

Interactive comment on “Bias Correction of Long-Path CO₂ Observations in a Complex Urban Environment for Carbon Cycle Model Inter-Comparison and Data Assimilation” by T. Scott Zaccheo et al.

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The paper addresses the non-trivial comparison between CO₂ concentrations from in situ sensors with those from remote sensors, which measure path-integrated (path averaged) CO₂ concentrations. This work represents a very crucial step towards improved quantification of sources and sinks of greenhouse gas emissions as it may provide spatially integrated concentrations important for flux retrieval. This is especially important as urban centres become significant producers of greenhouse gases. Regional emission modeling frameworks will benefit from this work.

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It is a clearly written paper and the limitations of the approach are discussed in the end so I recommend publication. I just have a few comments, see below.

General comment:

In essence, if I'm not wrong, you calibrate the differential optical depth of your open path differential absorption spectrometer with point optical depths from in-situ sensors. It works and the result is impressive but the method is pragmatic as you state yourselves in the manuscript already. This must assume that the in-situ sensors are accurate, which is reasonable, but only near them, which is the dilemma of comparing path averaged CO₂ concentrations with point concentrations. Don't you risk adding a new bias by this method? In that context it would be interesting to know how much of the difference between GreenLite and the in-situ values are caused by instrument bias and random error and how much are actually "real", that is, physical differences in CO₂ concentrations due to the different volumes probed by the two approaches. To that end one could characterize the non-stationary noise (plus other instrumental contributions and spectroscopic uncertainties if relevant) and its corresponding error in delta tau and plot it as error envelope in Fig. 5.

Specific comments:

On page 8, line 26: Why do you need steps 1 and 2? To be close to the local minimum of your error function?

P6, l 25: It is not clear to me how you stabilized the instrument baseline. As far as I understand you try to keep the ON laser wavelength at maximum absorption. But the rest is unclear. What's the role of the thermal controller? Did you lock the OFF wavelength to the ON wavelength via the differential optical depth?

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