

We want to thank Grant Forster for his review of the paper. The suggestions and comments have been considered for the improvement of the manuscript. In the following lines, the answers (in blue color) to his specific comments are developed. The recommended changes within the manuscript will be applied as soon as the open discussion will be ended.

Specific comments

1. I feel that a solid aspect of this paper is that the ARMON monitor performs extremely well and has excellent potential for deployment in radon networks. The other instruments have all been components of previous inter-comparison studies. Therefore, I suggest that the manuscript should be ARMON centric rather than being an inter-comparison study. I think that there is huge value in the work presented herein and the ARMON should be showcased. Perhaps change the title of the manuscript to reflect this?

We agree with the reviewer than the introduction of a new direct radon monitor, as the ARMON, in the inter-comparison of radon/radon progeny monitors for atmospheric concentration measurements is the solidest aspect of this work. We also agree that this monitor seems to have a great potential to be used within radon networks. The measurement technique of the ARMON is not new because it was already applied in previous instruments such as one built at the Brazilian National Institute for Space Research (INPE) (Pereira and da Silva, 1989; Tositti et al., 2002). In addition, the ARMON monitors have been already used in the past years for different studies in the atmospheric research field (Grossi et al., 2012; Vargas et al., 2015; Hernandez-Ceballo et al., 2015; Grossi et al., 2016; Grossi et al., 2018).

However we like to pointed out that, from a general point of view, it is the first time that four direct/indirect radon monitors, based on different measurement methods, have been running in parallel at the same site and at different heights. This gives the opportunity of comparing their responses under the same atmospheric and meteorological conditions. It is also the first time that the ARMON response is compared with the one of another direct radon monitor such as the ANSTO which is quite well characterized.

As correctly stated by the reviewer, the ARMON also shows a higher detection limit compared with the ANSTO and a larger uncertainty. At the same time seems that the ANSTO does a smoothing over the time series when fast changes in the atmospheric radon concentration are occurring. In order to correctly evaluate all these previous observations, the authors think that it is necessary, and are already planning, a long term inter-comparison campaign to specifically analyze the ARMON performances vs ANSTO's ones as explained also in the conclusion of this paper.

Therefore, we would like to present the results of these comparisons between different monitors without using any one as reference instrument neither focusing on anyone.

However, the modified version of our manuscript will showcase the introduction of a new portable direct radon monitor, the ARMON, its potential and the importance of completely evaluating its qualities and faults as direct radon monitor for atmospheric stations.

2. In the abstract, the author mentions that this paper evaluates “correction factors between monitors”. I think that the author needs to highlight that the slopes from the scatter plots are the correction factors.

It will be done as suggested by the reviewer.

3. I would like to see a section which compares the outcomes of this study with those from previous instrument comparisons (e.g. Schmithüsen et. al., 2017) to put the findings into context.

How well do they agree? How site-specific are these corrections and what can be done to overcome this? What needs to be considered in future inter-comparison studies?

We agree that a section where the findings of this studies will be compared with the ones founded in previous studies could be of interest.

We decided here to compare the slope/offset of the regression lines calculated in this study between ANSTO and LSCE monitors against the HRM because they were also calculated in Schmithüsen et. al., 2017 for others ANSTO monitors and at different heights. The slopes (correction factors) are defined as (routine station monitor) / HRM.

However, looking at these data it is important to take into account that so far a unique traceability chain is not yet available for atmospheric radon measurements and the different monitors used at the different stations could have different calibration chains (ex. radon source, primary standard, etc.). It is also important to underline that the heights of the input was different at each station in Schmithüsen et. al., 2017 and this, as reported in Levin et al., 2017, implies the need of a correction on the ^{218}Po concentration measured by the HRM, which was used as reference. In Schmithüsen et. al., 2017 these corrections were not applied.

The table below will be included and discussed in the modified version of our manuscript.

Site/Input Height	Schmithüsen et al., 2017	Schmithüsen et al., 2017	Schmithüsen et al., 2017	Present study	Present study	Present study
ANSTO monitors/HRM	Activity Range (Bq m ⁻³)	Slope	Offset	Activity Range (Bq m ⁻³)	Slope	Offset
Cabauw: 200/180 m	0-8	1.11±0.04	0.11±0.06			
Saclay: 100 m				0-11	1.03±0.01	0.15±0.06
Lutjewad: 60 m	0-6	1.11 ± 0.02	0.11 ± 0.02			
Heidelberg: 35 m	0-15	1.22 ± 0.01	0.42 ± 0.04			
Cabauw: 20 m	0-12	1.30 ± 0.01	0.21 ± 0.03			
Orme des Mérisiers: 2 m				0-22	1.17±0.01	0.63±0.03
LSCE One-filter Monitor/HRM						
Orme des Mérisiers: 2 m	0-9	0.68±0.03	-0.18±0.09	0-15	0.76±0.01	-0.29±0.03

4. I think it would help to rearrange the methods section to clearly state that “direct” and “non-direct” methods are being compared. As highlighted above I feel that this is the really strong part of the manuscript as this brings in a second “direct” measurement.

We will rearrange the methods section as suggested by the reviewer and we will also underline the importance of the presence of a second direct radon monitor.

5. Section 2.1.2. Can you add a little bit of information to describe how the measured progeny from the HRM one-filter monitor is related to ^{222}Rn activity concentration? This is discussed in Schmithüsen et al (2017) but it would be good to see it repeated here.

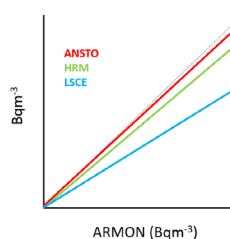
We will add this information in the text.

6. Section 2.1.3. It is stated that the ARMON is portable. Can you elaborate and possibly give the dimensions?

Sure, we will add this information in Table 1 in the “portability level” column (see below)

Monitor	Method	α Spectrum	Flow Rate (L min ⁻¹)	Detection Limit (Bq m ⁻³)	Typical uncertainty	Remote Control	Need of dry air sample	Need of corrections depending on the height of the inlet	Portability Level and monitor size	References
ANSTO	Dual- flow- loop two- filter	No	~83	0.03	8-12%	Yes	No	No	Low ; 1.92 m ³	Whittlestone and Zahorowski (1998) ; Brunke et al. (2002)
ARMON	Electrostatic deposition	Yes	1-2	~0.2	20%	Yes	Yes	No	Medium; 0.18 m ³	Grossi et al. (2012)
HRM	One- filter	Yes	20	~0.05	15-20%	Yes	No	Yes	High; 0.08 m ³	Levin et al. (2002)
LSCE	One- filter	Yes	160	~0.01	20%	Yes	No	Yes	High; 0.03 m ³	Polian, 1986; Biraud, 2000

7. I suggest an additional figure with a synthesis of the slopes between the different monitors that are summarized in Table 2. This could be in the form of ANSTO vs. all of the other monitors for each site. However, keep table 2 as it contains all of the detail, it's just not easy to picture and visualize. I have added a figure to demonstrate what I mean.

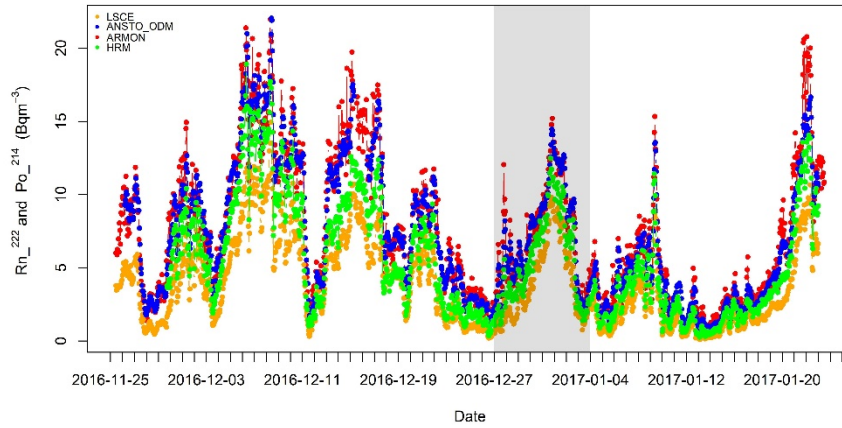


Within the text of the point 7 the reviewer suggested to plot the results of Table 2 in the form 'ANSTO vs all' but in the figure he copied as example he plotted 'ARMON vs all'. We guess he meant the second case. The suggested figures, as summary of the table results, will be added to the manuscript both for ODM and SAC sites.

Technical comments Figures:

Sometimes hard to distinguish between the blue traces (ANSTO) and the black traces (ARMON) on the figures. However, this may be due to my eyes?

We have tried different colors. Here we copy an example with red (for us the best choice) used for the ARMON. We will change all figures in agreement with it within the modified version of our manuscript.



Line 42: replace “because of the” with “from the”.

Lines 200 – 201: “method C”. It’s unclear what this means.

Line 251 and 252: I don’t understand this sentence.

Line 251 - 257: Switched tense after the first sentence.

Line 255: Replace “Fine” with “fine”

Line 261: Replace “in order to” with “To”

Line 353 – 358: This long sentence is hard to follow. Please revise.

Line 383: Remove “compared” Use “ ” or “alpha” Use “progeny” or “daughters”.

The previous changes suggested by the reviewer will be applied within the modified manuscript.