

Name of research institute or organization:

Departement Umweltwissenschaften, Universität Basel

Title of project:

Quantifying mountain venting of boundary layer air through Rn-222 measurements

Project leader and team:

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Project description:

This project has two objectives. First, to learn more about mountain venting of boundary layer air and, second, to provide other projects with a direct measure of the influence of boundary layer air at the Jungfrauoch station. Regarding the first objective, we have made progress based on our observations from the years 2010 and 2011 (Griffiths et al., 2014). Applying a new objective analysis method, we quantified the land-surface influence at Jungfrauoch on an hourly basis, finding that anabatic winds occurred on average on 40 % of days. However, strong recent land surface influence was also observed on days without an anabatic component but with strong winds. Enhanced radon concentrations are an equally reliable indicator of both anabatic and non-anabatic land surface influences. Regarding the second objective, our infrastructure continuously provides half-hourly radon concentration measurements that are made freely available every day around midnight for the preceding 24 hours (<http://radon.unibas.ch>). The available record reaches back to the year 2008.

However, this second objective is compromised at the moment. As already described in the last report, we have faced a continuing problem of sample air contamination with radon-rich air from the tunnel system since the beginning of 2013, most likely caused by a combination of changes effected in the tunnel and ventilation systems over the past few years (Activity Report 2013, p. 101-103). To illustrate the continuing nature of the problem, we have plotted the 10th percentile of radon concentrations measured over the past five years (Fig. 1). It indicates an increasing background of radon since the beginning of 2013. Contamination seems to have been reduced somewhat in 2014, but still seriously compromises the reliability of our measurements. While implausibly high radon values (e.g. > 10 Bq m⁻³) are clearly identifiable as affected by contamination, intermediate values are not. As a result, our measurement record cannot be reliable and is of little use at the moment for separating between background conditions and land surface influence. The connection between the tunnel-ventilation system and the contamination issue is strongly supported by a sometimes clearly observable temporal coincidence of contamination with the time of day (Fig. 2). As already shown for the beginning of March 2013 (Activity Report 2013, p. 102), the contamination begins at 06:00 hours in the morning and may last the full day of operations in the tourist sector at Jungfrauoch. Figure 2 (below) also illustrates the problem of identifying a contaminated measurement. While the period from the 12th to the 15th December 2014 shows a clear pattern of contaminations that coincide with operations in the tourist sector, neither the day preceding, nor the two days following this period are so clearly contaminated. Most likely they were also affected but to a lesser extent, possibly because of different wind, weather or operational conditions. There is no way for us to distinguish between an un-contaminated and a slightly/moderately contaminated measurement.

We hope to solve the contamination issue this year by extending the sample inlet line along the facade of the research station. The opportunity to do this will arrive when the scaffolding for replacing the eastern part of the station's roof is in place.

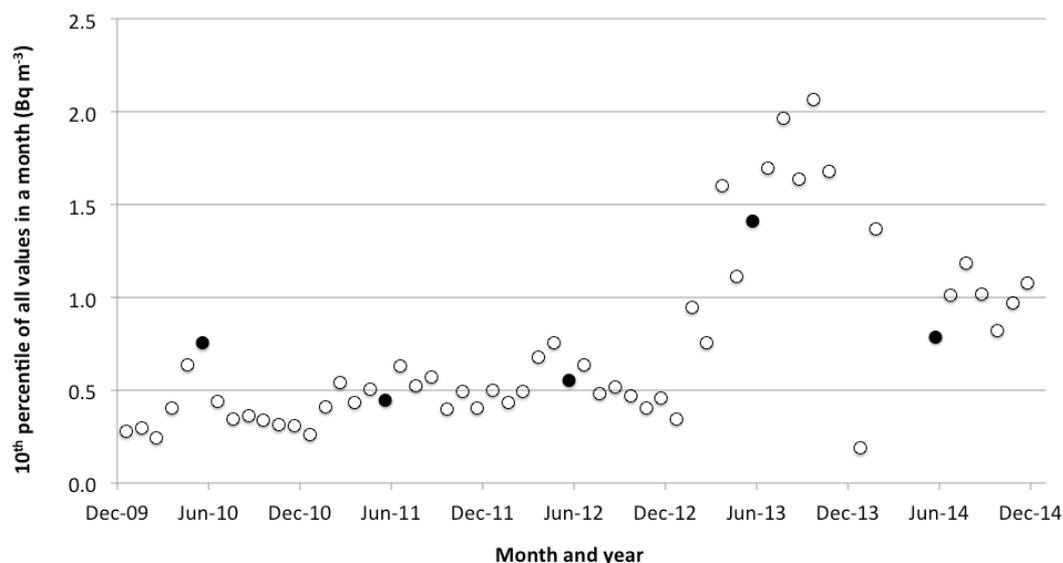


Figure 1. 10th percentile of monthly radon concentrations measured at Jungfraujoch during the past four years (black dots represent the month of June).

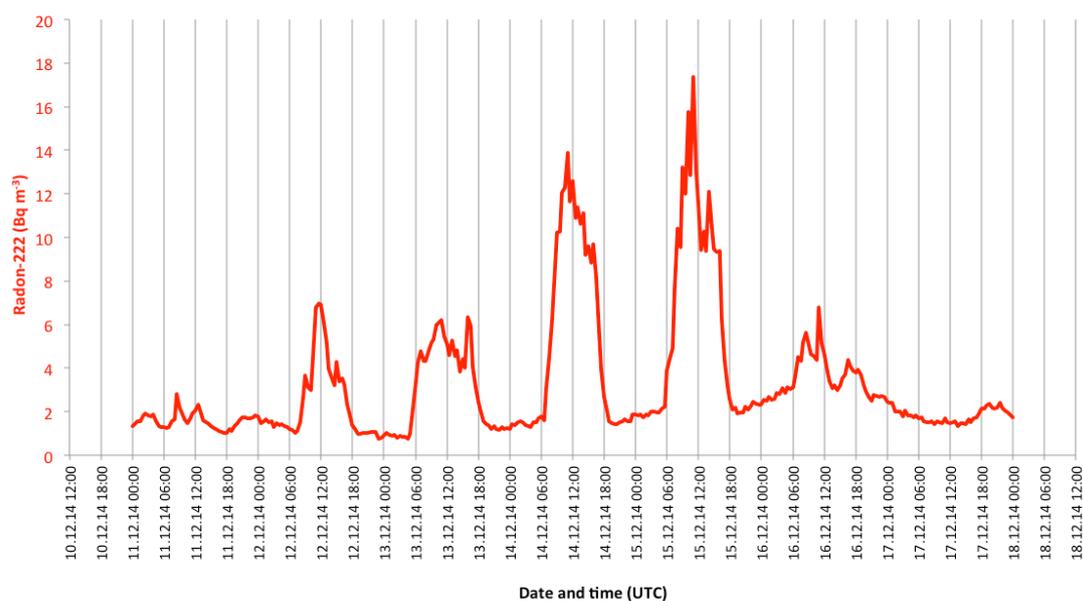


Figure 2. Diurnal pattern of radon concentrations measured over a 7-day period in December 2014. The contamination coinciding with the daily routine at Jungfraujoch is clearly discernible on some but not on all days. As long as the contamination problem persists, it compromises the reliability of our measurements in general.

Key words:

Atmospheric transport and mixing, planetary boundary layer, free troposphere, radon, tracer

Internet data bases:

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

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

Collaborating partners/networks:

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 2014:

Refereed journal articles and their internet access

Griffiths, A.D., F. Conen, E. Weingartner, L. Zimmermann, S.D. Chambers, A.G. Williams, M. Steinbacher,
Surface-to-mountaintop transport characterised by radon observations at the Jungfraujoch, *Atmospheric Chemistry
and Physics*, **14**, 12763-12779, doi: 10.5194/acp-14-12763-2014, 2014.
www.atmos-chem-phys.net/14/12763/2014/

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