

## ***Interactive comment on “Field inter-comparison of two high-accuracy fast-response spectroscopic sensors of carbon dioxide” by B. A. Flowers et al.***

**Anonymous Referee #2**

Received and published: 7 November 2011

The paper compares two commercially available laser-spectroscopy based sensors for measurement of ambient CO<sub>2</sub>. It describes laboratory and field comparisons and provides a statistical analysis of the results.

I can not recommend publication without major changes of the manuscript, see my detailed comments below.

General comments: A linearity check of the CRDS cannot be performed using a dilution technique, as the error in flow rates largely exceeds the expected deviation of the CRDS signal from linearity. No uncertainty estimate on the resulting mixing ratio after dilution has been given, this is required to assess linearity of the sensor. In addition, nitrogen was used for dilution, which is not recommended for CRDS measurements

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of CO<sub>2</sub>. See Chen et al., 2010, who found pressure broadening effects resulting from different compositions of synthetic air, and therefore recommend ambient air standards for calibrations. Thus the linearity checks described in the manuscript are not useful the way they are described.

The CRDS response was calibrated “with respect to the TDL sensor”: It is unclear why the authors did not calibrate the CRDS itself with calibration gases, either in the field, or (if it is assumed that drift is small) using before and after deployment calibrations in the lab. “Calibrating” to the sensor that one wants to compare with sounds like circular reasoning.

Other comments: P5839 L7: reference to WMO report: there is a more recent report available that I recommend citing.

P5840, L1: Wavenumbers are given for the TDL, but not the CRDS. This should be added for completeness.

P5840 L6: The CRDS sensor uses near-IR, not mid-IR.

P5840, in Methods section: The sample pressure, flow rate and cell volume should be given for both instruments in the methods section.

P5841, L25: What do the authors mean by “TDL response . . . are held constant”?

P5842 L 21: may be one should be more specific, and differentiate between short term noise (e.g. detector noise), and noise caused by drifting of the instrument response (e.g. thermal drift not accounted for in a correction).

P5843 L18: reference “van Pelt, 2011” is not in the references list

P5844, L6: is the inlet height 4 meter or 5 meter? Should be consistent throughout the manuscript

P5845, L9: Has it been tested if the sensors have a zero intercept? From Figure 1 this seems to be the case

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P5846, L 26: The mean difference of 1.8 ppm seems larger than the combined uncertainties, which is what matters (not the variabilities). This is also by far larger than the compatibility requirements suggested by WMO

P5846, L18: It would be good to specify the weight and size

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Interactive comment on Atmos. Meas. Tech. Discuss., 4, 5837, 2011.

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