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Atmospheric Measurement Techniques Discussions

Interactive comment on "Retrieval of MetOp-A/IASI CO profiles and validation with MOZAIC data" *by* E. De Wachter et al.

Anonymous Referee #2

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Retrieval of MetOp-A/IASI CO profiles and validation with MOZAIC data, by De Wachter et al. [2012].

— Major issues —

1) Given that it appears this is the first time this algorithm is introduced, and that its products will be widely distributed, I would expect a more detailed description of the algorithm (and future data users deserve to have one). But there is no reference to any detail algorithm description or something like an Algorithm Theoretical Baseline Document (ATBD), so I assume none exists (at least not publicly).

If that is the case, then the algorithm description in this paper is insufficient. For exam-

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ple what is missing are sensitivity and error analyses. How sensitive is the retrieval to errors in the spectroscopy, meteorological input like temperature, humidity, wind speed, surface pressure and skin temperature, the surface emissivity database, instrument errors and calibration, the simultaneous N2O retrieval and the cloud filtering.

Such detailed information was provided for FORLI in the study by Hurtmans et al. [2012], so I think this is also required for SOFRID.

Given that these are not "first" results from a new instrument doing CO measurements ("first light paper"), as quite a few papers on IASI carbon monoxide have been published during the last few years, I firmly believe such information should be incorporated.

2) Only after reading the paper a second time I understood that not just Frankfurt and Windhoek but all collocated MOZAIC profiles were compared. Results are only presented in table 1. Given the extended analysis of Frankfurt and Windhoek analysis the analysis of the other locations is thus very meager, to say the least.

I would at least expect a more detailed statistical analysis of the MOZAIC data, for example a table for all airports (descents, ascents) – given a minimum number of collocations – containing at least the biases, root-mean-square differences and correlation coefficients for all the airports. I think the richness of the MOZAIC database and the geographical coverage of MOZAIC deserves to be discussed in more detail, and will give some indication of the quality of IASI given geographical locations, CO profile shapes and other conditions.

3) Page 3280, line 6-7. "The upper limit of 225 hPa was chosen to be within the boundary level of aircraft profiles."

Figures 2+3 show that the IASI sensitivity for both the surface-480 hPa and 480-225 hPa averages extend beyond the maximum height of the MOZAIC profiles. Furthermore, later on it is not explained in relation to the "smoothing" of MOZAIC using the IASI averaging kernel it is not explained how is dealt with the missing information in

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MOZAIC for altitudes where IASI is still sensitive.

Or, alternatively, it is not shown (quantitatively) that this only has a small effect, but given the shape of the surface-480 hPa and 480-225 hPa kernel shapes I doubt this being the case.

This is crucial information for understanding differences between SOFRID/FORLI and MOZAIC and the conclusions drawn about the performance of both algorithms, but it is not discussed in the paper.

— Minor issues and typos —

Page 3273, line 3, change to "Although not considered a greenhouse gas"

Page 3273, line 6, suggest to change to ". . . long-lived trace gases, including greenhouse gases (Bergamaschi et al., 2000; Shindell et al., 2009)".

It has now finally been recognized that air quality and radiative forcing by greenhouse gases are linked, thus understanding carbon monoxide is also relevant from the perspective of climate change.

Shindell, D. T., G. Faluvegi, D. M. Koch, G. A. Schmidt, N. Unger, and S. E. Bauer (2009), Improved attribution of climate forcing to emissions export, Science, 326, 716–718, doi:10.1126/science.1174760.

Page 3273, line 12. I don't know why TIR nadir sounders are "particularly" suited for vertical profiling. They may be better than VIS nadir sounders, but I would argue that limb sounders are particularly suited. Furthermore, for CO the DOF of TIR profiles is not much more than two (2). Hence, I would refrain from using the expression "vertical profiling". Basically all one can distinguish is lower from upper troposphere (which nevertheless is highly valuable . . .). Better is probably to state that "TIR nadir sounders can provide information about the vertical distribution of atmospheric trace gases". Or maybe even "the vertical distribution of trace gases in the troposphere".

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Page 3274, lines 14-17. "As the FORLI ... widespread distribution". This is an important motivation for writing this paper, hence deserves a more prominent place. I therefore would suggest to move this sentence to page 3273, after line 23.

Page 3274, line 18-19. Change to "In section 2 the two algorithms developed to retrieve CO profiles from IASI radiances are introduced."

Page 3275, first paragraph. The spatial resolution of IASI should be mentioned here, as it is missing in the paper.

Page 3276, line 5-6. The surface pressure, temperature and humidity profiles are taken from the operational MetOp-A level 2 IASI product.

Page 3278, line 11. Change to "between IASI and other satellite instruments measuring CO (for the ...". I would not use the term "sounder", as this is generally used in relation to instruments that measure the IR spectrum (or parts of it) enabling the retrieval of atmospheric profiles with a good vertical resolution (for example for temperature and water vapor). I would therefore not classify MOPITT as a "sounder", which was part of the George et al. [2009] study.

Page 3279, line 11-13. "These flights are strongly represented in the dataset ...". I don't understand what is meant here. Do you mean that there are many measurements (many take-offs and landings) so that it properly samples the seasonal cycle? Please clarify.

Page 3280, line 5, change to "Based on the shape of the averaging kernels"

Page 3280, section 4.2. I would suggest to briefly discuss basis statistics (bias, root-mean-square differences and correlation coefficients) of the SOFRID and FORLI results for both days (1 January and 1 July). It is important to get some quantitative indication of how these two algorithms compare, realizing that it is beyond the scope of this paper to present a detailed comparison of the results from both algorithms. Such numbers would then support the claim the "SOFRID and FORLI show similar global

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distributions" (page 3281, line 18).

Page 3281, line 1, remove "up" in "uplifted" (it is either "convectively lifted" or "uplifted"). Same for "uplifted" in line 6.

Page 3282, lines 15-16. Sentence can be deleted ("Better insight ... variations of CO.").

Page 3283, lines 2-3. Delete the sentence ("The retrieval errors ... in good agreement."). It is unclear to me no why it can be expected that retrieval errors should be similar (could not find a justification).

Page 3283, line 7-8. "This may be linked to the insensivity ...". Shouldn't that be "This is linked to the insensitivity ..."? Given that the only difference between the two is the application of the Averaging Kernel, there is no other explanation than the sensitivity related to the Averaging Kernel.

Page 3283, lines 9-10. Delete sentence "A comparison ... Figs. 7 and 8)". Since this will be discussed later on, there is no reason to already mentioning here that this will be discussed as the discussion takes place in the same section.

Page 3283, line 25. Change "especially" to "more so".

Page 3286, line 22. Change "On the overall, both ..." to "Overall, both ..."

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 3271, 2012.