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Atmospheric Measurement Techniques Discussions

Interactive comment on "Accurate measurements of carbon monoxide in humid air using the cavity ring-down spectroscopy (CRDS) technique" *by* H. Chen et al.

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We thank the reviewer #1 for the detailed and helpful comments and give our responses to each of these comments below. Accordingly, changes in the manuscript have been highlighted in the revised version.

Responses to Anonymous Referee #1

The manuscript 'Accurate measurements of carbon monoxide in humid air using the cavity ring down spectroscopy (CRDS) technique' by H. Chen et al. investigates the interferences of water vapor and CO2 on carbon monoxides measurements made with

Picarro CRDS instruments. The methodology of obtaining appropriate correction functions is described in detail and will help users of these instruments to improve their measurements.

The paper is very well written and clearly structured. The abstract provides a good summary of the paper. The methods and measurements used for data evaluation are scientifically sound. The work is a valuable contribution for users of CRDS CO analyzers which I recommend to be published in AMT after considering the following minor issues.

C1: Griffith et al. (2012) and Zellweger et al. (2012) should be updated, now AMT.
R1: These have been updated in the revised version, and we have also updated Nara et al. (2012) and Karion et al. (2012).

C2: P6497, L15/16: check lower/upper case of p84 and P84
R2: Corrected.

C3: P6497, Equation (2): What is H2Opct? Please explain, more detailed as in line 21. Is this H2O reported by the instrument? Although, peak84_raw and P84_RAW should be described in one sentence; these parameters are very specific for the Picarro instruments.
R3: H2Opct is one of the water vapor variables reported by the Picarro instrument (with the variable name "h2o_pct" or "b_h2o_pct") and is determined from the detection of the absorption lines of H2O that are adjacent to the absorption line of CO, and has a unit of %. Indeed, these parameters are specific to the Picarro instrument, and we have specified that the CO measurements have been made by CRDS instruments manufactured by Picarro Inc.. We have furthermore added text to explain this better.

C4: P6499, L19-21: Is this also true for the instruments with improved fitting algorithms?

R4: The coefficients for correcting CO water vapor dilution and pressure-broadening effects apply for the instruments with improved fitting algorithms as well. The improved fitting algorithms can represent the line interference between H2Opct and CO better than the previous version, which results in less dependence of CO measurements on H2Opct. However, this improvement does not affect the water vapor dilution and pressure-broadening effects at all, and therefore these coefficients should apply for the instruments with improved fitting algorithms as well. We have added a sentence in Sect. 2.3 to clarify this: "Note that the corrections for water vapor dilution and pressure-broadening effects for CO have not been changed with the new fitting algorithm, and the coefficients obtained in Sect. 2.1 apply for instruments with the new fitting algorithm as well."

C5: P6505, L1/2: 'To measure humid ambient air without drying the air...' Consider rewriting this sentence.
R5: We have changed to "To obtain dry mole fractions of CO without a need to dry the ambient air".

C6: The paper focuses on CO2 interferences on CO in the CO2 mole fraction range from 360-390 ppm. Very often, 390 ppm is exceeded even at remote sites, and it would be helpful if the authors could more clearly state if the interferences above 390 ppm are significant or not. If I understood correctly, these CO2 interferences are small with 0.3 ppb per 100 ppm CO2 change, even above 390 ppm CO2. Is this correct?
R6: Yes, it is correct. Although the paper focuses on CO2 interferences on CO in the CO2 mole fraction range from 360-390 ppm, we have two other experiments that indicate the CO2 dependence above 390 ppm CO2 is small: 1) in Sect. 2.4, we derive a dependence of CO measurements of -0.3ppb/100ppm CO2 ; 2) we made a water test using 550 ppm CO2 for a CRDS analyzer with a new fitting algorithm and did not observe significant differences (see Sect. 2.3, Fig. 4). From all these results, we are confident that the dependence of CO measurements on CO2 mole fractions is small.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 6493, 2012.