

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:

Monitoring of tropospheric Kr-85 activity concentrations at Jungfrauoch (JFJ) continued in 2010. 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 a pulsed release behaviour. The resulting plumes can be detected at sampling stations located in downwind direction even at distances of a few hundred kilometres (spikes in Figure 1). Above the planetary boundary layer the strength and frequency of such spikes are reduced compared to stations at lower altitude (Figure 1). Due to a half life of 10.76 years Kr-85 accumulates in the atmosphere. Since the start of massive reprocessing it had created a baseline which was characterized by a continuous mean increase rate of about 0.03 Bq/m³ per year during the past four decades. It has reached a maximal value of about 1.50 mBq/m³ at the stations located at mid northern latitudes (Figure 1, Inset). Recently a trend reversal has been observed and more Kr-85 of the atmospheric inventory decays than what is released globally [1-4]. This implies that the world wide reprocessing activities do not increase any longer or even decrease like, for example, the release data of La Hague (Figure 1, red areas). At present the major emission source of Kr-85 into the atmosphere is the nuclear reprocessing plant in La Hague and most of the high values could be traced back to the La Hague by atmospheric dispersion calculations. Additionally the data show a high correlation between the measured Kr-85 activity concentrations at Jungfrauoch and even more pronounced at Freiburg and the published releases of the NPP La Hague (Figure 1).

The data of the BfS global Kr-85 measuring network provide an instrument for the surveillance of radioactivity in the environment. The location of the JFJ sampling site is important because of its altitude. The data are representative for the northern tropospheric background level.

Known Kr-85 emissions can also be used for the validation and calibration of global circulations models [5]. Last but not least, a well known atmospheric Kr-85 activity concentration is essential to use Kr-85 as one of the most reliable dating methods for groundwater. Advantageous for dating was up to now the steadily increase of the input activity which provides unique groundwater age estimations [6].

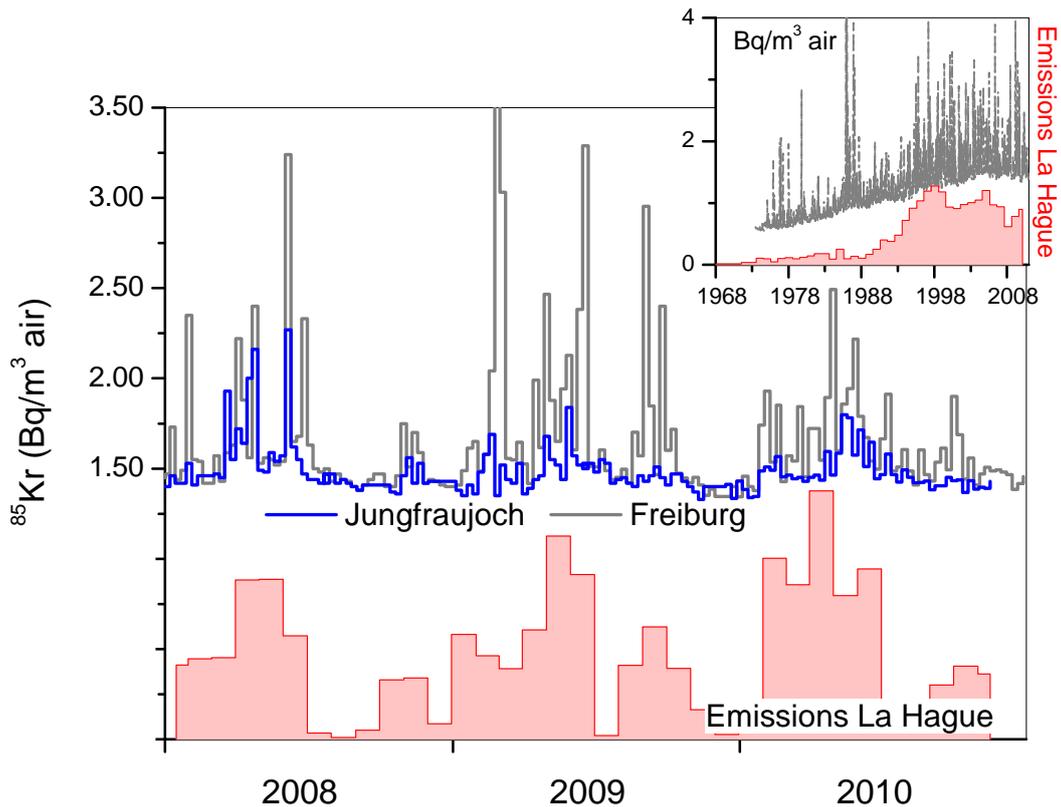


Figure 1: Measured atmospheric ^{85}Kr activity concentrations in weekly air samples, collected at Jungfrauoch (3500 m a s l) and Freiburg i. Br., during the last three years. Inset: Values for Freiburg i. Br. over the last 35 years. The red columns represent the monthly emissions from La Hague in arbitrary units (the order of magnitude is 10^{16} Bq Kr-85 per month).

Key words:

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

Internet data bases:

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Collaborating partners/networks:

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Scientific publications and public outreach 2010:

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

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

[3] Schlosser, C.: Großräumige Veränderung der Umweltradioaktivität: Atmosphärische Radioaktivität. In: Interventionen und Nachhaltigkeit im Strahlenschutz. Klausurtagung der Strahlenschutzkommission am 13./14. November

2008, Berlin. Veröffentlichungen der Strahlenschutzkommission, Band 65, H. HOFFMANN GmbH, Berlin, 2010, 254-280, ISBN 978-3-87344-159-0

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[6] Onnis A., Althaus R., Klump S., Purtschert R., Kipfer R., Hendricks-Janssen H., and Stauffer F. (2010, submitted) Worth of multiple, combined environmental tracer data in groundwater modeling. *Journal of Hydrology*

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