

Name of research institute or organization:

**Bundesamt für Strahlenschutz, Freiburg i.Br.
Climate and Environmental Physics, University of Bern**

Title of project:

⁸⁵Kr Activity Determination in Tropospheric Air

Project leader and team

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Project description:

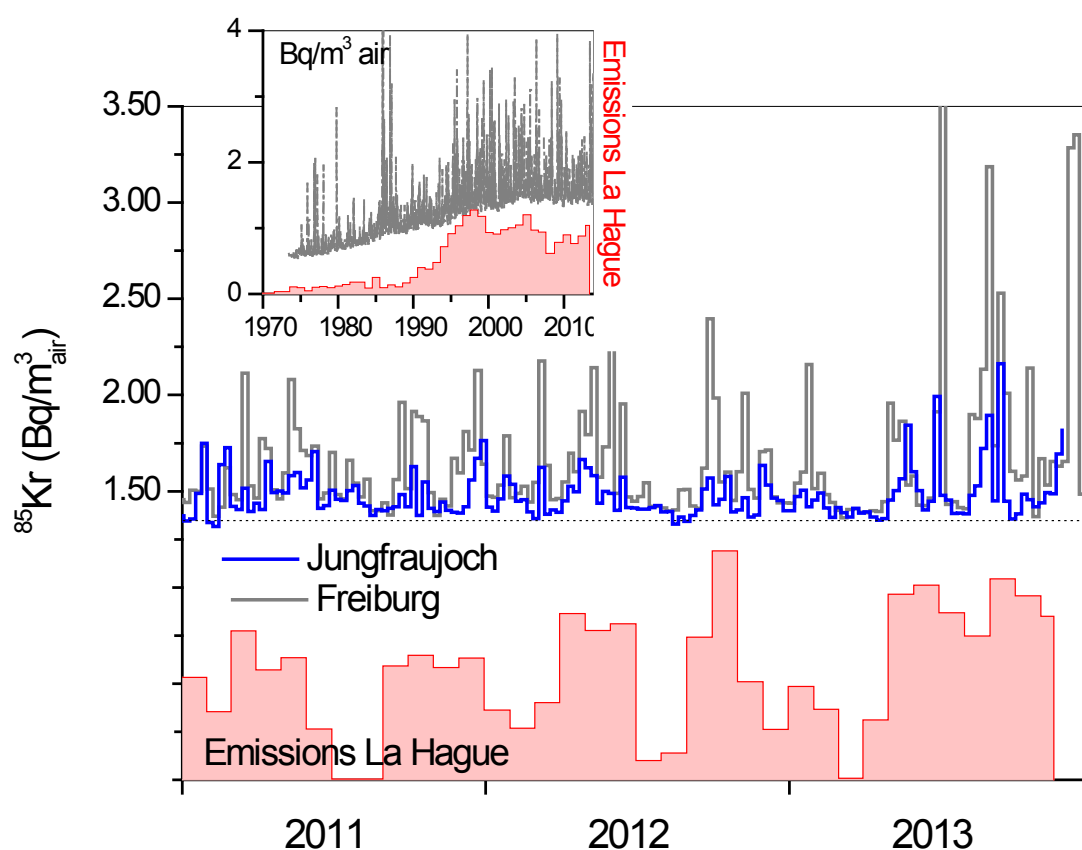


Figure 1. Measured atmospheric ⁸⁵Kr activity concentrations in weekly air samples, collected at Jungfrauoch (3500 m asl) and Freiburg i. Br. (280 m asl), during the last three years. Inset: Values for Freiburg i. Br. over the last 40 years. The red columns represent the monthly emissions from La Hague in arbitrary units (the value for December 2013 is missing; the order of magnitude is 10¹⁶ Bq Kr-85 per month). The dotted line represents a baseline activity of 1.36 Bq/m³ air.

Monitoring of tropospheric Kr-85 activity concentrations at Jungfrauoch (JFJ) continued in 2013. Krypton is separated from about 10 m³ of air continuously collected during one week and sent to the Bundesamt für Strahlenschutz in Freiburg i.Br. for measuring the Kr-85 activity concentration.

The major sources of atmospheric Kr-85 are nuclear reprocessing plants which are characterized by pulsed releases. During the last few decades the most relevant emitter is the facility in La Hague in France. The released plumes can be detected at sampling stations located in downwind direction even at distances of a few hundred kilometres (spikes in Figure 1). Due to a half-life of 10.76 years Kr-85 accumulates in the atmosphere if the release rate exceeds the decay rate of the ^{85}Kr inventory in the atmosphere. Such a steady state emission-decay equilibrium has been established over the last 8-10 years (Figure 1). The continuous and high emissions from the reprocessing facility in La Hague since May 2013 are reflected by the higher magnitude and frequency of the activity peaks measured at JFJ and in Freiburg i.Br. compared to the previous years. Above the planetary boundary layer the strength and frequency of such spikes are reduced compared to stations at lower altitude.

The location of the JFJ sampling site is crucial because of its altitude. The data are representative for the northern tropospheric background level (currently at $1.36 \text{ Bq/m}^3_{\text{air}}$) and are important for the assessment and quantification of environmental radioactivity and radiation exposure in Switzerland. Krypton-85 data are also used for studies about the dispersion of air masses, e.g. the inter-hemispheric exchange [3]. The known temporal ^{85}Kr activity evolution in the atmosphere is also the basis for dating groundwater on timescales of decades [4].

Key words:

Krypton, ^{85}Kr , radioactivity in air, reprocessing plants

Collaborating partners/networks:

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Scientific publications and public outreach 2013:

Refereed journal articles and their internet access

[3] Bollhöfer A., C. Schlosser, J.O. Ross, H. Sartorius, S. Schmid, Variability of atmospheric krypton-85 activity concentrations observed close to the ITCZ in the Southern Hemisphere, *Journal of Environmental Radioactivity*, **127**, 111-118, doi: 10.1016/j.jenvrad.2013.10.003, 2014.

[4] Visser, A., H.P. Broers, R. Purtschert, J. Sültenfuss, M. de Jonge, Groundwater age distributions at a public drinking water supply well field derived from multiple age tracers (^{85}Kr , $^3\text{H}/^3\text{He}$, noble gases and ^{39}Ar), *Water Resources Research*, **49**, 7778-7796, doi: 10.1002/2013WR014012, 2013.
<http://onlinelibrary.wiley.com/doi/10.1002/2013WR014012/abstract>

Data books and reports

[1] Umweltradioaktivität und Strahlendosen in der Schweiz, Bundesamt für Gesundheit, Abteilung Strahlenschutz, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013 (in preparation).

[2] Umweltradioaktivität und Strahlenbelastung, Deutschland, Jahresberichte 2007, 2008, 2009, 2010, 2011, 2012, 2013 (in preparation); Reihe Umweltpolitik; Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit.

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