Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2019-108-RC1, 2019

Atmospheric Measurement Techniques Discussions

Interactive comment on "Recent advances in measurement techniques for atmospheric carbon monoxide and nitrous oxide observations" *by* C. Zellweger et al.

Anonymous Referee #1

Received and published: 6 June 2019

General comments

The focus of this paper is topical, since the interest and need for better understanding on especially trends of atmospheric concentrations of N2O is raised due the climate change issues during last years. However, the instrumentation and calibration gases are still not at the level enabling the expected accuracy for the measurements of CO and N2O amount fractions. This paper also promotes atmospheric stations to pay attention to the problematics found from the amount fraction measurements by discussing them broadly, and this way improve the quality of atmospheric CO and N2O concentration data globally.

Printer-friendly version

Discussion paper

The introduction section describes the background of the field and the aim of the paper shortly but still adequately. Results are dealt with high expertise and there is no doubt that authors have a deep understanding of the field. Since some graphical results are complicated, slightly longer explanations would help the reader, without a need to find a clarification from references. Tables and graphs itself are clear. Authors are referred to the key articles of this topic. The English of this paper is mainly sufficient. Altogether, my opinion is that the scientific quality of this manuscript is high, and it should be published with revisions.

Specific comments

-page 4, section 2.1: there is probably a SOP for the TS measurements at the stations? Like, how the TSs are prepared for the measurement? Is there used a similar sequence for TSs as the station uses for its own cylinder measurements or instructed by WCC? Is the protocol dependent on the instrumentation? Who is measuring the TSs in practice? I am not asking to answer all of these, but just shortly clarifying how the TS measurements done; with a certain fixed protocol or not; since this may affect to the results as well. Stations personnel may have bad habits, but they may also know by experience if their instrument needs special way to handle it.

-page 5, lines 11-12: two questions concerning water vapour correction of WCC. 1) Since droplet method is not giving appropriate results, but in page 12 you are listing two - most probably superior - methods to determine water vapor correction function, why WCC is not using or even testing those methods? 2) If the correction of the effect of water vapour to CO measurements is difficult, why WCC is not drying the sample?

-page 8, lines 27-31/Figure 5: concept “relevant amount fraction” for N2O remains a bit unclear. So, is the “relevant amount fraction range” a central 10 nmol/mol range representative for the unpolluted troposphere for the year of the audit and the “relevant amount fraction” a single representative value $\pm$0.1 nmol/mol? Please try to state this more explicitly in the text.

-pages 8-9, section 3.1.2: it is clear how and why the compatibility goal for N2O is determined. However, you clearly show in this manuscript that it will not happen in near future that atmospheric N2O measurements will reach the goal. So, should the goal be revisited? I would like to see a statement in conclusions section regarding the necessity of these goals no-one is reaching.

-page 11, lines 1-2/Figure 10: if I understood correctly, the droplet tests are always made with the same CO amount fraction (300 nmol/mol), but is the water vapour response dependent on amount fraction of CO, i.e. have you run the test with other CO amount fractions? It is a bit hard to see from the graph 10; there is no chronological trend, but the water vapour response is varying randomly?

-page 11, lines 4-9: you state that the clearly decreased bias between TI and PUY instrument was thanks to the drying of sample air for TI. However, you also changed the inlet line and never tested the other line with dryer. Please, mention this uncertainty more clearly in the text.

-page 11, line 13: did you use the same individual instrument (TI) in PYU and in AMY? Differences between Picarro G2401 individuals, especially regarding CO performance, may be high. -page 11, lines 16-19: since there was three clearly different periods; due the calibrations of AMY instrument; during the comparison measurements at AMY, please provide the biases for each period separately.

-page 12, line 18: is the drying of the sample air the only option, as you state, or is it possible to reach the goal with well and frequently made water vapour tests as well? You also leave open the questions how to dry and how low water levels are needed to reach. By looking the Figure 10, it looks that water levels below 0.3 %, roughly, would give CO values stable enough when Picarro G2401 instrument is used. That kind of a water levels are possible to reach by using Nafion dryer, for example. The drying issue is an endless story, but open this theme with a few sentences.

-figure 7: since the water vapour was probably the main reason for bad agreement

between TI and PUY instrument, please add a panel showing the H2O % reading of TI.

-figure 13: please, mark the calibrations of AMY instrument in lower panel with vertical lines, for example.

Technical corrections

-page 1, line 20: “analyse” > “analysed”.

-page 2, line 1: “GAW programme” is written with and without a capital “p” in this manuscript. Please uniform using lower case “p”.

-page 2, line 11: What is “Empa”? Please add institute full name and location.

-page 2, line 11: Use “WCC” instead of “World Calibration Centre”. There is often used the full name instead of abbreviation, even though the abbreviation is introduced when first time mentioned. Like three lines below “World Calibration Centre” in written again, and with gas components and instrument techniques is the same issue. Uniform all these issues in the whole manuscript.

-page 2, line 14: WCC-N2O, who operates? It is written on page 3, so move it to here.

-page 2, lines 28-30: introduction of the GC detectors for CO; now it is not fully clear that CG/FID with methaniser and CG/HgO are two separate instruments to measure CO. Please reword.

-page 4, lines 9-10: move the operator of CCL to where it is first time mentioned.

-page 5, line 6: add comma after “measurements”.

-page 6, line 15: maybe “trend in the atmospheric concentrations” over “in the atmosphere”.

-page 7, lines 13-14: what is the meaning of “(see also Figure, right)”?

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-108, 2019.

Printer-friendly version

Discussion paper