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Atmospheric Measurement Techniques Discussions

Interactive comment on "Carbon monoxide measurements onboard the CARIBIC passenger aircraft using UV resonance fluorescence" *by* D. Scharffe et al.

D. Scharffe et al.

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Response to Christoph Gerbig

General comment:

We agree that the discussion of the measurement uncertainty is not comprehensive and have added several paragraphs dealing with it. As the sensitivity and background signals and their drifts differ from flight to flight the expanded uncertainty has to be calculated for each flight and within a flight even for each section between two calibrations. This is now discussed in detail.

Specific comments

Response time has been corrected to 63%.

Ar/CO2: In the discussion version of the paper we stated incorrectly that we used Ar with 2.5% of CO2 to operate the lamp and to flush the optics of the instrument. Ar with 0.25% of CO2 was used and this is now corrected in the text. Replacing nitrogen to flush the optics of the instrument by Ar/CO2 had reduced the sensitivity by less than 2%.

Sofnocat is usually operated at ambient pressure and room temperature. We operate Sofnocat at a pressure slightly above the pressure in the measuring cell, i.e. slightly above 10 hPa which reduces the contact time $\sim$100 times against a cartridge of the same volume operated at ambient pressure. To keep the cartridge small and to achieve quantitative oxidation of CO, the reduction of contact time was compensated by increased temperature. This is now mentioned in the text.

"The high stability of the photomultiplier.." has been reworded. Dependence of PM dark count and sensitivity was meant.

The performance of the instrument is now compared to Gerbig et al. (1999).

"Lamp did not ignite.." is corrected.

The reason for the anticorrelation of O3 and CO near the tropopause is the mixing of stratospheric and tropospheric air, the former being rich in O3 and the latter being rich in CO. This is now mentioned in the text.

P 2691, L21: Only one digit after decimal point is now given.

Response to anonymous referee #2

Specific comments

As mentioned in the 2nd paragraph of page 2687 even saturation with water at 20oC

does not influence the signals for zero air and calibration gas. To avoid contamination of the instruments by polluted air near airports, the measurements start at ∼2.5 km altitude.

Sofnocat: The issue of high operating temperature was raised by all reviewers and is now addressed in the text and in the response to Gerbig′s review.

Ar/CO2 mixture is according to the specifications of the manufacturer made of 0.25% of 99.995% CO2 and the rest is 99.9999% Ar. The O2 content, if any, should thus be below 1 ppm.

CO reference is tied to NOAA 2004 scale as mentioned in the Chapter 5.

Response to anonymous referee #3

General comment:

We do not claim to have improved the physics of the instrument of Gerbig et al. (1999). The objective of the paper is to describe technical modifications of a commercial instrument which were necessary to pass the safety certification process and to improve its reliability. We also think that our experience might be interesting for other researchers who venture measurements onboard aircraft or even operate the commercial instrument at stations.

The issue of accuracy is now addressed by an additional paragraph and in the response to Gerbig′s review.

Specific comments:

Contamination of calibration gas: As described in the text pressure regulators of different type and from different manufacturers contaminate the calibration gas to a different degree. Consequently, the contamination originates to large degree from the pressure regulator. However, contributions from the stainless steel tubing and Swagelok quick connector are also possible.

Sofnocat: See response to Gerbig′s review.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 2681, 2012.