

Interactive comment on “Continuous low-maintenance CO₂/CH₄/H₂O measurements at the Zotino Tall Tower Observatory (ZOTTO) in Central Siberia” by J. Winderlich et al.

Anonymous Referee #1

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Title: Continuous low-maintenance CO₂/CH₄/H₂O measurements at the Zotino Tall Tower Observatory (ZOTTO) in Central Siberia

Authors: J. Winderlich et al.

The submitted manuscript presents 6 months of continuous carbon dioxide, methane and water vapour measurements in Siberia. It is an interesting paper mainly because it is one of the first publications that proves that this type of commercial cavity ring down spectrometer is very feasible for longer term monitoring purposes.

Paper is very detailed, clearly structured and describes carefully conducted work.

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However, I have three main concerns that should be addressed before publication.

- The presented time series is pretty short even if a detailed analysis of the data is not part of this paper. The authors should consider extending the time series in Fig. 6 to up-to-date data (if the instrument is still running). No information is given on the length of the available data set. Aren't 6 months too short to determine a seasonal cycle?

- The manuscript is too detailed in some respects. The description of the meteorological measurements is not at all required here. Section 2.8 could be remarkably shortened; the corresponding Table 3 and Figure 5 are not necessarily needed. The description could be part of an overview paper of the tall tower special issue (if there is any) or a separate publication on the ZOTTO tower in general. Table 1 is also very detailed and provides plenty of information that is of minor interest when only considering the CRDS measurements (but could be kept anyway). There are already some papers published dealing with measurements at the ZOTTO tower. Is all this information so far unpublished? If the authors decide to keep all this additional information I suggest to change the title of the paper to something like 'Zotino Tall Tower Observatory (ZOTTO) in Central Siberia: site description and first continuous low-maintenance CO₂/CH₄/H₂O measurements'. If so, a photo of the tower and the surroundings could be maybe added.

- It would be nice to add an additional plot illustrating the performance of the instrument besides the ambient air time series. This could be a time series of the target gas measurements and/or the calibrations to get a feeling of the variability of the instrument performance. The comparison of the continuous measurements and the flask samples could be also shown.

In conclusion, the paper is within the scope of 'Atmospheric Measurement Techniques' and is of sufficient originality to merit publication in this journal. However, it also needs further minor revisions before publication (see comments below).

Specific comments:

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Page 1400, lines 1-2: skip first sentence: I do not see that this statement is a main outcome of the paper. The authors refer to a couple of previous publications in Section 1.1 to underline this statement. Merge the necessary information (station name, coordinates) into the second sentence.

Abstract: information on the length of the data set is missing.

Abstract, lines 16-18: I don't like the idea to speak about seasonal cycle amplitudes when there are only 6 months of data available even if the data cover a complete vegetation period. The authors should clearly mention that the data set isn't covering a whole year. The information is missing that the 26.4ppm refer to CO₂.

Page 1401, lines 27-28: I do not agree with this statement. There are many atmospheric measurements sites in polluted environments, e.g. for monitoring air quality limit violations. Add maybe 'for background composition observations' after 'atmospheric measurement sites'.

Page 1403, lines 12-16: sentence sounds awkward. Rewrite it. 'reduced' has to be read 'enhanced'? Split sentence into 2.

Page 1404, line 12: 'mushroom-shaped inlet'. Is that a standard term? I have never heard of it. However, I can imagine how it might look like.

Page 1406, lines 5-7: how do you know that the maintenance on an annual basis is sufficient when the instrument ran so far only for 6 month?

Page 1406, lines 26-27: drifts: what does that mean? Is that a drift in the standards or a drift in the sensitivity of the Picarro? Please clarify.

Page 1407, lines 25-27: please specify the duration of a calibration. A back-of-the-envelope calculation told me that you roughly need 2l per calibration, right?

Page 1409, equation 2: equation is not needed, skip it.

Page 24-27: If I understand correctly, the water trap can equilibrate to ambient pressure

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through the outlet at the top. That means that changing the downstream pressure of your flushing gas changes the flow (and not the pressure) of your gas through the trap and the gas has simply less time to take up water at higher flow rates, right?

Page 1411, lines 12-17: this was done in the laboratory in Jena?

Page 1412, lines 22-23: 'For each tower level six data points are recorded within 3 min.' Why not simply: 'Each tower level is sampled for 3 min.' The 30sec averaging is already mentioned above.

Page 1413, lines 2-7: move to Section 2.3

Page 1414, line 6-7: Are the results of the individual neighbouring calibrations significantly different that a linear interpolation is required to be applied? How much does the instrument drift? It would be interesting to see some of the calibration results (see main comments above).

Section 2.8, Table 3, Figure 5: This section could be strongly shortened. To my mind, Table 3 and Table 5 are not needed. See main comments above.

Page 1415, lines 4-5: that's the only place in the manuscript where some dates are mentioned. However, it is still not clear for the reader if the data set ends on November 24.

Page 1415, lines 21-27: please clarify? How many 30sec data are used for the comparison with the flask data. The flask sampling takes 15min. Did you consider 30 data points for comparison? Or only a reduced set as the buffer volume provides an integration over 37min. Which 30sec data did you choose then?

Page 1416, line 5: add 'CO₂' after 'All'.

Page 1417, lines 14-26: Nighttime inversion layers mainly develop during clear sky conditions and low speed. I suppose that the night from July 22 to 23 is one of the most remarkable ones. Do you also observe episodes with inverted profiles, i.e. higher

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concentrations at the higher levels cause e.g. by long-range transport of polluted air etc. Please elaborate a little bit. What's the height of the vegetation? Please add in Section 1.1.

Fig. 1: Is it possible to add the Ob swamplands and the Yenisei river in the map?

Fig. 6: Does panel c contain H₂O data from the Picarro and the meteo logger? If so, please update the legend.

Fig. 6, caption: I suggest adding the start and end date of the presented period.

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