AMTD

Interactive
comment

Interactive comment on "Evaluation of MOPITT version 7 joint TIR-NIR X_{CO} retrievals with TCCON" *by* Jacob K. Hedelius et al.

Anonymous Referee #2

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General Comments

The manuscript entitled 'Evaluation of MOPITT version 7 joint TIR-NIR X_{CO} retrievals with TCCON' by Hedelius et al. presents results from an intercomparison between MO-PITT TIR-NIR data products and CO measurements from the ground-based TCCON network. Covering various technical aspects of intercomparison strategies between the two remote sensing instruments, the manuscript fits well into the scope of AMT. Apart from this detailed validation, it is demonstrated how the different methods of bias correction affect CO emission estimates based on assimilation of MOPITT observations. The paper is well written and the methods are clearly described, with only minor technical and typographical errors. I recommend publication in AMT after minor revisions based on my comments below.

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Discussion paper

The level of detail and the discussion of various methods applied for the intercomparison studies make the paper quite lengthy. I feel that the readability could be enhanced if parts of these discussions would be moved to the appendix or the supplement. In particular, a large number of correlation plots of MOPITT versus TCCON X_{CO} are presented Section Section 4.2, each of them dealing with the differences in a priori and AKs of both instruments in a different way, with the different methods summarised in Table D1 being difficult to understand. However, there is very little discussion of the impact of these different methods and, in my opinion, not much to learn for the reader. I would therefore suggest to restrict the discussion to the method that has been chosen as standard, and to move Figure 6 to the appendix or supplement.

The manuscript concludes with useful technical suggestions for filtering and bias correction of MOPITT data, and with suggestions for additional information that could enhance future MOPITT data products. What is missing are quantitative statements on the level of agreement between MOPITT and TCCON CO measurements using the different methods presented, an assessment of which method can be recommended, as well as a summary of the lessons learned from the model assimilation studies presented in Section 5. Which of the different assimilations proposed here would be the 'best'?

Technical Comments

P2, L21: 'It acts as and indirect greenhouse gas (GHG) as a minor source of CO_2...': please check sentence structure

P4, L10: The fact that 'MOPITT data are the longest satellite record of atmospheric CO' has already been stated earlier (P3, L7) and should be removed here.

P5, L23: Insert 'that' between 'They noted' and 'the surface type'

P6, L13: I suggest to remove 'eliminates' with 'is insensitive to' (two times)

P6, L15: 'The network has been around since...' -> 'The network has been established

in...'

P6, L12: The statement that MOPITT data are subject to errors is trivial since this applies to any measurement.

P6, L30: 'long length' -> 'large length'

P8, L18: A first order approximation is always linear (at least if it is based on a Taylor expansion, which I guess is what the authors mean).

P8, L30: Please specify what you mean with 'statistically reasonable products'.

P8, L32: Do you mean $1° \times 1°$ latitude/longitude regions?

Figure 2: It is not clear to me what is shown on the y-axis. The axis label states it would be the difference between retrieved and prior X_{CO}, whereas it is stated on P9, L17 that it would be the difference to the weighted mean from all sensors.

P12, L4: I have difficulties to understand this sentence. Do you mean that the bias is determined by subtracting the median from all the X_{CO} measurements within a specific region?

P12, L33: Replace '$\times$' with 'times' (here and anywhere else).

Figure 7: It is not clear which of the various methods to account for a priori and AK differences has been applied to calculate the relative differences between MOPITT and TCCON shown here.

P21, L31: I don't understand what you mean with the statement that the information content is 'a measure how accurate a measurement is to how well a value is a priori known'. H_s expresses the Shannon information content and quantifies to what extent the knowledge about the system is improved by the measurement.