

Interactive comment on “Simultaneous Detection of C₂H₆, CH₄ and $\delta^{13}\text{C-CH}_4$ Using Optical Feedback Cavity Enhanced Absorption Spectroscopy in the Mid-Infrared Region: Towards Application for Dissolved Gas Measurements” by Loic Lechevallier et al.

Loic Lechevallier et al.

grilli.r@gmail.com

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We thank the reviewer for the very fruitful comments and remarks, which helped us to improve the manuscript. All the remarks from the reviewers have been addressed below, and changes in the manuscript have been done accordingly (highlighted in red).

Reviewer(s)' Comments to Author:

C1

Referee #2:

This article presents an OF-CEAS based mid-IR interband cascade laser spectrometer for the simultaneous measurement of [CH₄], [C₂H₆], and $\delta^{13}\text{C-CH}_4$. It is targeted to concentration ranges for CH₄ and C₂H₆ as they are found in seawater. The manuscript is well written and structured, and the results are presented in a clear and concise fashion. I recommend publication in AMT after the authors have addressed a few minor points listed below.

1 (comment from Referee): page 2, line 27: in the text the ICL is said to be from Nanoplus, but in figure 1 you write NanoGiga.

1 (author's response) : It is indeed an ICL from Nanoplus. The figure have been corrected.

2 (comment from Referee): page 3, line 6: there are a few different procedures to compute the signal used to steer the piezo-mounted mirror (to control the OF phase) (e.g. "asymmetry" of the modes etc.). Which one is used here?

2 (author's response) : The phase locking is done by looking at the symmetry or the cavity mode. This has now be specified in the text "The phase error was retrieved by analyzing the symmetry of the cavity modes during the acquisition, as explained in (Morville et al., 2005). "

3 (comment from Referee): page 4, line 8: what lineshape do you use for the spectral fit? Voigt? Could some of the issues mentioned later (i.e. dependence of $\delta^{13}\text{C-CH}_4$ on [CH₄]) come from this choice?

3 (author's response) : Please see the answers to the Referee #1.

4 (comment from Referee): page 4, line 14: after the 200 spectra are acquired, how are they interlaced? I.e. how do you know by how much the cavity modes of the n-th spectrum are offset from the (n-1)th spectrum?

C2

4 (author's response) : For the interlacing, we scan the cavity temperature by a bit more than one cavity FSR. For the interlacing to work well this scanning has to be as linear as possible in order to avoid artefacts in the spectrum. A dedicated labview routine is then identifying after how many consecutive spectra 1 FSR scan is achieved and it is homogenously distributing the spectra within this 1 FRS window. This has now been described in the manuscript "The interlacing is computed by a custom Labview routine that recognize after how many consecutive spectra a complete scan of the cavity FSR is complete. The spectra are then homogeneously distributed within the one FSR span to originate the interlaced spectrum."

5 (comment from Referee): page 4, line 31: is the exponent of your NEAS correct? should it not be -11 (per spectral point)?

5 (author's response) : The referee is correct. The values reported were not normalized by the root-square of the number of spectral elements. We further realized that the number of spectral elements used for the calculation should be 48 (as shown in figure 2). Therefore we now reported the correct values of 1.28×10^{-10} and $2.6 \times 10^{-9} \text{ cm}^{-1} \text{ Hz}^{-1/2}$ per spectral element.

6 (comment from Referee): page 5, line 14: what are line "surfaces"?

6 (author's response) : It is the area underneath the absorption line. This is now specified in the manuscript (areas underneath the absorption line)

7 (comment from Referee): page 5, line 21: you say the positions of the cavity modes are "locked", but relative to what? To the time axis of each scan (i.e. the cavity modes should always occur at the same time relative to the start of the tuning ramp)?

7 (author's response) : The position of the cavity modes is locked with respect to the position of the absorption lines. This is now clearer in the manuscript.

8 (comment from Referee): page 5, line 27: I think you mean at 17h30 (not 14h30)

8 (author's response) : Yes. This has been corrected.

C3

9 (comment from Referee): page 11, figure 1: solenoid (not solenoide)

9 (author's response) : Corrected

10 (comment from Referee): page 12, figure 2: subscript the "4" in CH₄ in the caption.

10 (author's response) : Corrected

11 (comment from Referee): page 13, figure 3: you could use the same y-axis for the top panel (just a suggestion)

11 (author's response) : Figure 3 has been modified accordingly.

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