Name of research institute or organization:

Institute for Chemical and Bioengineering, Swiss Federal Institute of Technology, ETH Zurich

Title of project:

Background air monitoring of mercury at the High Altitude Research Station Jungfraujoch

Project leader and team:

Dr. Christian Bogdal, project leader
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Project description:

Mercury is a heavy metal of particular concern due to its ability to bioaccumulate in ecosystems, and its significant negative effects on human health and the environment. Next to ocean currents, the atmosphere plays a key role in the global cycling of mercury. Main emissions of mercury occur into the atmosphere, where gaseous elemental mercury (GEM) represents >95% of total mercury. Due to its long residence time in the atmosphere, GEM undergoes long-range atmospheric transport. Thus, GEM is a ubiquitous environmental contaminant occurring in regions far away from its initial emission source. For an improved understanding of the atmospheric fate and transport of mercury, it is necessary to document and comprehend the distribution and extent of emissions from point and diffuse sources, whether these are of anthropogenic origin or due to natural sources and processes.

Measurements of atmospheric mercury at background sites provide an important contribution to the current discussions at the United Nations Environmental Programme (UNEP) to establish a global convention on mercury with the goal to reduce environmental contamination by mercury. To fulfill this goal, UNEP recommends that a global monitoring network on atmospheric mercury should be established to ensure that the required field data are available. Switzerland takes also part in the negotiations on global mercury regulations and supports these international efforts.

In the first project year, a measurement facility for GEM in the Sphinx Observatory at the High Altitude Research Station Jungfraujoch (3580 m a.s.l.) has been established. The mercury analyzer is kindly provided by the partners from the Division of Atmospheric Sciences at the Desert Research Institute DRI (Reno, Nevada, USA). The mercury analyzer draws ambient air at a flow rate of 0.8 l/min through two gold cartridges where GEM is trapped by amalgamation. GEM is then thermally desorbed and detected by cold vapor atomic fluorescence spectrometry at 253.7 nm. Dual gold cartridges allow sampling and desorbing alternatively. Thus, air is sampled continuously and a data point is obtained every five minutes.

Next, to the set up of the instrumental analytics, first data about background concentrations of GEM have been gathered during the first project year (Figure 1). Concentrations of GEM were on average 1.3 ng/m^3 with a relatively small variation (min: 0.8 ng/m^3, max: 2.6 ng/m^3, standard deviation: 0.14 ng/m^3).

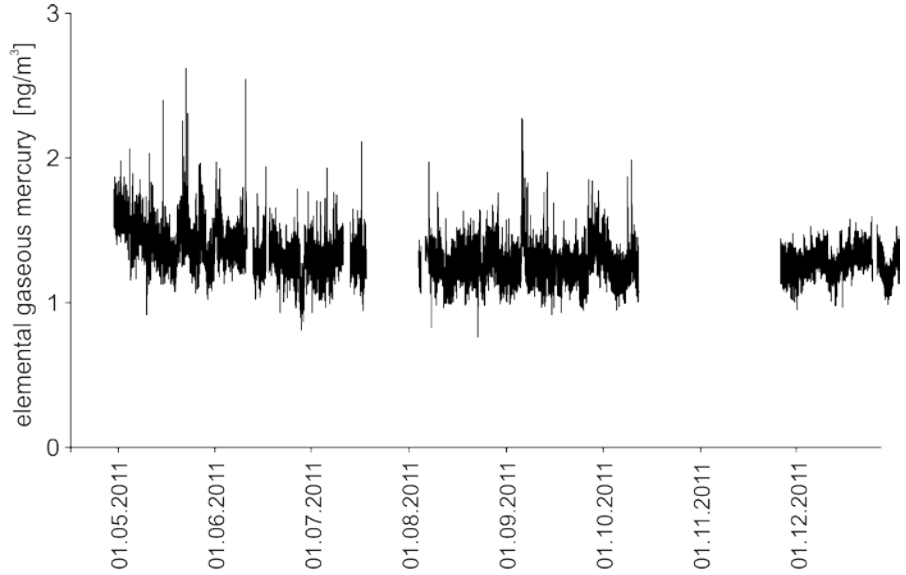

Figure 1. *Concentrations of elemental gaseous mercury measured at Jungfraujoch (3580 m a.s.l.) from 28.04.2011 to 31.12.2011.*

The concentrations of GEM at Jungfraujoch are in the range of typical background levels measured worldwide, confirming that GEM is a ubiquitous environmental pollutant. This first data set is expected to provide further insights into the emissions and fate of atmospheric mercury. The time series will be interpreted regarding the origin of air masses occurring at Jungfraujoch during the sampling events.

Key words:

mercury, atmosphere, long-range transport, air monitoring

Collaborating partners/networks:

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