

Name of research institute or organization:

**Institut für Umweltp Physik, Universität Heidelberg**

Title of project:

Long-term observations of  $^{14}\text{CO}_2$  at Jungfraujoch

Part of this programme:

ICOS

Project leader and team:

Ingeborg Levin (project leader)  
Samuel Hammer

Project description:

Atmospheric  $^{14}\text{CO}_2$  observations at Jungfraujoch started in 1986 and were continued without interruption until today. This long-term record is used for studies of the dynamics of the regional and global carbon cycle (e.g. Graven et al., 2017; Orr et al., 2017), as background reference to estimate the regional fossil fuel  $\text{CO}_2$  component at polluted European stations (e.g. Berhanu et al., 2017) and as  $^{14}\text{CO}_2$  reference for the free troposphere over Europe (e.g. Palonen et al., 2017). The current decreasing  $\Delta^{14}\text{CO}_2$  trend at Jungfraujoch amounts to about 5‰ per year with a small seasonal cycle, which is due to the seasonal input of  $^{14}\text{C}$ -enriched stratospheric air into the troposphere and some seasonal contributions from biogenic and anthropogenic  $\text{CO}_2$  fluxes.

Key words:

Carbon dioxide, carbon cycle modelling, radiocarbon, fossil fuel  $\text{CO}_2$

Internet data bases:

<https://heidata.uni-heidelberg.de/dataset.xhtml?persistentId=doi:10.11588/data/10100>

Yet unpublished data are available on request at the authors.

Collaborating partners/networks:

ICOS (<https://www.icos-ri.eu/>)

Scientific publications and public outreach 2017:

### **Refereed journal articles and their internet access**

Berhanu, T. A., S. Szidat, D. Brunner, E. Satar, R. Schanda, P. Nyfeler, M. Battaglia, M. Steinbacher, S. Hammer, M. Leuenberger, Estimation of the fossil fuel component in atmospheric  $\text{CO}_2$  based on radiocarbon measurements at the Beromünster tall tower, Switzerland, *Atmos. Chem. Phys.*, **17**, 10753-10766, <https://doi.org/10.5194/acp-17-10753-2017>, 2017.

Graven, H., C.E. Allison, D.M. Etheridge, S. Hammer, R.F. Keeling, I. Levin, H.A.J. Meijer, M. Rubino, P.P. Tans, C.M. Trudinger, B.H. Vaughn and J.W.C. White, Compiled records of carbon isotopes in atmospheric  $\text{CO}_2$  for historical simulations in CMIP6, *Geoscientific Model Development*, **10**, No 12, 4405-4417, doi: 10.5194/gmd-10-4405-2017, 2017. <https://www.geosci-model-dev.net/10/4405/2017/gmd-10-4405-2017-assets.html>

Hammer, S. and I. Levin, Monthly mean atmospheric  $\Delta^{14}\text{CO}_2$  at Jungfraujoch and Schauinsland from 1986 to 2016 [dataset], doi:10.11588/data/10100, 2017.

<https://heidata.uni-heidelberg.de/dataset.xhtml?persistentId=doi:10.11588/data/10100>

Orr, J. C., R.G. Najjar, O. Aumont, L. Bopp, J.C. Bullister, D. Danabasoglu, S.C. Doney, J.P. Dunne, J.-C. Dutay, H. Graven, S.M. Griffies, J.G. John, F. Joos, I. Levin, K. Lindsay, R.J. Matear, G.A. McKinley, A. Mouchet, A. Oeschler, A. Romanou, R. Schlitzer, A. Tagliabue, T. Tanhua and A. Yool, OMIP biogeochemical protocols and diagnostics for CMIP6, *Geoscientific Model Development*, **10**, 2169-2199, doi: org/10.5194/gmd-10-2169-2017, 2017. <https://www.geosci-model-dev.net/10/2169/2017/>

Palonen, V., J. Pumpanen, L. Kulmala, I. Levin, J. Heinonsalo and T. Vesala, Seasonal and diurnal variations in atmospheric and soil air  $^{14}\text{CO}_2$  in a boreal Scots Pine forest, *Radiocarbon*, doi: 10.1017/RDC.2017.95, in press.

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