Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 7, 151-166, 2007
www.atmos-chem-phys.net/7/151/2007/

Circumpolar transport and air-surface exchange of atmospheric mercury at Ny-Ålesund (79° N), Svalbard, spring 2002

J. Sommar[1], I. Wängberg[2], T. Berg[3], K. Gårdfeldt[1], J. Munthe[2], A. Richter[4], A. Urba[5], F. Wittrock[4], and W. H. Schroeder[6]

[1]Department of Chemistry, Göteborg University, Kemivägen 4, 41296 Göteborg, Sweden

[2]IVL Swedish Environmental Research Institute, P.O. Box 47086, 40258 Göteborg, Sweden

[3]Norwegian Institute for Air Research (NILU), P.O. Box 100, 2027 Kjeller, Norway

[4]Institute of Environmental Physics, University of Bremen, NW1, Otto-Hahn-Allee 1, 28359 Bremen, Germany

[5]Ecological Spectroscopy Laboratory, Institute of Physics, Gostauto 12, 2600 Vilnius, Lithuania

[6]Environmental Canada: Meteorological Service of Canada, 4905 Dufferin Street, Toronto, Canada

Abstract. Mercury in different environmental compartments has been measured at Ny-Ålesund (78°54' N, 11°53' E) during an intensive campaign, 17 April to 14 May 2002. Time-resolved speciated determination of mercury in the atmosphere and snow was conducted at the Norwegian research station at the Zeppelin mountain, 474 m above the sea level, and at the Italian research facility Dirigibile Italia, 12 m above the sea level. Total Gaseous Mercury (TGM) was present in the range <0.1 to 2.2 ng m^{-3} during the campaign. Three mercury depletion events, identified as periods with decreased TGM concentrations, were observed. At the lower altitude, TGM concentrations following such events were found to exhibit both higher magnitude and larger variability in comparison to results from the Zeppelin station. Oxidised mercury species in air and fall-out with snow as well as mercury attached to particles were also measured and their concentrations were found to be anti-correlated with TGM in air. concentrations of total Hg in snow (Hg-tot) showed a large (~15×) increase in response to Gaseous Elemental Mercury Depletion Events (GEMDEs, range 1.5–76.5 ng L^{-1}). Solid evidence for photo-stimulated emissions of Hg^0(g) from the snow pack in conjunction to depletion events were obtained from gradient measurements as well as from flux chamber measurements. Steep diurnal concentration variations of Hg^0(aq) in surface seawater were also found to concur with changing solar radiation. The concentration of Hg^0(aq) in seawater was found to be in the range 12.2–70.4 pg L^{-1}, which corresponds to supersaturation. Hence, the seawater surface constituted a source emitting elemental mercury. The concentrations of RGM (reactive gaseous mercury), Hg-p (particulate mercury), and BrO column densities (detected by DOAS) were very low except for a few individual samples during the major Hg^0 depletion event. BrO vertical column densities obtained by the remote satellite ESR-2 and trajectory analysis indicate that the air masses exhibiting low Hg^0

concentrations originated from areas with high BrO densities.

Final Revised Paper (PDF, 2048 KB) Discussion Paper (ACPD)

Citation: Sommar, J., Wängberg, I., Berg, T., Gårdfeldt, K., Munthe, J., Richter, A., Urba, A., Wittrock, F., and Schroeder, W. H.: Circumpolar transport and air-surface exchange of atmospheric mercury at Ny-Ålesund (79° N), Svalbard, spring 2002, Atmos. Chem. Phys., 7, 151-166, 2007. Bibtex EndNote Reference Manager