

## ***Interactive comment on “Real-time analysis of $\delta^{13}\text{C}$ - and $\delta\text{D-CH}_4$ in ambient air with laser spectroscopy: method development and first intercomparison results” by S. Eyer et al.***

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We would like to thank the two Referees, Murray Hamilton and Hinrich Schäfer for taking the time to read our manuscript and for their helpful comments and suggestions. These have been addressed individually. Each reviewer comment is followed by the replies and the proposed changes in the text are indicated with "".

Referee #2 (M. Hamilton)

1) In the interest of improved readability, in the abstract (last sentence of paragraph 1)

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the per-mille symbol should also accompany the "0.1". In the 1st sentence of paragraph 2, "replicate" should be replaced by "re-peated". The former is strictly correct but the latter is plainer English.

Done

2) In section 2.1.2, paragraph 4; the sentence beginning "Therefore, we decided for a compact Stirling ..." is a bit obscure in its meaning. Specifically, how are you gaining in terms of size, weight and performance? What is this to be compared to?

The authors agree that the statement seems arbitrary. Therefore a sub-sentence was added to page 8932 Line 6 ff: "... gaining in terms of size, weight and cooling performance, with respect to the standard refrigeration unit (PCC: Polycold Compact Cooler, Brooks Automation, USA) employed in the Medusa preconcentration device (Miller et al., 2008)."

3) I would suggest that the narrative in section 2.1.3 be supported by a figure similar to Fig 4. which sets out the various time intervals and their relationships.

The authors agree and added a new figure (see figure 1 in this response). Figure caption:

"Workflow of QCLAS (top) and TREX (bottom) during a complete measurement cycle consisting of three phases: CH<sub>4</sub>-adsorption (phase I), CH<sub>4</sub>-desorption (phase II) and trap conditioning (phase III). During phase I, the sample gas and CG1 are analysed by QCLAS with intermediate flushing, while the adsorbent trap is cooled down by coupling to the base plate, and CH<sub>4</sub> from ambient air is adsorbed. During phase II, CH<sub>4</sub> desorption is initialized by decoupling the trap from the base plate and sequential heating of the adsorbent trap. In addition, desorbed CH<sub>4</sub> is filled into the QCLAS gas cell. In phase III, the adsorbent trap is conditioned (TREX), while the analysis of the sample gas is initialized (QCLAS)."

4) In section 2.2.2 the provenance of this number 1955.3 +/- 6.8 ppb should be given.

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Since this is used as a standard it is important to tell the reader how this was obtained.

Authors: The given value originates from the fact that the deployed calibration gases were diluted by a constant factor of 500:1 and the resulting mole fraction happened to be 1955.3 +/- 6.8 ppb on average. To clarify this we add the following text: " These standards were diluted by a factor of 1:500 to ambient mole fractions (1955.3 +/- 6.8 ppb CH<sub>4</sub>) with high-purity synthetic air (Fig.3)."

5) In section 3.1, I found the titles of the subsections confusing. In section 3.1.1 one presumes that TREX was used, yet the heading for section 3.1.2 would imply that it wasn't.

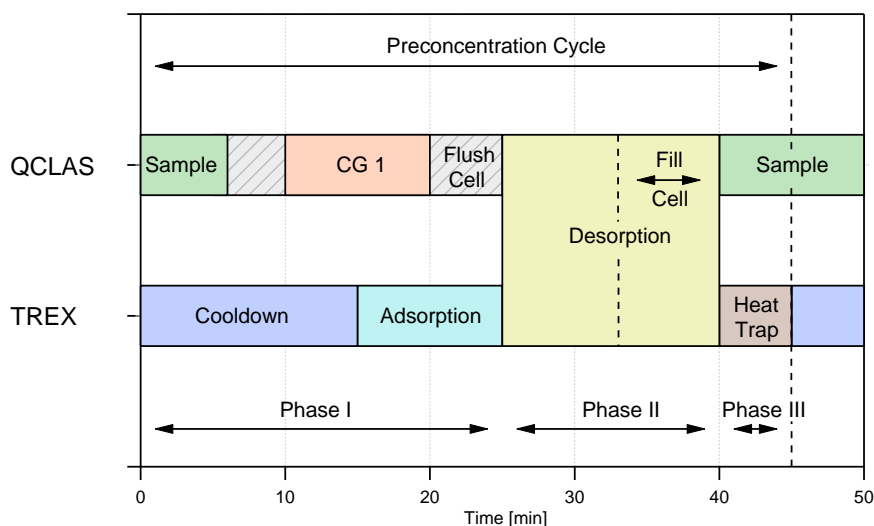
The authors agree and changed the subsections to: 3.1.1 Performance characteristics of QCLAS; 3.1.2 Optimization of TREX-QCLAS

6) In section 3.3, do you mean by "more stable boundary conditions" that a night-time inversion formed in the atmospheric boundary layer (to cap the upward movement of CH<sub>4</sub>)?

The authors agree that the statement might be insufficient and re-phrased the sentence on page 8946 Line 10 ff to: "... the nights with the highest CH<sub>4</sub> mole fractions also exhibit very low wind speed (0–7 m s<sup>-1</sup>), indicating formation of night-time inversion in the atmospheric boundary layer."

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**Fig. 1.** Workflow of QCLAS (top) and TREX (bottom) during a complete measurement cycle consisting of three phases: CH<sub>4</sub>-adsorption (phase I), CH<sub>4</sub>-desorption (phase II) and trap conditioning (phase III). ...

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