury released into the environment is observed in the atmosphere. Among pollutants mercury is a major environmental concern due to its ecological hazard. The mercury can reside in the atmosphere for a long time, and it is a reason of its global propagation in the Northern Hemisphere. For the first time (1995), the effect of Atmospheric Mercury Depletion Event (AMDE) in the troposphere was observed at the Canadian station Alert. This phenomenon is observed annually during Apr-Jun, when the polar sunrise starts till the end of the snowmelt. The same effect was reported for other polar stations situated northerly of 60°.

Since Jun 2001, long-term continuous monitoring of gaseous elemental mercury in the boundary layer of the atmosphere at the polar station Amderma (69,720N; 61,620E; Yugor Peninsula, Russia) is conducted using analyzer “Tekran 2537A”. Individual measurements are collected every 30 min. From the end of March till early June, during recent 12 years the AMDEs were observed every year. However, from June 2010 till July 2013, when analyzer was installed at about 200 m away from the Kara Sea coast, a shift of the processes of mercury depletion to winter months (Dec-Feb) was observed. For winters of 2012-2013, an increase of AMDEs events (up to 31) has been registered for the first time. In spring 2013 a sharp increase of AMDEs duration (up to 145 hours) was also recorded. Number of events then 10 times more than during monitoring period of 2001-2004.

At the same time, the shift of Atmospheric Mercury Enhancement Events (AMEEs) from the spring to summer (Jun-Aug) seasons has been identified. From Jun 2010 till Jul 2013 the most intensive growth of AMEEs in summer (45 events/year) was observed. The maximum number of AMEEs (75 events) was recorded in summer of 2013, but the maximum duration (112 hours) of events was obtained for summer of 2011. In previous years of monitoring (when the analyzer was placed at distances of 2.5 and 9 km from the coast), the maximum number of AMEEs was observed in spring.

The shift of AMDEs to winter could be a consequence of the ice cover absence in the coastal zone for winter seasons. The reason could be due to increasing of marine aerosols concentration within the atmospheric boundary layer over the Kara Sea, and therefore, intensive deposition of atmospheric mercury without photochemical reactions is observed. The shift of AMEEs to summer season might depend on the increased air temperature, and therefore, there will be an intensive evaporation of mercury from the underlying surface.

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