

Name of research institute or organization:

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

Title of project:

SwissQuick: Emissions and imissions of atmospheric mercury in Switzerland

Project leader and team:

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Project description:

Mercury is a heavy metal of particular concern due to its ability to accumulate in ecosystems, and its significant negative effects on human health and the environment. Long-term human exposure to small amounts of mercury has been shown to result in serious neurological impairments [1]. The major anthropogenic releases of Hg to the environment result from atmospheric emissions by combustion processes, mainly coal burning and metallurgic processes and artisanal small scale gold mining. Due to its long residence time, gaseous elemental mercury, Hg(0), undergoes long-range atmospheric transport [2]. Thus, mercury can occur in regions far away from its initial emission sources.

To improve the understanding of the atmospheric emissions and transport of Hg(0), a long-term monitoring project was started in December 2013 at the High-Alpine Research Station Jungfraujoch. The goal of the ongoing study is to determine the source regions and to establish a top-down emission inventory for Europe on the basis of atmospheric mercury measurements at the Jungfraujoch. We use a Lagrangian Particle Dispersion Model FLEXPART to establish the source receptor relationship. By means of a Bayesian-Inversion we establish the spatial emission pattern of mercury for Europe as described by [3].

The measurement series was continued throughout the year 2015, prolonging the measurement series to currently two entire years.

A Tekran 2537X gaseous elemental mercury analyzer is used to measure the concentration of Hg(0) by cold vapor atomic fluorescence spectroscopy (detection limit: 0.1 ng /m<sup>3</sup>). The instrument provides a high temporal resolution of 5 min and uses an internal permeation source for automated calibration.



Figure 1. Daily mean Hg(0) concentrations on the Jungfraujoch from December 2013 until October 2015 with a median of 1.63 ng/m<sup>3</sup> and  $Q_{0.1}/Q_{0.9}$  of 1.45/1.82 ng/m<sup>3</sup>.

The Hg(0) concentrations measured at Jungfraujoeh (Figure 1) are comparable to background levels measured worldwide [2]. The median over the sampling period from December 2013 until October 2015 is 1.63 ng/m<sup>3</sup>. The differences between the years 2014 1.60 ng/m<sup>3</sup> and 2015 1.65 ng/m<sup>3</sup> are small. No annual trends could yet be identified. The preliminary investigations of potential sources of Hg(0) point towards Eastern Europe as a major contributor to the Hg(0) detected at the Jungfraujoeh.

A measurement campaign is planned for 2016 to measure different mercury species in the atmosphere, such as oxidized and particulate mercury. Therefore, an upgrade to the measurement device is needed. The new data will provide further information on the processes regarding mercury in the atmosphere.

#### References:

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#### Key words:

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Mercury, gaseous elemental mercury, long-range transport, air monitoring, trajectory modeling, Lagrangian particle dispersion model

#### Collaborating partners/networks:

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funding: Swiss Federal Office for the Environment (Bundesamt für Umwelt, BAFU)

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