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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Factors controlling temporal variability of near-ground atmospheric ^{222}Rn concentration over Central Europe" *by* M. Zimnoch et al.

Anonymous Referee #3

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The article in acp-2013-964 entitled "Factors controlling temporal variability of near-ground atmospheric 222Rn concentration over central Europe" by Zimnoch et al., presents a 5 five year analysis of Rn concentrations and fluxes in two sites in central Europe. It provides interesting information on the various scale temporal characteristics of Rn and the controlling factors, while at the end it attempts to estimate Rn build up rates. Overall, it is an interesting paper, within the scope of the journal, however it needs major revision before it can be considered for publication in ACP. Below the authors may find my major comments and suggestions for improvement (language editing and corrections would be of benefit).

Abstract, ln 12: The standard deviations provided seem to be very low. Do they result from annual averages? Please clarify in the same sentence. Section 1, ln 6-7: Use the same format throughout the text to refer to isotopes (not Rn-222)

Section 1, paragraph 1: 222Rn is also used as a tracer for both horizontal transport (from continental to oceanic areas) and vertical transport (from the BL to the free troposphere and vice versa) (e.g. Gerasopoulos et al. 2005, JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 110, D15309, doi:10.1029/2005JD005991). Please elaborate much further on the use of Rn as a tracer of various atmospheric processes (enrich your refs), providing specific applications and benefits from it, thus indirectly highlight the need and usefulness of your study. In general I appreciate short and straightforward introductions but that was way too short.

Section 1, paragraph 2: Please remove technical information that should appear in the methodology part (e.g. instrumentation, elevation etc) and before describing the contents and structure of the paper please clarify the motivation and objectives of your work.

Section 2: Since the study covers the period 2005-2009 why are meteorology descriptions limited to 2005-2007? What is the elevation for the wind speed measurements (2, 5, 10m ?), is it common in both sites? I guess the site description should precede the brief climatologies provided.

Section 3.1: Since the paper is a bit crowded in terms of figures, I would suggest you remove Figure 1 and include it as supplementary material (probably together with a x-y scatter plot and regression analysis information)

Section 3.2: Please clarify at this point whether the two methods were deployed at the same time in both sites.

Section 3.2.1: Is the correction applied for surface Rn concentrations applied for the first time? If not please provide references. Figure 2 could also be transferred to the

ACPD
14, C2314–C2318, 2014

supplementary material since it does not seem to add directly on the discussion of the paper. The k-factor estimates arise from year 2005 though applied for the whole period. I suggest a better justification for this is provided and probably an analysis of initiated errors and uncertainty is included (sensitivity analysis?)

Section 3.2.2: This section could to be the one that evaluates the Rn fluxes measurements from the two different methods. However, no attempt to compare them here is made and a plot with monthly averages (Fig. 9) is discussed later. In 3.2.2 (ln 13) it is implied that both methods were active for the whole period, but later on we learn that this experiment was implemented (or here presented?) just for one year. I suggest the whole comparison/evaluation discussion is moved here. Why not showing the comparison on a point (8 points by day) or daily basis? Even if the results do not show up well it is worth knowing the time scale of their agreement (e.g. it works well on an annual average). It is necessary to sort out the periods used throughout the whole text and make it clear to readers.

Section 4, Table 1: The contents of Table 1 providing basic statistics certainly need to be rearranged. There is no point and physical meaning in showing average minima and maxima, and of course it is not correct to calculate amplitudes from these values since the real cycle is smoothened out this way. I suggest you only include average +/- standard deviation, median, 1st and 3rd quartiles. Make sure you refer to the same time interval all the time e.g. daily values, for instance columns 2 ad 3 of the current table refer to hourly values? Also check that the standard deviation also refers to the same time interval. It is not possible that such a daily variability would provide you with so small standard deviations for the whole period but also in each separate season.

Section 4.1: Once more the standard deviations in Fig. 5 seem very small. How are the average diurnal cycles calculated? If it comes as the average of five years average (per season) then it is not quite correct, each point (hour) should be the average of all same hours for the whole period (season) with its accompanying standard deviation (std). If std is quite large then you may use standard errors. The same stands for the

ACPD
14, C2314–C2318, 2014

discussion of amplitudes. The average amplitude (peak-to-peak) may not be the one shown in the plot (depending on the way of calculation), the correct one being when calculating max-min for each day and then doing all the statistics.

Section 4.2: The example provided is quite nice and straight. Overall, the title of this sections refers to "synoptic" changes and one expects to see maybe mean synoptic maps, rose diagrams showing the dependence of Rn concentrations on wind speed and direction for the whole period and both sites, some cluster analysis on back trajectories and link certain concentration levels with different source areas and/or trajectory characteristics (e.g. elevation from ground). I suggest you move your relevant analysis (related to Fig. 10) in this section, enrich and rearrange the discussion accordingly. That would also make the seasonality section shorter and more robust.

Sections 4.4 and 4.5 should be 4.3.1 and 4.3.2 since they deal with the seasonality analysis. In these sections I get the feeling of information repeated, for instance in Fig. 4 we get the seasonality from the hourly means, in Fig. 7 the same from monthly means and then in Fig. 11 whole period monthly means are also given. The authors should probably rearrange the whole discussion so that the minimum of plots is required. Section 4.4, 1st paragraph, ln 22-23: The statistics on the data selection effects on data availability could be more detailed and stepwise. If the authors see opportunities for further discussion or interpretation through common plotting and commentary of the Rn concentrations and fluxes, they should do it.

Section 4.5: The back trajectory analysis is fine, however you miss the vertical information of the trajectories. Please consider supplementing or substituting the current analysis with cluster analysis of back trajectories, or provide further statistics for the current grids (e.g. average level of the trajectory) Fig. 11: You need better axis label in plot (g) and (h)

Section 4.6: Please explain in the text the need to adopt the third selection criteria for your analysis (minimum concentrations). Again in page 3686 (ln 13) it seems as

ACPD
14, C2314–C2318, 2014

the difference is calculated from the means and then you propagate the errors of the means. The most appropriate way is to calculate the difference for each individual 94 pairs and then do statistics on that. In the last two paragraphs of this section, the analysis provided is probably one significant add on from this work and what should really be highlighted. It would be nice to illustrate somehow in a plot your major relevant findings and include a more through use of the errors propagation in all estimates provided, and subsequently comparisons made.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 3667, 2014.