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Atmospheric Measurement Techniques Discussions
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Interactive comment on "Intercomparison of Open-Path Trace Gas Measurements with Two Dual Frequency Comb Spectrometers" *by* Eleanor M. Waxman et al.

Anonymous Referee #1

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This manuscript, entitled "Intercomparison of Open-Path Trace Gas Measurements with Two Dual Frequency Comb Spectrometers," reports on a quantitative evaluation of atmospheric trace gas measurements based on dual-comb spectroscopy. Thanks to their well-polished dual-comb spectrometers and analytical approach, the retrieved dry mole fractions agree to 0.57 ppm for CO2 and 7 ppb for CH4 between the two measurement systems. These results are excellent, while there are some obscure points in the manuscript. Therefore, I recommend the manuscript for publication if following comments and questions are addressed.

[Specific comments]

[1] While I am briefly familiar with the technique of gas spectroscopy, I am not an expert

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in atmospheric measurement and concerned about some technical descriptions.

i) Is it OK for AMT readers to use some technical terms such as “WMO-calibration” and “WMO compatibility goal” without any simple explanation?

ii) L207: I was confused with the expressions of concentration. Is it correct that the dry and wet concentrations of carbon dioxide are expressed as “XCO2” and “CO2,” respectively?

iii) L209: “Volume mole fraction” might be simply “mole fraction.”

iv) Figure 5: I found volume percentage is normally expressed as “v/v% .” Is “%v/v” OK too?

[2] According to the footnote in P2, “ppm” and “ppb” are used for dry concentration (dry mole fraction) and “%v/v” is for wet concentration (wet mole fraction) as in Figure 5. However, “ppm” is used for ΔHDO and ΔH2O in Figure 6 and 7.

[3] I think the explanation about dual-comb spectroscopy is a little insufficient. For example,

i) L94 and 97: Authors should refer to Figure 1(a) here instead of Figure 1 and 1(b).

ii) L102: I could not understand the explanation “the instrument lineshape is effectively the sum of two delta-functions.” What does it mean?

iii) L139: Readers might not be sure whether fr is a sampling rate or a bandwidth.

[4] L183: Please define C_nˆ2.

[5] In Figure 4, the observed HDO is 10ˆ{-4} %v/v level, whereas ΔHDO is 1000 ppm level in Figure 6 and 7. Are they consistent?

[6] In the caption of Figure 8, “40 ppmv/$\sqrt{\tau}$” and “4 ppbv/$\sqrt{\tau}$” might be “40 ppm/$\sqrt{(\tau/\mathrm{s})}$” and "4 ppb/$\sqrt{(\tau/\mathrm{s})}$," respectively.

[Technical corrections]

[1] There are some notations without space between the value and unit; for example “1-10s” in L46, “10%” in L51. Please check and correct them.

[2] Notation variability, "dual comb" and "dual-comb."

[3] L94: Reference (Ideguchi, 2017) is missing in the list of references.

[4] L214-215: Notation variability, "three-hour" and "3-hour."

[5] L217: A beginning parenthesis is missing.

Please also note the supplement to this comment:
http://www.atmos-meas-tech-discuss.net/amt-2017-62/amt-2017-62-RC1-supplement.pdf

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