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Atmospheric Measurement Techniques Discussions

Interactive comment on "Improving the TROPOMI CO data product: update of the spectroscopic database and destriping of single orbits" *by* Tobias Borsdorff et al.

Anonymous Referee #2

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This paper looks at two improvements to XCO from TropOMI 1) spectroscopic updates, and 2) two types of destriping. Results with different spectroscopy are characterized through comparisons to TCCON. Destriping results are characterized by the "stripiness measure" which quantifies the cross-track vs. along-track variability.

Major comments:

1) This mission requirement is 10% precision and 15% accuracy for single soundings. This work should estimate the precision and accuracy for the different configurations in addition to reporting "rms", "std" and "bias" in Table 1 and the metrics in Figs 2-3.

2) De-striped results should be compared to TCCON to quantify the improvement re-

sulting from de-striping.

Specific comments.

Comment on abstract line 3: To be more clear as to the current TROPOMI configuration, change the wording from "Using HITRAN 2008 spectroscopic data with an updated water vapor spectroscopy, the CO data product is compliant with the mission requirement of 10% precision and 15% accuracy for single soundings." to, "The current TROPOMI is processed using HITRAN 2008 spectroscopic data with an updated water vapor spectroscopy and produces CO products compliant with the mission requirement of 10% precision and 5 15% accuracy for single soundings."

Comment on abstract lines 5-14: The current paper should quantify the precision and accuracy for the different configurations and destriping.

Comment on abstract lines 9-14: The wording says that "HITRAN 2012 ... reduce the bias..." and then later says, "HITRAN 2012 worsens the fitting quality". This is confusing. Does it improve XCO but worsen the spectral fit?

Comment on abstract line 14: The "spectral fitting quality" is not defined (is this the spectral residual?). Ideally report values, rather than it "is worse". Or report about how much worse.

Comment on abstract lines 13: "introduces an artificial bias" Specify the size of bias.

Abstract, line 18 "However, still better quality is achieved..." Comment: "better quality" should be quantified.

Page 3, line 5. "The operational TROPOMI CO processor uses the line lists of HITRAN 2008 (Rothman et al., 2009) ... water vapor". Link this to Table 1, "... water vapor (HITRAN 2008+H2O in Table 1)"

Page 4, line 11. "Table 1 provides the TROPOMI-TCCON mean bias, the standard deviation, and the RMS of the spectral fit residuals when using the current TROPOMI

spectroscopic database, the SEOM-IAS, HITRAN 2012 or HITRAN 2016 data base." Comment: I do not see the RMS of the spectral fit residuals in Table 1. Table 1 caption says all values in Table 1 are "CO biases".

Figure 1 caption "Not co-located measurements are marked in gray color." What does this mean, non-colocated measurements?

Figure 1 caption. The definition of the gray dots is not explained in the caption or text. There are additionally two sizes of gray dots.

Figure 1 caption. The blue and gray are hard to distinguish, either make the gray or blue darker.

Figure 3 caption "mean bias (TROPOMI - TCCON) between co-located daily mean XCO values (see Fig. 1, 2) of TROPOMI and TCCON". Is this using the pink, gray, or both types of dots from Fig. 2?

Figure 3-4. Define sigma-bar in (a), std-bar in (b) and rms-bar in (c).

Table 1. "Table 1. TROPOMI CO bias with respect to TCCON (bias, std, and rms)". This is not de-striped, correct? Bias, std, and rms need to be defined. The text says this is the spectral rms, but Table 1 states this are all "XCO biases". Do these relate to b-bar, etc., from Fig. 2? Sigma-bar from Fig 2 needs to be included in this table as this is part of the systematic error.

A table needs to be shown with estimates of the precision and accuracy to link to the mission requirements. E.g. subtracting out the mean bias and combining with the bias variability and std-bar to estimate the accuracy, and using rms-bar for precision (if I understand these terms.)

Add comparisons to TCCON after destriping with the two types of destriping into a table, either to Table 1 or an additional table. Although the FFD destriping method shown in Fig 7 looks better comparisons to TCCON are needed to quantify if destriping improves precision and accuracy.

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