

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-112

Anonymous Referee #1

Referee comment on "Analysis of improvements in MOPITT observational coverage over Canada" by Heba S. Marey et al., Atmos. Meas. Tech. Discuss.,
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Marey et al. present an investigation on the possible increase of valid CO measurements from the MOPITT instrument by including observations affected by low clouds. As MOPITT provides the longest series of global observations of CO available, the dataset is extremely valuable and an endeavour to optimize it is highly appreciated. In the manuscript a variety of example cases are presented where the original cloud-filtered retrieval product is compared to the one without application of a cloud mask. In combination with co-located CO measurements by IASI and the MODIS cloud information the authors provide a plausible case for including also cloud-affected measurements in the MOPITT set of data.

Still I cannot recommend the manuscript in its present form for publication because it seems that the authors have stopped half-way in their analysis: (1) the cases are only presented as a set of images which makes it very difficult for the reader to infer quantitative conclusions, (2) χ^2 is tentatively proposed at the end as a quality index measure, however, without any quantitative analysis or explanation; (3) I would have expected that a new enhanced dataset is proposed and presented and at least a first quantitative comparison with external data (e.g. IASI) in comparison with the 'old' dataset is provided. However, this is not the case and the reader remains with the impression that one can get more from MOPITT by using also cloud-affected scenes, but it remains open what is the final new dataset and how large might the related uncertainties be.

Specific comments:

L71-75:

Could you be a bit more specific what the effect of clouds separately on the two CO retrievals (TIR and NIR) are?

L109:

Why are only the TIR CO products used here? It may be instructive to compare TIR and NIR retrievals with and without the cloud mask.

L108, 117:

Please specify in the instrument description the swath width, pixel size etc. which is referred to later on.

L245:

How is the MODIS cloud height for a MOPITT pixel determined (should also be described in the instrument-section)?

L258-L270: '4.4 MISR and MODIS height comparison'

This is a small section which describes for two parts of a scene the comparison between MISR and MODIS cloud height and concludes: 'Therefore, MISR and MODIS agree with the cloud height values.' I don't believe that such a conclusion can be drawn from the material presented here. Also, the related Figures 4 and 5 do not at all allow the reader to easily judge on this conclusion. I strongly recommend to skip this section and better provide and discuss references on previous MODIS cloud height validation.

Chapter 4.3, 4.5:

The related Figures (3, 6-9) as well as the discussion do provide only qualitative views and a first impressions of the situation. However, a quantitative analysis is entirely missing. E.g. one could discuss the different regions via scatter plots, MOPITT CO (with/without cloud-mask/only low clouds) versus MODIS cloud height/cloud cover and versus IASI CO.

Chapter 4.7:

(1) It should be introduced how chi2 values are calculated (reference), (2) why are there

chi2 values much larger than 1 in the standard retrievals? (3) the argumentation is again based on maps (Figure 10) and should be more quantitative (e.g. chi2 versus cloud height, chi2 versus CO), (4) why do you expect a correlation between chi2 and cloud height? E.g. if the cloud in the field-of-view is homogeneous, why would one expect a larger chi2 for high clouds than for lower ones? (5) why should one use the chi2 value instead of MODIS cloud height as 'index measure in the cloud detection scheme'?

Conclusions:

It should also be discussed how the uncertainty of the CO retrievals for the additional pixels may realistically be quantified.

Technical comments:

L71, 'CO gas' -> 'CO'

L166, delete 'of the MODIS'

L168: 'IF' -> 'if'

Figures: bad quality, often overlapping colour bars and labels