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Atmospheric Measurement Techniques Discussions

Interactive comment on "Identifying 'persistent temperature inversion' events in a Subalpine Basin using Radon-222" *by* Dafina Kikaj et al.

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The study is focused on the identification of PTI events in a subalpine basin using two different methods: a radon-based approach and a pseudo-vertical temperature gradient technique. The first part of the paper is aimed to describe the efficacy of the radon-based approach, the second section on the comparison with the second method and finally the evaluation of observations in relation to the air quality.

I have three major comments that affect the manuscript reading:

#1 The radon analysis includes a long timescale contribution. Authors state that seasonal variability [P3-Line 33-36] depends on soil emanation during the year and they remove this contribution dividing the year using a calendar criteria. Recent papers

[Salzano et al 2016, Salzano et al 2018] modeled 222Rn emanation in agreement with observed variations [Szegvary et al 2007, Szegvary et al 2009, Zhuo et al 2008] and they showed that variations of soil emanation can be significant at a seasonal scale (up two or three times higher in summer compared to winter depending on latitude and site climatology) and probably also at a synoptic and daily scale depending on precipitations and soil freezing (10-20% higher when soils are dryer, for example at mid day). Season identification can be supported by the definition of soil emanating conditions. Authors could add at least precipitations to figure 5 and they could highlight soil-moisture effects that can affect monthly statistics, for example in September.

#2 Figures and text must be re-organized in order to increase readability. Please re-organize the text and the figures in order to group RBM and TGM results without jumping ahead and back from results to discussions.

#3 The identification of PTI events with RBM is based on the selection of a threshold defined statistically using the standard deviation of the synoptic 222Rn. Figures 2,6,7,8 show a dashed line but it is not clear in the text how it is calculated this value. Is it one for the whole year? Different values for each figure? Can the selection of the period impact on the threshold estimation?

In details:

P4-Line 25 The radon element (IUPAC) has different isotopes and only 222Rn is the decay product of 226Ra. Please refer to the IUPAC definition of radon as the element in the whole manuscript.

P5 Lines 27-33 What are you measuring, Rn or 222Rn? What is the Alphaguard model?

Figure 2 I suggest authors to show the whole dataset in order to describe longer timescale radon contributions (Figure 5a ???). While the synoptic variability is clearly recognizable from the picture (red line versus black line), the next step is hard to be

understood and replicated. You could, for example, overlay an additional line for the long-term subtraction.

Figure 2b shows a subtraction of 222Rn that comes from the analysis described by figure 3b. The amount of this subtraction in the different seasons are partially described in the text and in the processing data chain (section 2.3.1) but numbers are not reported anywhere.

Figures 2, 6, 7, 8 should be prepared together with the same 222Rn scale (nor Rn). The title in the “a” figure is OK but must defined differently from titles in figures “b”. There is subtraction and only in P7-Line 28 and later in figure 5b you specify what you mean with “synoptic”.... I suggest also to specify over the dashed line the value of sigma, it is not possible to define numbers from the y-axis. Colours and captions can help readers.

Figure 3a should be prepared for all the seasons as well as 3b.

Figure 5 should be moved before and colours of diurnal and synoptic 222Rn could be used also in figures 2,6,7,8

Figures 11,12,13 should stay with figure 4 in section 3.3

Figures 9,10,14,15 should stay together as well as the specific text in section 3.4

REFERENCES Salzano et al 2016 DOI: 10.1007/s10546-016-0149-6 Salzano et al 2018 DOI: 10.5194/acp-18-6959-2018 Szegvary et al 2007 DOI: 10.1016/j.jenvrad.2008.01.011 Szegvary et al 2009 DOI:10.1016/j.atmosenv.2008.11.025 Zhuo et al 2008 www.atmos-chem-phys.net/7/2789/2007/

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