Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC1
https://doi.org/10.5194/amt-2022-274-RC1, 2022

Comment on amt-2022-274

Anonymous Referee #1

Referee comment on "New methods for the calibration of optical resonators: integrated calibration by means of optical modulation (ICOM) and narrow-band cavity ring-down (NB-CRD)" by Henning Finkenzeller et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-274-RC1, 2022

Review of Finkenzeller et al. “New methods for the calibration of optical resonators: Integrated Calibration by means of Optical Modulation (ICOM) and Narrow Band Cavity Ring-Down (NB-CRD)”

Finkenzeller et al. provide an innovative discussion of cavity-based calibration techniques. The ICOM technique especially is a new and very different approach to understanding the behavior of light in optical cavities in order to retrieve trace gas concentrations. The paper is of high import to the community, the experiment design is well described and well designed. I recommend publication follow addressing the comments below.

Major Comments:

While the paper is written from the perspective and application of the CE-DOAS retrieval method, some commentary on how to apply this to the BBCEAS style retrievals using the equations in Fiedler or Washenfelder would be useful for the community. Specifically, how do these calibration methods help to get to the mirror reflectivity (especially for situations where the extinction in the cavity is not know such as open cavity or the mentioned retrieval of data while sampling the path with the ICOM method).

It would be helpful for the authors to comment on how levels of extinction in the cavity effect the ICOM method. Specifically, how would this be utilized in the cases where the absorbers or extinction severely reduce the effective pathlength in the cavity? At what range of concentrations is the ICOM retrieval valid for all spectra? How do structured absorbers effect the value retrieved?

Line 254: Here it is mentioned that the mirror reflectivity is calculated using Rayleigh scattering of air. Why would air be used instead of N2 which has no CIA features in this wavelength range? (Especially when the oxygen content of synthetic zero air often varies per the manufacturer from 20-24%.)

How is the state of the mirror to be deconvolved from the combined value of the mirror and other losses in a situation where a calibration gas (free of absorbers of interest) isn't supplied? I would assume that this also may be a concern where the extinction in the cavity (especially for open path operation) undergoes temporal changes.

Are there other practical concerns that need to be addressed such as variability of chip saturation between the full spectrum and the ICOM spectra, as well as how different spectrometers may or may not be suitable for this application? (e.g. how a mechanical shutter operation may vary from using an electronic shutter, or how bleed down the chip for an electronic shutter may or may not effect any of these retrievals).

Minor Comments:

Line 101: rephrase to "allows retrieval of wavelength dependent path length"

Line 245: fit coefficient (remove s).

Line 251: "ambient air and helium repeatedly" (remove to)

Line 253: Rayleigh scattering (not absorption). Also, there is no mention of which Rayleigh scattering cross-section is used for Helium.