Atmospheric
Measurement
Techniques

EGU

Open Access

Discussions

Interactive comment on "MAX-DOAS measurements of HONO slant column densities during the MAD-CAT Campaign: inter-comparison and sensitivity studies on spectral analysis settings" *by* Y. Wang et al.

M. Wenig (Referee)

Mark.Wenig@lmu.de

Received and published: 3 May 2017

The paper describes a very extensive comparison study of several MAX-DOAS HONO measurements from different groups. Using coinciding measurements in Mainz as well as modeled spectra, their comparison can focus on different aspects of the instrument characteristics and retrieval process. The paper addresses relevant scientific questions since the findings can be used for improving existing retrievals and are very valuable for future instrument and algorithm design. It is more an evaluation of existing methods rather than the introduction of a novel concept, but the methods and conclusions are

very solid. At some points the paper is a little vague, when only speculations are provided instead of explanations for observed differences. The title is appropriate and the abstract summarizes the presented work well. The paper is a little long, especially in combination with the supplementary material. The paper should be readable without the supplement as it should only provide extra material if the reader wants to go into more details. Overall the manuscript is of high scientific quality and I recommend publication after some minor corrections and clarifications as listed in the following:

L13p2 "uncertainty from different sources" sounds confusing, how about "uncertainty from all the different sources" or "overall uncertainty"?

L14p2 "the systematic bias of the fitted from the simulated real HONO delta SCDs is" is grammatically challenging as well.

L18p2 The sentence "However, systematic uncertainties limit the reliability of the results." is very general. What do you know about systematic errors? If the bias is known, you can correct for it. If not, how reliable are the results?

L25ffp5 When you define the different quantities, please provide equations. That would make it easier later on in the paper if you could just refer to the variable. For example what is the difference between delta SCD with sequential FRS and dSCD?

L4ffp6 When you describe Fig. 1 you mention the different fit results for O3, NO2 and BrO but for HONO you just write "The HONO absorption structures are well retrieved using both types of FRS.", but the fit parameters are 5.5 and 6.9 10^15 molec. cm^-2, so quite different.

L31fp6 You write "because of unknown instrumental problems, CMA and Boulder didn't participate in the comparisons of the delta SCDs for a sequential FRS and dSCDs for a daily noon FRS, respectively", you could mention that the other measurements were not affected.

L1fp7 In the sentence "all the instruments capture well the diurnal evolution and eleva-

tion angle dependence of the HONO delta SCDs." "capture well" sounds very general, you could be more specific by mentioning if they agree within the uncertainties or if there are significant differences.

L10ffp8 You use the average of selected instruments as the reference values, but then you compare all instrument to that reference (l13p8,l11p9), that's not very consistent. How about using a median or something similar for reference instead?

L2fp10 Again, an "unknown problem" can always be the reason for discrepancies, can you be more spefic?

L12p10 You mention "Note that there is no random noise added into the synthetic spectra." But in Sec. 4.9 (l4fp17,also table S1) a SNR of 3000 is mentioned that is added to the synthetic spectra, so why not in Sec. 3.4?

L29p13 You write "The Thalman O4 cross section at 203k orthogonalised to that at 293k is calculated by the orthogonalisation based on Gram-Schmitt's algorithm and is shown in 30 Fig.9." and Fig. 9's caption says "normalized absorption cross sections". How were they normalized or related to that what scalar product was used for the orthogonalization algorithm, e.g. is a polynomial removal part of the scalar product?

L29p15 The degree of the polynomial was "arbitrarily selected" as five, why not 3? Fewer parameters to fit usually make the optimization more stable.

L12p16 "In spite of these possible interferences, taking into account typical instrumental problems (like spectrograph straylight), the consideration of an intensity offset correction in the fit is still recommended for the HONO retrieval." I agree, but can you underline this statement with some data or estimates? How do you know which influence is more important?

L23fp18 What do you mean exactly with "systematic differences [...] caused by implementation of DOAS fits in the software packages", different fit functions or numerical implementations of the optimization?

C3