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Atmospheric Measurement Techniques Discussions

Interactive comment on "Continuous methane concentration measurements at the Greenland Ice Sheet-atmosphere interface using a low-cost low-power metal oxide sensor system" *by* C. J. Jørgensen et al.

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Dear Anonymous Reviewer #3. Thank you very much for your help in improving the manuscript. Please find our detailed point-by-point to your constructive criticism of our manuscript in the included file "Combined point-by-point responses to reviewer's comments"

"Anonymous Referee #3 Received and published: 30 March 2020 In this paper, the authors studied the performance of a low-cost and low-power methane (CH4) sensing

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system prototype based on a metal oxide sensor (MOS) sensitive to CH4. The sensor was tested in a natural CH4 emitting environment at the Greenland Ice sheet (GrIS). The primary scientific importance of the study is that it provides a clear example on how the application of low cost technology can enhance our future understanding on the climatic feedbacks from the cryosphere to the atmosphere. The present study fits within the aim of this journal and the results are promising and interesting for future applications of low cost sensors.

The reviewer think that the paper can be published for open discussion and a main lack has been observed: - Low costs sensors from past studies show a 'drift' of the sensors response over the time. The authors do not cite this problem and neither they have tested it because a short experiment has been performed. This should be underline and future studies should include long term comparison between reference instrument and low cost sensor kit. The correction for the drift of the sensor will increase the final uncertainty related to the measurement and will also increase the cost of the field campaign because of the need of in situ continuous calibrations. The reviewer suggests to perform a study on the sensor drift over the months."

⇒ Reply 44: We agree with #R3 that sensor drift may be an issue which potentially can limit the long-term applicability for the specific sensor, and that this issue should be addressed in our future research.

Another study has been published for discussion in AMT during the time period where our manuscript has been in review, namely [https://doi.org/10.5194/amt-2019-402] "Long-term reliability of the Figaro TGS 2600 solid-state methane sensor under low Arctic conditions at Toolik lake, Alaska" by Eugster et al., 2019. In this study, the authors evaluated the long-term stability of a similar CH4 sensitive metal oxide sensor and conclude the following:

- Quotations from the abstract of amt-2019-402:

"At weekly resolution the two sensors showed a downward drift of signal voltages indi-

cating that after 10–13 years a TGS 2600 may have reached its end of life.. . .”

“Weekly median diel cycles tend to agree surprisingly well between the TGS 2600 and reference measurements during the snow-free season, but in winter the agreement is lower.”

“We conclude that the TGS 2600 sensor can provide data of research-grade quality if it is adequately calibrated and placed in a suitable environment where cross-sensitivities to gases other than CH4 is of no concern.”

- Quotation from amt-2019-402, ll. 208-210:

“They [TGS 2600 sensors] provide encouraging results suggesting that with occasional (infrequent) calibration against a high-quality standard, e.g. using a traveling standard operating during a few good days with adequate coverage of the near-surface diel cycle of CH4, TGS 2600 measurements might be suitable for the monitoring of CH4 concentrations also in other areas.”

We have added this reference to the manuscript in section 3.5, where the issue of potential drift is discussed.

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2019-468/amt-2019-468-AC3-supplement.pdf

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-468, 2019.

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