Interactive comment on "Increasing the accuracy and temporal resolution of two-filter radon–222 measurements by correcting for the instrument response" *by* A. D. Griffiths et al.

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We thank the reviewer for taking the time to provide this review. Three main points were made. The first point was a recommendation to include measurements from a fast-time-response detector. We shall include new measurements from a fast-response detector, most likely a RAD7, in our revised manuscript.

The second point was a recommendation to perform a pseudo-data experiment to benchmark the performance of the algorithm. Even though the reviewer has indicated that either of these first two recommendations would suffice, we think that it would be useful to include both. As a result, we shall include results of a pseudo-data experiment in the revised manuscript.

The third point was a query about how well these results might generalise to other instruments of the same make. Although it was not discussed explicitly in the manuscript, we have investigated this question and found that it is possible to apply the correction to other instruments. In fact, the data in Fig. 9 are deconvolution results from a different detector. This generalisation is possible because the instrument response can be derived from a combination of the detector model and routine calibrations, which have been performed monthly. Routine data acquisition uses 30 minute counting intervals, and the calibration period begins when a solenoid valve opens and allows radon emitted from a calibration source to enter the main delay chamber of the detector. Calibration typically lasts for several hours so that the detector can approach steady state. By fitting the model to the calibration data, we are able to derive the detector response from the shape of the calibration peak. The detector response found using this method is not as well-constrained as the detector response we measured using a 1 minute injection. For the best possible results, especially at 10 minute resolution, it would be appropriate to measure the detector response (using a 1 minute injection at the inlet). Even so, the detector response derived from calibration is good enough to reconstruct 30 minute or hourly measurements from archived data.

Some remarks about generalising these results to other detectors, will be included in the discussion section of the revised manuscript.

Regarding the specific comments, the suggested changes will be included in the revised manuscript. One comment was more involved and deserves a direct response.

Please expand how/why the temperature measurements are "better" in the newer detector. Improved sensor or better placement of sensor/detector to allow measuring a more representative temperature compared to the old system? Do you have a comparison of the delay chamber measurements from the new Vaisala, compared to the temperatures measured in the previous system to be able to compare the time-series?

The measurements in the new detector are more representative of the air temperature in the delay volume. The older detector, used by Brunke et al. (2002), relied on a temperature sensor which measured the temperature of a data logger's wiring panel. The data logger was inside an electronics enclosure adjacent to the main delay chamber. Figure 1 shows time series from our detector, comparing the data logger temperature with the delay chamber and external air temperature. It shows that, in our detector, the electronics enclosure is warmer than the delay chamber and the data logger temperature changes slowly, compared with the delay chamber temperature. We do not have access to the older detector, but suspect that the behaviour of its data logger temperature would be similar.

In the revised manuscript, we shall change

"The Brunke et al. (2002) detector lacked an internal temperature sensor, relying instead on the temperature reported by a data logger, which was inside the detector but separate from the delay chamber, for air density calculations." to

"The Brunke et al. (2002) detector lacked an internal temperature sensor, relying instead on the temperature of a data logger for air density calculation. This data logger was inside the detector, but inside an electronics enclosure separate from the delay chamber. In our detector, the data logger data logger temperature ranged from being 0–20 °C higher than the delay chamber temperature."
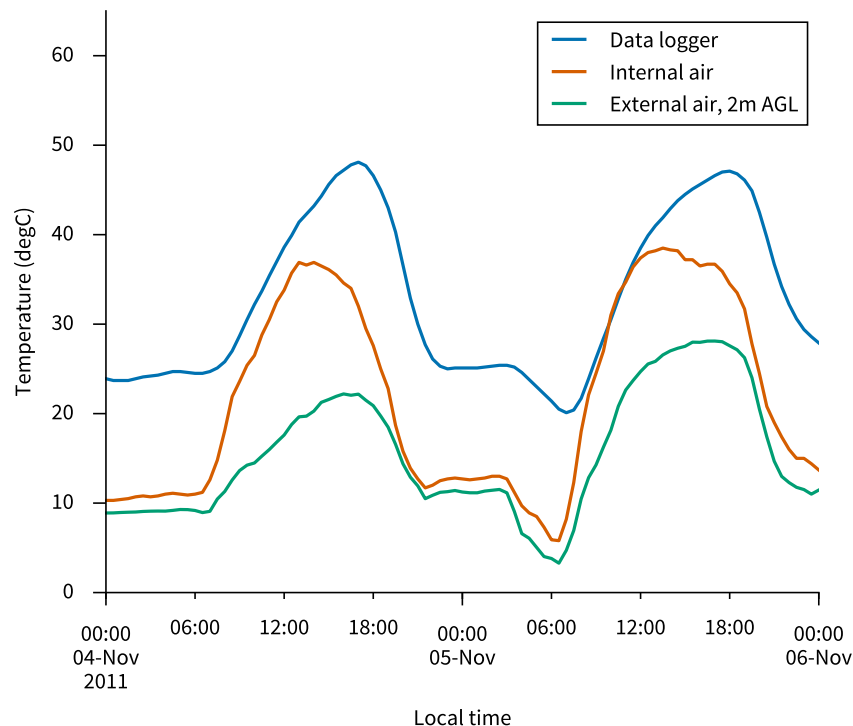
Fig. 1. Temperature sensor comparison. The data logger, inside an electronics enclosure, is warmer and changes slowly compared with the air temperature inside the delay chamber (internal air).