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:

Our radon detectors at Jungfraujoch and at Bern have been operating almost continuously throughout the year, with the exception of 10 days at the beginning of December 2012, when a failed hard disk shut down operations at Bern. At Jungfraujoch we had shorter, but more frequent gaps in data coverage at times when ice formation obstructed sample flow through the air inlet. However, most of our efforts during the past year have gone into the analysis of the first two years of data (2010 and 2011) from both stations.

The conceptual framework of our analysis treats radon concentration at Jungfraujoch as a direct measure of ground influence (which means our definition of ground influence is weighted by radioactive decay of radon). Within this framework we presume that:

- Anabatic flow up the mountain has a diurnal signature with maximum concentrations in the afternoon
- Non-anabatic and local influence can happen at any time of day
- More distant ground influence is characterised by lower radon *variability*

We ranked all days by their contribution to the amplitude of the composite diurnal cycle of the full data set. According to their rank, blocks of 120 days each can be selected with the clearest anabatic, baseline and non-anabatic ground influence.

Composite diurnal plots of radon concentrations at Jungfraujoch and Bern for these three blocks of days show (Figure 1):

- Boundary-layer air at Bern is indistinguishable from the air at Jungfraujoch for a couple of hours in the afternoon on the most anabatic days
- Baseline days are characterised by the lowest radon concentrations at Jungfraujoch, but with a larger diurnal cycle at Bern than non-anabatic days (large diurnal cycle at Bern implies stronger night time stability: light winds, clear)
- Non-anabatic have an insignificant diurnal cycle at Jungfraujoch, but twice as large radon concentrations as baseline days, and the weakest diurnal cycle at Bern (i.e. less stable nights)

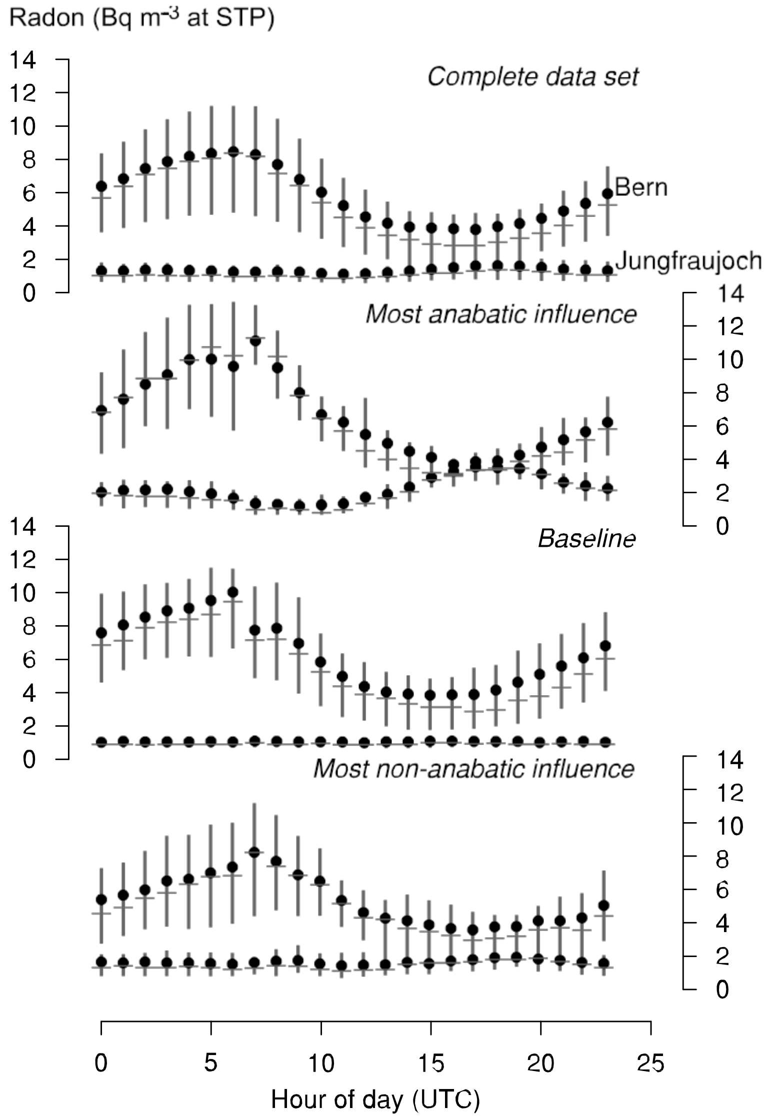

Figure 1: Jungfraujoch and Bern radon diurnal composites (note: includes only northwest winds, but including all wind directions does not change the overall picture). The mean in each bin is marked by a dot, the median by a horizontal bar and the vertical bar extends from the 25th to the 75th percentile.

An interesting feature revealed by our analysis is the apparent 'on-off' nature of the anabatic contribution to the daily radon loading at Jungfraujoch (Figure 2, top panel), although the radon seasonal cycle is pretty smooth (Figure 2, lower panel). Possibly, the relatively sudden change in mountain slope albedo, with the disappearance and re-appearance of snow cover in spring and autumn, respectively, and the related ability of slope surfaces to warm up during the day and drive an anabatic flow or not, may play a role in this.

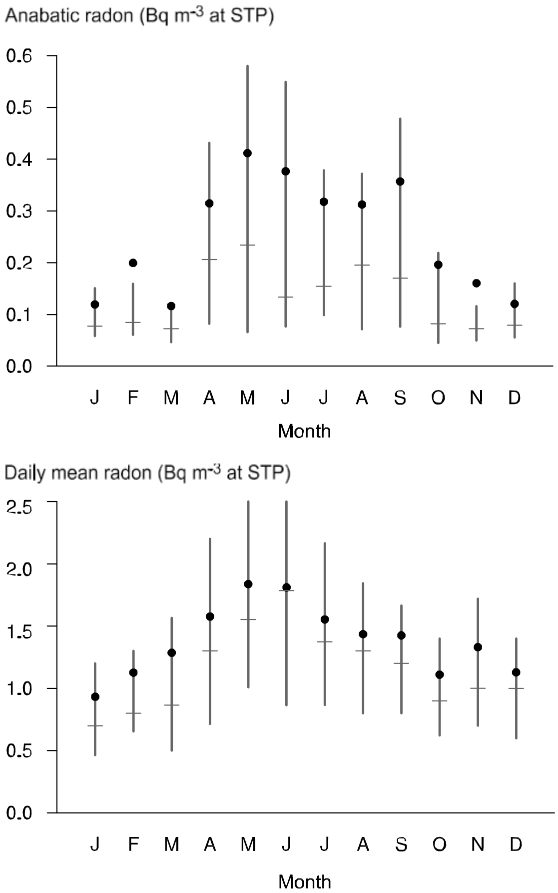

Figure 2: Anabatic contribution to the daily radon loading seasonal cycle (top) and radon seasonal cycle (bottom) at Jungfraujoch. The mean in each bin is marked by a dot, the median by a horizontal bar and the vertical bar extends from the 25th to the 75th percentile.

Key words:

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

Internet data bases:

http://pages.unibas.ch/environment/
http://radon.unibas.ch/

Collaborating partners/networks:

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