

## ***Interactive comment on “Simultaneous Detection of C<sub>2</sub>H<sub>6</sub>, CH<sub>4</sub> 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.***

### **Anonymous Referee #1**

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This paper deals with simultaneous detection of ethane, methane and carbon isotopic composition of methane by means of mid-IR optical feed-back cavity enhanced absorption spectroscopy. The performance of the spectrometer (as obtained in the laboratory environment) in terms of sensitivity and measurement precision makes it suitable for in-situ measurements in ocean waters. In this respect, the scientific motivations are strong and very well highlighted.

C1

The work is performed well and the paper is clearly organized and written, with figures of excellent quality. Therefore, the manuscript deserves publication.

I recommend the authors to consider the comments reported hereafter.

1. The spectral region of interest shows a manifold of lines. The authors are obliged to consider 46 absorption lines in the fit of a single spectrum, with a relatively large number of free parameters. To mitigate this issue, physical constraints are applied to some of the parameters, thus reducing the degrees of freedom for the fitting procedure. Since this is one of the key points of the article, more details should be provided. In particular, a careful reader would like to know: the total number of free parameters; the number of experimental points of the interlaced spectrum; the adopted lineshape model.
2. This reviewer has the suspicion that the Voigt model has been used; if this is the case, I recommend the authors to give a look at the paper of Tennyson et al., Recommended isolated-line profile for representing high-resolution spectroscopic transitions (IUPAC Technical Report), Pure and Applied Chemistry, 2014. I am sure that the use of the HTP model would lead to reduced residuals. However, Figure 2 should provide also the residuals for the interlaced spectrum.
3. Temperature stabilization and control of the V-shaped cavity are requested in order to obtain a high-quality interlaced spectrum. In fact, the authors explain that an increase of the spectral resolution is achieved by slightly scanning the temperature of the cavity (0.02 °C of excursion), which causes a shift of the cavity mode positions with respect to the absorption lines. On page 3, they state that the cavity temperature is stabilized at 308.15 K, giving only two decimal digits. This means that the authors can control the temperature at the level of 10 mK, which is NOT sufficient for a refined control of the cavity modes. Nevertheless, reaching the mK level is surely not an easy task. Moreover, the requested equipment would limit the portability of the spectrometer. Such a key point should be discussed.

C2

4. As for the dependence of the isotopic ratio on the methane concentration, this reviewer would suggest to consider the possibility of a side effect due to the choice of the wrong line shape model.

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