

Interactive comment on “Comparison of XCO abundances from the Total Carbon Column Observing Network and the Network for the Detection of Atmospheric Composition Change measured in Karlsruhe” by M. Kiel et al.

Anonymous Referee #2

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General Comments: This paper discusses a comparison of CO measurements made in the mid-infrared using NDACC protocols with CO measurements made in the near infrared using TCCON protocols at Karlsruhe. The configuration of the apparatus allowed simultaneous measurements using a common input optics and solar tracker. The differences between the measurements are discussed and partitioned according to known differences between the two methods.

The paper is generally well-written with attention to details and after some considerations and corrections listed below, be suitable for publication in AMT.

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Specific Comments: Page 1 line 6: The fundamental band of CO is referred to as the $4.5\mu\text{m}$ band – I have always seen it referred to as the $4.7\mu\text{m}$ band which more correctly represents the band centre of 2140cm^{-1} . This occurs in several places in the manuscript.

Page 2 line 4: The authors talk about the ground-based data providing the same quantities as measured by the satellite. However in practice the satellite and the ground-based measurements are different – as evidenced by different weighting functions and averaging kernels (AKs)– and so the comparison almost always requires significant interpretive work to accomplish. The sentence should be revised.

Page 2 line 9-10: No instrument actually provides a column amount of a constituent – that would require an AK that was invariant with height. We can provide column estimates given certain assumptions, but not true column amounts. Since the variations in the AKs are significant in this paper, this should be clarified.

Page 2 line 16: Many satellite instruments (e.g. IASI, MOPITT, TES, AIRS) use the fundamental band of CO for their measurements.

Page 3 Lines 15-17 and Page 6 lines 25-27. According to page 3 the spectral ranges of the detectors imply that the overtone band of CO is measured by the InSb detector but page 6 implies that it is done by the InGaAs detector. These points should be reconciled.

Page 3 line 22 the text implies that there is a choice of bands for CO. The only CO band in the MIR is the fundamental and the only one in the NIR is the first overtone – there is virtually no choice in what bands to use.

Page 4 line 27 the source of the eight profiles is not mentioned – are these radiosonde ascents or reanalysis products or something else?

Page 5 line 20 I think that a minus sign got into equation 3. The denominator of the first term is dimensionally inconsistent as written.

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Page 6 lines 1-9. The discrepancy between the total dry air column derived from the ground pressure and that derived spectroscopically is troubling. The error appears to be constant and so cannot be due to the water vapour correction. The bias is significant and warrants some careful investigation.

Page 6 line 9 Surface pressure measurements at high accuracy are relatively easy to make, the references to “inadequacies in measurements of the ground pressure” are somewhat surprising.

Page 7 line 22 Figure 16 does not reflect the text as it does not vary the slant column.

Page 8 lines 5-15 In this section we have reference to several correction factors that seem to verge on the empirical. If comparisons between datasets are to have validity, then these differences need to be explained – which is the main point of this paper.

Technical Corrections: Page 1 line 3 “..allows us to record..”

Page 1 line 11 “..XCO can be explained by the smoothing effect..”

Page 5 line 24 “..FTIR setup allows us to record....”

Page 11 line 20 “...might be due to imperfect knowledge of the spectroscopic parameters...”

Figures: I found that the figures were hard to read – the lighter blue dots on a grey background with white grid lines was difficult to interpret. The figures also should be understandable in black-and-white as well as color through the use of different symbol shapes or some similar mechanism.

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