Characterisation of air masses through radon measurements

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1. Project description

In this project we continuously measure atmospheric radon (^{222}Rn) concentration outside the Research Station at Jungfraujoch. Newly acquired radon data and data of concurrently measured functional parameters of the radon detector are transferred daily to the Atmosphere Thematic Centre (ATC) of the European Integrated Carbon Observation System (ICOS). The goals of ICOS are to understand the carbon cycle, to detect changes in carbon source and sink terms, and to monitor longterm trends of anthropogenic emissions. Radon is in this context an auxiliary parameter. At Jungfraujoch it provides a means to separate 'free tropospheric conditions' from those 'influenced by the planetary boundary layer'. We presented a novel approach of how this separation may be accomplished in last year's report.

The novel approach to separate 'free tropospheric conditions' from those 'influenced by the planetary boundary layer' has already been useful in three studies on the abundance and variation of ice nucleating particles in contrasting air masses at Jungfraujoch. One of the studies has been published in its final form (Brunner et al., 2021a), the other two are available as preprints and are currently in discussion (Brunner et al., 2021b; Conen et al., 2021).

Data coverage of radon measurements in 2021 was 92% (Figure 1). The missing 8% were partly due to monthly calibrations and three-monthly determinations of the instrumental background. Overall, these necessary, routine procedures accounted for about one-third of the missing data (~3%). The remaining two-thirds (~5%) resulted from the rejection of measured radon values. Rejection by the automatic quality control and processing procedure at ATC-ICOS happens when functional parameters of the radon detector, such as sample flow rate are outside a specified range. A larger data-gap of about 10 days seems to have occurred during the middle of December. A closer look at the data will be necessary to understand why this has happened and whether at least some of the missing data from this period might be recovered.

The lower bound of radon concentration values was enhanced from the beginning of April to the end of September (Figure 1). Short peaks with values exceeding 3 Bq m^{-3} were also observed outside this period and were usually associated with storms, such as at the end of January.

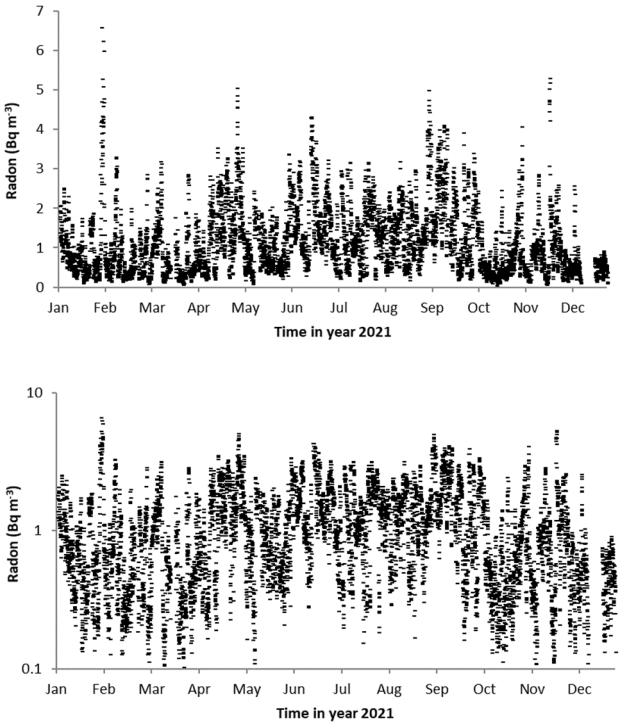

Figure 1. Hourly atmospheric radon concentration at Jungfraujoch throughout the year 2021 (top: linear scale; bottom: log-scale). Data was processed at ICOS ATC and downloaded from the ICOS data portal.

References

Brunner, C., B.T. Brem, M. Martine Coen, F. Conen, M. Hervo, S. Henne, M. Steinbacher, M. Gysel-Beer, Z.A. Kanji, The contribution of Saharan dust to the ice nucleating particle concentrations at the High Altitude Station Jungfraujoch, Switzerland, Atmos. Chem. Phys. **21**, 18029–18053, doi: 10.5194/acp-21-18029-2021, 2021a.
https://doi.org/10.5194/acp-21-18029-2021

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Internet data bases

https://www.icos-cp.eu/data-services/

Collaborating partners / networks

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Scientific publications and public outreach 2021

Refereed journal articles and their internet access

Brunner, C., B.T. Brem, M. Martine Coen, F. Conen, M. Hervo, S. Henne, M. Steinbacher, M. Gysel-Beer, Z.A. Kanji, The contribution of Saharan dust to the ice nucleating particle concentrations at the High Altitude Station Jungfraujoch, Switzerland, Atmos. Chem. Phys. **21**, 18029–18053, doi: 10.5194/acp-21-18029-2021, 2021. https://doi.org/10.5194/acp-21-18029-2021

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