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Atmospheric Measurement Techniques Discussions

Interactive comment on "High-precision measurements of nitrous oxide and methane in air with cavity ring-down spectroscopy at 7.6 µm" *by* Jing Tang et al.

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Review of the manuscript AMT-2018-385:

The manuscript untitled "High precision measurements of nitrous oxide and methane in air with cavity ring-down spectroscopy at 7.6um", AMT 2018-385, presents a Cavity Ring Down Spectrometer (CRDS) dedicated to atmospheric measurements of nitrous oxide and methane at room temperature. A particularity of this setup is that it works in the MIR (7.4-7.8 um). Few CRDS setups are currently operating at those wavelenghts. The described CRDS setup is claimed having a detection limit of about 7.10ˆ-10 cm-1, also, standard deviation on the ring down time is of about 0.03%, which is a standard for

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CRDS setup. Here are some comments, first part are general comments and second part are technical questions.

General comment : Some English corrections are needed like for example : line 8-10, p 4 "the threshold trigger sends out a triggering signal to shutdown the AOM and a ring-down signal sequence is occurred and recorded by...". "is occured is not correct. Some other spots like this one have been detected.

Mistake line 14, p2 "fineness" is "finesse".

Please add reference "Long et al, Opt Lett. 2016 Apr 1; 41(7): 1612–1615, doi: [10.1364/OL.41.001612]" line 30 p 2. This work shows the development of MIR CRDS setup.

Specific comments :

Temperature fluctuations : line 26, p 3 : why not having picked Invar as material instead of stainless steel? Since the authors are not using frequency stabilisation scheme to correct for frequency drifts due to temperature changes. The cell body thermal expansion generates absolute frequency change of the cavity mode position and small changes of the FSR. This will results in variations in the ring down time. I agree that stainless steel is the standard material for commercial tubing and therefore easier to obtain. But Invar thermal expansion is 17 times smaller that stainless steel and so would be the frequency fluctuations. Using Invar and stabilizing the tube temperature using simple PID setup could de facto remove the help of processing correction, therefore eliminating additionnal sources of bias.

Line 11, p 4 : what is the pressure sensor used and then, it's accuracy? Then, what is the impact of the pressure sensor accuracy on the measurement uncertainty? We know that the pressure is one of the principal source for abundance measurement's accuracy.

Line 18, p 5: The authors say that the cavity is pumped down to 6.4 mbar. Is this the

lower pressure reached?

P7 : The authors shows that the ring down time is linearly dependent on the offset voltage applied to each of the 3 PZTs used. The time constant change can be as high as 10%... How are the mirrors attached to the cell? Are they glued?

Spectra acquirement: The authors do not describe how they jump for one cavity mode to another during spectra acquisition. Do they use wavelenght meter for targetting the next TEM00 mode? How stable is the frequency axis of the spectra?

Spectra processing: The authors specify that the differences between CH4 or N2O measured VMR are due to AOM-induced small change in deflection angle. Then, is this effect systematic? repeatable? How can we identify the true value from the 3 sections? Can the authors provide fit residuals along with spectra (fig 6)? The measurement differences can also be attributed to spectroscopic uncertainties or on the section B, due to the presence of N2O line beneath CH4 lines... Have these options been investigated by the authors? If so, can the author explain what are the conclusions of their investigation?

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-385, 2018.

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