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A spectroscopic transfer standard for accurate atmospheric CO measurements

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Atmospheric carbon monoxide (CO) is a precursor of essential climate variables and has an indirect effect for enhancing global warming. Accurate and reliable measurements of atmospheric CO concentration are becoming indispensable. WMO-GAW reports states a compatibility goal of ± 2 ppb for atmospheric CO concentration measurements. Therefore, the EMRP-HIGHGAS (European metrology research program – high-impact greenhouse gases) project aims at developing spectroscopic transfer standards for CO concentration measurements to meet this goal. A spectroscopic transfer standard would provide results that are directly traceable to the SI, can be very useful for calibration of devices operating in the field, and could complement classical gas standards in the field where calibration gas mixtures in bottles often are not accurate, available or stable enough [1][2].

Here, we present our new direct tunable diode laser absorption spectroscopy (dTDLAS) sensor capable of performing absolute ("calibration free") CO concentration measurements, and being operated as a spectroscopic transfer standard. To achieve the compatibility goal stated by WMO for CO concentration measurements and ensure the traceability of the final concentration results, traceable spectral line data especially line intensities with appropriate uncertainties are needed. Therefore, we utilize our new high-resolution Fourier-transform infrared (FTIR) spectroscopy CO line data for the 2-0 band, with significantly reduced uncertainties, for the dTDLAS data evaluation. Further, we demonstrate the capability of our sensor for atmospheric CO measurements, discuss uncertainty calculation following the guide to the expression of uncertainty in measurement (GUM) principles and show that CO concentrations derived using the sensor, based on the TILSAM (traceable infrared laser spectroscopic amount fraction measurement) method, are in excellent agreement with gravimetric values.

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References
[1] EMRP project ENV52-HIGHGAS (Metrology for high-impact greenhouse gases), available at: http://www.euramet.org/.
[2] J. Nwaboh, A. Manninen, J. Mohn, J. C. Petersen, O. Werhahn, and V.Ebert, European Geosciences Union General Assembly 2015, EGU2015-13542, 2015, Vienna Austria