

## ***Interactive comment on “Technical note: Facilitating the use of low-cost methane (CH<sub>4</sub>) sensors in flux chambers – calibration, data processing, and an open source make-it-yourself logger” by David Bastviken et al.***

### **Anonymous Referee #3**

Received and published: 26 February 2020

The authors are to be commended for working toward affordable instrumentation for trace gas measurement. In addition, information provided for construction of a low-cost datalogger can be useful for other environmental measurements as well.

The authors take a primarily empirical approach to the problem of extending the range of usability of a commercial sensor. The goal is to be able to measure low levels that would be of interest in natural ecosystems. Toward this goal they describe a variety of curve-fitting calibrations. It seems possible that many readers will find the most value in knowing how best to apply these sensors, and what ultimate performance can be

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achieved. This reviewer suggests that revisions focus mostly on optimum calibration procedures and the performance metrics that can be so obtained. The following are some specific comments addressing individual statements in the manuscript.

Line 59 typo (is are)

L 63 It would be helpful to know what mixing ratios were successfully measured

L 77 why were 10 RH sensors used? Was this to provide some averaging?

L 84 How does measured RH compare with the vapor pressure of water at the given temps?

L 89 typo (form) , superfluous 'before'

L 92 some further discussion of time response is called for, especially if some data points are to be removed from the analysis on the basis of delayed responses

L 92 typo (therefor)

L 108 it is unclear why knowing RL is considered challenging, as 1% resistors are routinely available at low cost.

L 123 this reviewer is not in a good position to assess the calibration approaches in detail, as they are mainly empirical and specific to these particular sensors (which this reviewer has not personally used)

L 168 a few more details of the datalogger would be of interest to readers here. What is input voltage range and resolution (e.g. number of significant bits?). What other parameters would someone wanting to use this device in the field want to know? (see also below)

L 176 typo (influence)

L 180 self heating is a very interesting issue. How much power is dissipated at the sensor surface, and would it be expected to produce heating that is significant relative

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to the uncertainty with which sensor temperature is constrained/influenced by environmental conditions?

L 220 It would be most helpful if the conclusions stated here were expressed more quantitatively, expressed perhaps in terms of accuracy, reproducibility, and long-term stability.

L 234 Good that code is provided for the datalogger!

### Supplement

The datalogger may be of interest to many who plan on building their own field instrumentation. A more detailed circuit diagram, perhaps accompanied by a clear and more explicit image of the physical setup, would be helpful to those not experienced with Arduino.

Fig S1 shows responses over ranges of several hundred ppm. It is suggested to also present data on an expanded scale at the lower end of the usable range.

Fig. S2 what are the units associated with RMSE in this figure. It gives the impression that acceptable results can not be obtained without using 8 or 9 reference samples.

General: what are the authors' observations with regard to aging and long-term stability of these sensors?

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