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Atmospheric Measurement Techniques Discussions

Interactive comment on "Impact of land-water sensitivity contrast on MOPITT retrievals and trends over a coastal city" *by* Ian Ashpole and Aldona Wiacek

Anonymous Referee #1

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This study examines how MOPITT version 7 TIR-NIR retrievals compare over land versus water over and around a single coastal city – Halifax, Canada. The authors examine the L3 product as well as the L2 product averaged separately for land and water over the same grid box. They generally find that retrievals over water retrievals are higher than over land. Most of this difference can be accounted for by differences in averaging kernels. While this paper has numerous strengths (nearly flawless grammar, and very detailed), I think a step back is needed to understand the overarching goal of this study or central question to be answered. This may involve a scope change from e.g., a very local to a global scale, examining additional MOPITT products, and/or including additional measurement results or results from a model the authors run. While

I cannot recommend publication in its current form, I encourage resubmission when the comments below are addressed.

General (Some of these general comments may supersede specific comments below).

G1: The paper is quite detail oriented, but at times there is so much repetition and additional words and phrases that it makes it difficult to read. I think the length could be cut down by as much as 50%. Part of this could be through wording changes, part of it by reorganization, and part of it fewer numerical details that could be succinctly summarized in Tables. Aim for describing things in context rather than the large number of uncommon symbols and abbreviations.

G2: One of the major conclusions of this paper is caution in examining retrievals around coastlines throughout the world. This conclusion is not supported by this paper. Instead this paper focuses on only one coastal grid box of hundreds across the globe. All references that imply potentially large differences elsewhere need to be removed or a study needs to be undertaken to look at all coastlines.

G3: MOPITT version 8 has been available for a year, but version 7 was used. While there is nothing wrong with using an older version, V8 should at least be mentioned with a note that the difference may or may not remain in V8. Further, when comparing land and water soundings the TIR product is probably a better choice than TIR-NIR as NIR bands are only used over land. Retrievals from other seasons should also be considered for completeness, even if not examined in as much detail.

G4: A major conclusion seems to be that averaging kernels need to be accounted for. When they are, the differences in retrieved amounts over land compared to water decrease significantly. The need to account for averaging kernels has already been known in the remote sensing community for decades.

G5: A recommendation in this paper is that all soundings over water should be discarded. This would represent a significant loss of information. The argument is that

individual land soundings have greater information content (which is not surprising as land soundings use both TIR and NIR, when water soundings can only use TIR). If this argument were extrapolated further, one might say to only use soundings with degrees of freedom of signal (DFS) of say 1.8 or larger. While this would also maximize information content of individual soundings, it would likely decrease the information content from the MOPITT record of the Earth system as a whole. An atmospheric model is needed to substantiate the advice of discarding all retrievals over water.

G6: P-values are used throughout, but their implications often need more consideration. A small p-value may indicate a statistical difference in the mean, but does not say why the difference appeared. In this study it seems the difference can mostly be accounted for by differences in averaging kernels (which are already known to be important). When 93% of days do not have the right data, it makes it difficult to draw conclusions.

Specific comments

P2L41: CO is the only target gas from MOPITT (CH4 cannot and will not be retrieved from the observations).

P2L43: A reference is needed for CO lifetime.

P2L43: Volatile organic compounds contribute (indirectly) to about half of CO in Earth's atmosphere.

P2L63: What is meant by "information content" here? DFS? Shannon information content? (They are related, so maybe this is meant to be generic?)

P5L130: Include a reference to the a priori.

P5L133: Watch your usage of "layers" versus "levels" here and throughout. Retrievals are on layers, but are reported on levels for MOPITT. Note there are only 8 layers from 900 to 100 hPa (when surface pressure is greater than 900 hPa). The uppermost layer is 100 to 50 hPa.

P5L141: Equation 1 is missing the error term.

P6L163: "Is generally advised against" – please provide a reference.

P6L165: These supposed guidelines need to be clarified. While such restrictions may increase the average information content of individual soundings, the restrictions may decrease the information content of the system as a whole.

P6L173: Maybe this many significant figures are what are reported in the census, but it seems like too many. What if someone moves to Halifax?

P6L174: Briefly describe the pollutants.

P6L177: It appears that 2 more years of MOPITT V7 data are now available.

P7L205: A brief explanation about the 4 MOPITT pixels is needed here.

P8L223: I dislike the use of "true" for model values. Please modify throughout.

P13: Watch significant figures throughout.

Table 3: Is the purpose of p-values here to show that CO levels are changing in the MOPITT record?

Briefly describe why OLS was used.

Figure 6: "Next page" (?)

Figure 8: Are the bounding boxes shown correct for a 1 degree box?

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