

Name of research institute or organization:

Departement Umweltwissenschaften, Universität Basel

Title of project:

Baseline characterisation of air masses using radon-222

Part of this programme:

ICOS

Project leader and team:

Dr. Franz Conen, project leader

Mr. Lukas Zimmermann

Dr. Alastair Williams

Dr. Alan Griffiths

Dr. Scott Chambers

Project description:

The high-altitude research station Jungfraujoch hosts a large number of instruments continuously measuring atmospheric concentrations of gases and particles emitted (mainly) from land surfaces, as documented by numerous contributions in this report. As a continental station, Jungfraujoch is influenced to changing degrees by local and more remote emission sources on diurnal, synoptic, and seasonal time scales. For interpreting atmospheric concentration records of gases and particles measured on site it is important to distinguish air masses influenced by local sources from air masses with a composition representative of the larger region, or of the northern hemisphere. A range of methods is applied to this end, including the NO_y/CO ratio, time of day filters, meteorological/synoptic filters, trajectory analyses, and others. With our project we aim to contribute to a reliable and straightforward identification of “near baseline” conditions at Jungfraujoch through continuous precise measurement of radon-222 concentrations. Although radon-222 has been used in this context for about a century, improvements are still being made. A novel approach to which this project has made a contribution is described and validated in detail in a forthcoming publication (Chambers et al., in press). It shows, for example, that monthly mean CO₂ concentrations at Jungfraujoch are close to “true baseline” values at Mauna Loa when selected for concurrent radon-222 concentrations below 300 mBq m⁻³.

Our radon-222 detector on Jungfraujoch, built by our research collaborators at ANSTO, provided reliable data from summer 2008 until the beginning of 2013. Then, intermittent contamination set in by air being pushed out of the tunnel system to near the air inlet of our instrument, probably caused by changes made to the ventilation system after the construction of a new tunnel section (see reports from previous years).

We are grateful to the International Foundation HFSJG to have provided a new inlet and a new place for our detector in the course of replacing the protective roof on the research station (Fig. 1). Since we have moved the detector to the new place at the end of October 2015, the contamination problem has disappeared. To that occasion we refurbished the detector with a new external air blower, a new gas meter and, more importantly, a new measurement head with reduced background counts. As before, half-hourly raw data is sent every day at midnight to a server at the University of Basel, where it is automatically analysed. The data is freely available to anyone at the site radon.unibas.ch.

Over the next years radon-222 measurements will also support our second project at Jungfraujoch, on ice nucleating particles. It will enable us to investigate the influence of recent land contact on the density and composition of populations of ice nucleating particles at tropospheric cloud height.

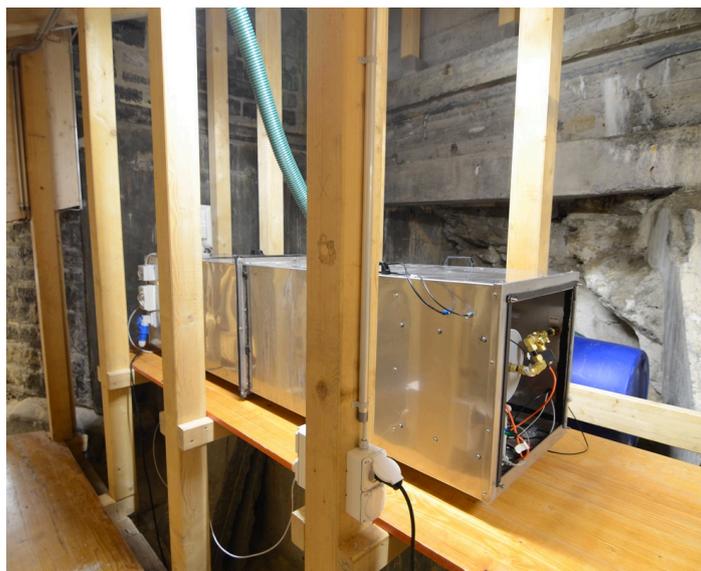


Figure 1. The radon-222 detector at its new location under the new protective roof of the research station.

Key words:

Baseline conditions, planetary boundary layer, free troposphere, radon-222, tracer

Internet data bases:

<http://radon.unibas.ch/>

<http://www.ansto.gov.au/ResearchHub/IER/Research/IsotopesinClimate/AtmosphericMixing/index.htm>

<http://www.gl.ethz.ch/research/bage/icos-ch/jungfraujoch.html>

Collaborating partners/networks:

Australian Nuclear Science and Technology Organisation (ANSTO), Sydney Australia

Laboratory of Atmospheric Chemistry, Paul Scherrer Institute, Villigen, Switzerland

Laboratory for Air Pollution/Environmental Technology, Swiss Laboratories for Material Science and Technology (Empa), Dübendorf, Switzerland

Scientific publications and public outreach 2015:

Refereed journal articles and their internet access

Chambers, S.D., W.G. Alastair, F. Conen, A.D. Griffith, S. Reimann, M. Steinbacher, P.B. Krummel, L.P. Steele, M.V. van der Schoot, I.E. Galbally, S.B. Molloy and J.E. Barnes, Towards a universal “baseline” characterisation of air masses for high- and low-altitude observing stations using radon-222, Aerosol and Air Quality Research, DOI: 10.4209/aaqr.2015.06.0391 (in press).

http://aaqr.org/ArticlesInPress/AAQR-15-06-SIMtS-0391_proof.pdf

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