

Interactive comment on "Building the COllaborative Carbon Column Observing Network (COCCON): Long term stability and ensemble performance of the EM27/SUN Fourier transform spectrometer" by Matthias Frey et al.

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The authors may want to consider these comments in preparation for their final submission of this paper.

Abstract: It may be helpful to emphasize that the instrument is solar-viewing.

P1L3 – The word "stable" is used throughout. The authors use the term to both refer to 1) mechanical stability of the instrument, and 2) comparability of the retrievals to another product. Because this is a subject term (e.g., one person may say 0.5% accu-

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racy is stable, and another may say 0.05%) it would be useful if the author's metric of stability was defined numerically. In the future, requirements for "stability" may change as well.

P1L5 – It may be useful to list the QA measures here, as the authors use several.

P2L2 – "Very uniform" is also subjective. It would be helpful to mention indicators of uniformness here in case readers only see the abstract.

P2L13 - Numerically, what is the reference precision of the TCCON?

P2L14 – Not only do 125HR instruments require more frequent maintenance than EM27/SUN instruments, it also needs to be done on site.

P2L20 –Ye et al. (ACPD, 2017) https://doi.org/10.5194/acp-2017-1022 recently estimated city/urban emissions using satellite observations. Data from other current and future satellites may be used to estimate emissions from more localized sources, but that remains to be seen.

P2L25 – "Low-cost" is subjective, but I would actually say the EM27/SUN spectrometer is quite expensive, and cost-prohibitive for many institutions to own. The authors may consider stating the 2018 price range for these instruments.

P2L29 & throughout – The authors often use the world "calibrated" when "compared" or "scaled to" would be a better choice in this context. Calibrated is usually reserved for values more directly measured and compared to a standard.

P3L15 – Define IMECC

P3L24 - Define/describe the NCEP data

P4L4 – What does "nominal" mean here and throughout?

Sect. 3.1 - The ME at MOPD is consistently around 0.985, so what should users running PROFFIT use for the ILS? Should the input ME at MOPD be 1.0? What was

used in this study (e.g., what does "real ILS" mean on P12L17)?

P8L23 – Given that Dragos Ene is a coauthor of this study it seems strange to use "they" instead of "we." The authors may consider removing the private communications citation and instead put in an author contribution section at the end: see Manuscript composition -> 14. Author contribution under https://publications.copernicus.org/for_authors/manuscript_preparation.html

P9L7 – I agree with Reviewer #2 that the focus on comparing with a LR rather than an HR dataset from the 125 HR instruments is dissatisfying. I would expect the additional information in HR data should at least make it possible to construct a dataset with smaller absolute errors and biases. If 2 Xgas measurements have large, but equal errors or biases they will agree well.

P13L19 – I would disagree that no maintenance is ever required. In my experience at least 6 of 9 EM27/SUN instruments I have been on campaigns with required some form of maintenance within their first two years. Even the reference spectrometer in this study needed maintenance in 2016. However, an advantage is they do not need to be maintained on-site, but rather can be shipped back to Bruker or KIT.

P13L21 – From here and the TCCON meeting the COCCON PROCEEDS sounds like a very exciting upcoming development. I think this project deserves a more complete description earlier on in the paper. I also agree that a more concrete description of COCCON will be useful.

P13L29 – Perhaps the authors may want to check with the editor, but there may be some conflicts of interest that should be declared (https://www.atmospheric-measurement-techniques.net/about/competing_interests_policy.html). For example, receiving research funding from, or working for a commercial company could be considered a conflict of interest per the Copernicus policy.

Figure 4 – The authors may consider changing the y-axis scale. Scales of 15 ppm, and

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5% (\sim 20 ppm) are, in my opinion, quite large and make it difficult to judge comparability of the retrievals on shorter timescales. Especially as the satellite community is pushing towards accuracy of 1 ppm (\sim 0.25%) or better for XCO2.

Metrics of stability in the Xgas retrievals in addition to the linear fit over the full time series may be useful in the text. For example, on different timescales such as months or seasons – especially since differences on these timescales are quite noticeable. This will help if the COCCON is used in satellite validation to know if comparisons should only be done over multi-annual scales to get an overall bias as high and low values will cancel out, or if shorter time-scales are plausible. Seasonal or month-to-month biases would also lead to artificial cycles in global assimilation models.

Table 1 – It would be helpful to have a caption as to why some uncertainties always propagate to negative on ME.

Table 5 - Would all the authors advise that regular ILS monitoring is unnecessary and other EM27/SUN operators just use the values in this Table?

Table 6 - Would the authors recommend instrument operators not make their own sideby-side comparison at the beginnings and ends of instrument campaigns, and instead use these scaling factors?

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