Biogeosciences
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Discussions

Interactive comment on "Evaluating the performance of commonly used gas analysers for methane eddy covariance flux measurements: the InGOS inter-comparison field experiment" *by* O. Peltola et al.

Anonymous Referee #1

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GENERAL COMMENTS:

In this manuscript, the authors present an inter-comparison of eight fast and precise CH_4 gas analysers suitable for eddy-covariance flux measurements using a dedicated and well-designed 3-weeks experiment. This methodological and technical topic is useful for the scientific community since the number of ecosystem-scale measurement sites of CH_4 fluxes is growing fast with the aim to better constrain the CH_4 global cycle. Reliable flux measurements are mandatory in this context and gas analysers, which are rapidly improving, are the cornerstone of these systems.

The paper shows some similarities with a previous and recent publication by the same first author (Peltola, O. et al., 2013, "Field inter-comparison of four methane gas analyzers suitable for eddy covariance flux measurements." Biogeosciences 10(6): 3749-3765), already comparing four of these height analysers but it now includes latest models and an original part of the present paper is the thorough discussion about the potential artifacts that can occur when correcting CH_4 fluxes from H_2O interferences. The magnitude of these effects is site and set-up specific and cannot therefore be extrapolated from this paper to all situations but the proposed methodology to handle the problem will be useful for the eddy-covariance CH_4 community, especially for non-experts dealing with slightly older analyser models.

The experimental set-up was not always optimal for testing the bulk performances of the analysers (separate intake tubes with different flowrates, logging problems with the LI-7000 and the G2311-f) but these limitations are properly dealt with in the discussion. Different plumbing schemes have also the advantage to allow testing robustness of the correction procedures. One missing point is that the authors should recognize explicitly that this short campaign was not relevant for testing the long-term behavior of these analysers (long-term stability, clogging of the cell, easiness of maintenance, . . .) which is an important aspect when choosing an apparatus for long-term campaigns.

State-of-the-art measuring techniques were used. The writing style is excellent, almost no typos, figures are clear and well introduced and reference to literature is appropriate and complete. I therefore recommend this paper for publication provided the minor (mainly technical) comments below are considered.

SPECIFIC COMMENTS:

P800L4: Precise what do you mean by "important". Since H_2O is mentioned, I guess you mean here through its role in the radiative balance of the atmosphere (and not through its forcing effect which is evoked in the next sentence).

P803L25: You should use micromol mol-1 instead of ppm

P807L22 and P808L1-4: Which kind of model was used for fitting the ensemble averaged temperature cospectra? Why didn't you use the traditional Kaimal's parameterization, which should be well verified on such an ideal site?

P827L1: Please consider adding a figure to illustrate your observed bias in the CH4 flux measured daily cycle in case of faulty flux computation. The question of the robustness of measured daily cycles is an important one in the community and I think it's worth a figure.

TECHNICAL CORRECTIONS:

P801L6: Typo: "main" instead of "mains".

P804L22: Typo: a verb is missing.

P806L22: Add the definition of molar mixing ratio here: "of gas c (ratio of gas c mole number to those of dry air)" and use latter on only "mixing ratio" and not "dry mixing ratio" like on L24.

P809L19: Insert this definition of "dilution" after the first occurrence of this term on L16.

P814L4: Typo: remove the first "values"

P818L10-18: Consider moving this paragraph to P810L20, in the MM section, and shorten it. This is just a confirmation of literature.

P822L1: "with the correction calculated with the internal H2O measurements and internal CH4 lag-time".

P824L21-P825L23: Move these two paragraphs to the introduction section.

P828L8: "of systematic bias".

P829L11: You can group the two identical terms in Equ. A1.

Table1: Please unify the order of presentation of analysers in all your tables. You should group them following a systematic logic (group same manufacturer and/or techniques).

Also in figures where it's relevant.

Figures: Consider removing all grids in your figures when they are not really useful.

Figure3: Typo: "to medium" instead of "to mediocre"

Figure4: Second sentence hard to read; please split it in two parts.

Figure10: The discussion linked to this figure is complicated (even if it's very precisely written and if I understood clearly your point). To lighten the figure, I would remove CH4 FGGA curve (its exact shape has no importance in the discussion) and add only a vertical line giving the lag time maximising its covariance. If you keep this curve, precise how it was normalize (by its maximum value). I would also avoid using the same colours in fig 11 since the figures are linked but the colours have different meanings in the two figures.

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