Dear Authors,

Thank you for the response to my initial comments. I appreciate that the manuscript currently under review is not an intercomparison manuscript and I am not asking for it to become one. As the authors point out, a separate, independent characterisation and intercomparison of the new ARMON V2 with other radon monitors has recently been conducted, for which the results are still being finalised for publication. In itself, this brings into question the timing and utility of the present manuscript – given that its content may either detract substantially from the novelty of the planned independent intercomparison study or be difficult to retrospectively correct if later found to be incomplete.

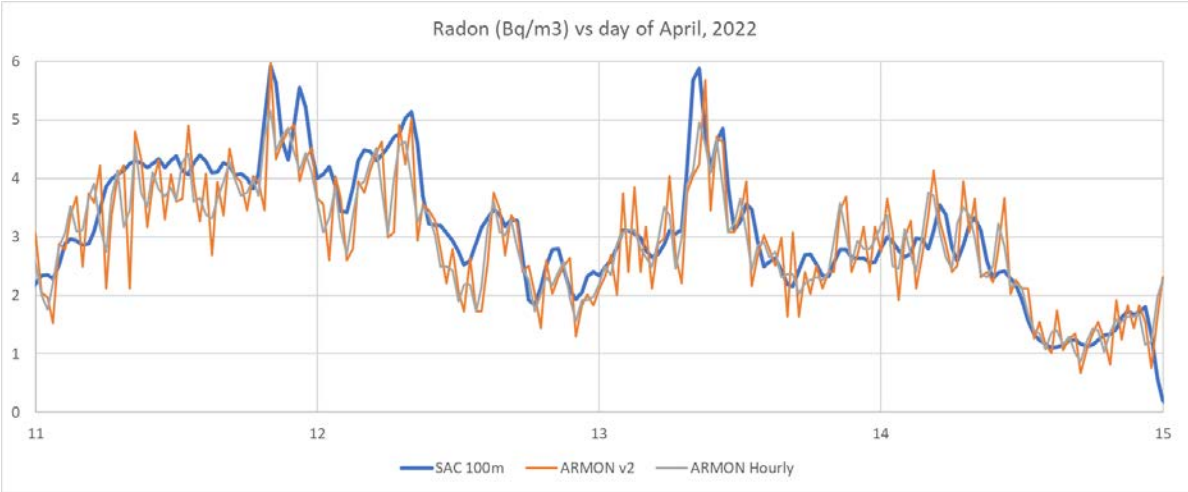
The main point I was trying to make is that the transparency of reported findings is important to the research community. Every instrument has its strengths and weaknesses, and this information needs to be reported in an easily interpretable, objective manner for potential users to make an informed decision as to whether a particular instrument is fit for the purpose they intend to use it for.

Lines 31-32 claim the suitability of the ARMON V2 as a calibration transfer standard device, and Lines 50-54 imply that the main target instruments for this service would be part of the European ICOS network. Radon measurements as part of the ICOS network are typically made at heights of 100 – 200 m above ground level. Furthermore, some of these sites are at remote, coastal or mountaintop locations, where radon concentrations are usually well below reported values typical of the terrestrial boundary layer globally (the value quoted by the authors was 5 Bq/m^3).

As an example, Cabauw is a key European ICOS site, located in a flat inland region. Based on 10 years of Cabauw radon observations at 200m agl, the 10^{th}, 50^{th} and 90^{th} percentile radon concentrations for this site are 0.35, 1.1 and 3.6 Bq/m^3, respectively. Another relevant ICOS station is Saclay, in France. Based on measurements at this site in 2022 at 100m agl the 10^{th}, 50^{th} and 90^{th} percentile radon concentrations were 1, 2.5 and 6.1 Bq/m^3, respectively. If the uncertainty of the ARMON V2 is only less than 10% for radon concentrations above 5 Bq/m^3, would the authors be able to comment on the implications for transferring an SI traceable calibration to an operating radon monitor at sites where the median annual radon concentration is around 1 or 2 Bq/m3 (as is likely to be the case for many ICOS stations)? Clearly, the ARMON V2 would be better suited as a calibration transfer standard for sites where median annual radon concentrations were above 5 Bq/m^3.

Lastly, following the "full uncertainty budget" for the ARMON V2 presented in this manuscript, the authors clarify in their response that the expected measurement uncertainty at the claimed detection limit of 0.13 Bq/m^3 is 60%, and at a concentration of 0.6 Bq/m^3 the uncertainty is 28%.

The plot below compares 30-minute output of the Saclay ICOS Station 100m radon detector with 30-minute AND hourly output of the ARMON V2, the subject of the current manuscript (this small data excerpt is from the field component of the intercomparison study currently in preparation).



As already mentioned, the absolute calibration of the Saclay 100m radon detector is still being finalised as part of the laboratory component of the independent intercomparison study mentioned above (and may be subject to change by a few %), and a full uncertainty budget of the Saclay 100m radon monitor (part of the same study), has yet to be published.

However, spectral analysis of the 30-minute concentrations of the Saclay 100m radon instrument is consistent with spectral behaviour of meteorological and trace gas observations measured at the same height; lending credence to fidelity of the reported 30-minute concentration variability (driven by various timescales of turbulence and atmospheric mixing) and indicating that all combined measurement uncertainties at these concentrations are likely to be small for this instrument. The spectral behaviour of the ARMON V2 begins to deviate from that of meteorological quantities at periods of atmospheric motion below 6 hours. This implies that most of the observed bias between the ARMON V2 and Saclay 100m detector results evident above are likely attributable to measurement uncertainty of the ARMON V2. This result is not unexpected when comparing instruments with detection efficiencies of around 0.006 cps/(Bq.m^{-3}) (ARMON V2) and 0.2 cps/(Bq.m^{-3}) (Saclay 100m detector).

As evident above, at radon concentrations generally between 2 to 5 Bq/m^3, the empirical measurement uncertainty of the ARMON V2 often exceeds 30%. From a counting perspective alone, this uncertainty will increase as concentrations decrease. Consequently, if the results of the “full uncertainty budget” presented in this study indicate an uncertainty of 28% at 0.6 Bq/m^3, I can only assume that some terms have either been underestimated or overlooked. I would appreciate any comment by the authors on how to reconcile these apparent theoretical and empirical discrepancies.

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