Atmos. Meas. Tech. Discuss., 7, C98–C101, 2014
www.atmos-meas-tech-discuss.net/7/C98/2014/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Updated SAO OMI formaldehyde retrieval" *by* G. González Abad et al.

Anonymous Referee #1

Received and published: 4 March 2014

General comments

This paper constitutes a deeply revised version of the existing OMI HCHO ATBD. Its aim is to present the new version of the HCHO product, the changes in the retrieval algorithm and the improvements brought to the final columns. To this point of view, the current paper will be very useful to the numerous users of the OMI HCHO operational product. Its subject is well within the scope of AMT. Generally, the scientific methods and assumptions are valid and clearly outlined. The paper is clearly written and well structured. I recommend a publication after minor revisions.

My main concern is that the retrieval updates that actually bring an improvement to the HCHO columns are not sufficiently highlighted. Changes are listed, but there is a lack of hierarchy in the updates and a lack of details in the comparison with the previous algorithm. In several places, the author claim for an improvement, without quantification

or justification. From the paper, it is very difficult to have an idea of the relative contributions of the updates in the SCD, AMF and reference sector correction, on the final VCD. My impression is that the AMF updates and the reference sector correction have the largest impact, more than changes in the fit of SCDs. The description of the algorithm steps is not very well balanced to this point of view. The section on AMF should be extended with more details, and Figure 8 should be detailed into SCD/AMF/VCD after correction, for the previous and new algorithm. Especially because published papers using the OMI HCHO product often include their own reference sector correction or AMF calculation (Marais et al. 2012; Barkley et al. 2013).

A weakness of the paper is the very limited error budget, and the lack of comparison with other satellite HCHO products, or validation with ground-based measurements. This should not however stop the publication of the paper.

Finally, the name/number of the next operational product version should be mentioned.

Detailed comments

Abstract

Are the updated mentioned in the abstract the key retrieval changes impacting the HCHO columns ? The numbers given at the end of the abstract are not detailed in the rest of the paper. Are the error estimates given on a per pixel basis? If not, for how many pixels? How is the detection limit defined?

Introduction

p2; line 25: Correct Âń NMVOC emissions Âż p3; line 10: Rephrase "good agreement between them" p3; line 26: Correct Âń available Âż p3; line 28: I would remove the words "in great details". p4; line 1: Please detail which other trace gases and other UV/Vis spectrometers, or remove.

Spectral fitting

AMTD
7, C98–C101, 2014

p5; line 17: What is the advantage of fitting an effective albedo? Can this retrieved quantity be used afterwards? p6, line22: Please explain how a 1-nm change of the fitting window stabilize the fit in time. This is not obvious. Is it really this change that reduces the degradation effects? A figure comparing new/old scd is needed (see my comment on figure 8). I would also like to see a quantitative comparison of the slant column standard deviations in a remote area, between the new and previous algorithm versions, in 2006 and 2012.

Vertical column

p8, line9: Why are the GEOSCHEM profiles averaged between 11:00 and 13:00 LT, while the overpass time of OMI is around 13:30? Is there a significant diurnal variation of the HCHO columns in the model ? p10, line 13: Detail which version of the OMI surface reflectance climatology has been used, which wavelength, min LER or most frequent LER? What about aerosol effects in AMF? To my knowledge, aerosol effects were taken into account in the previous version of the product (Sabolis et al ,2011). Please comment on the choice of removing this effect from the AMF calculation. A figure comparing new/old amf is needed (see my comment on figure 8).

Normalization

The increasing background, still present in the new version, although well reduced, requires more explanations to the reader. The use of a radiance as reference should completely correct for this. How are the fitting residuals increasing? and the noise on the slant columns?

p 10, line 3: The authors refer to a quality flag that has not been defined before in the paper. Which criteria are used to set the flag to 0? p10, equation 8: Does the Âń Correction(i,j) Âż refer to a slant column or a vertical column? I guess a slant column, but the symbol Âń OMI pacicifc Âż is not clear. p11, line 28: What does mean the sentence "we will assess the reliability of the bias-corrected columns more rigorously over time" ? The time series is long enough to do it now. Please elaborate. p11,

AMTD

7, C98–C101, 2014

figure 5: which year? which quantity is plotted exactly (referring to equation 8)? Why is there no negative column, while a radiance around the equator is used as reference? The explanation in the legend for the higher variability for Northern latitudes in winter months does not hold, because winter time SZA are not higher in Northern hemisphere than in the South. Or I am missing something ?

Comparison between previous and current HCHO SAO product.

p12, line 12: "less noisy", please quantify, for example by comparing standard deviations in a remote area. Please elaborate on the reasons for this lower noise. The new fitting window is slightly smaller than the previous one (this should rather increase the noise). What is the reason for the improvement? Figure 8: As already mentioned, this figure should be extended in order to show the same regional comparison for SCD and AMF (old/new product). p14, line 13: "the high concentrations over MED JJA are removed". Why? Is this related to the fact that previous version included an aerosol correction? Please elaborate. figure 9: Please show the same maps for 2006 (or 2005), or apply a basic normalization to the old SAO retrieval, as most users do. This would give a fairer comparison, and allow to better estimate the changes in HCHO columns and distribution.

Conclusions

p 14, line 8: "reference spectroscopy updates". Why mentioning this in the conclusion? The impact on the HCHO columns has not been discussed in the paper. p 14, line 25: The drift is greatly reduced, but is still present. The reasons for this should be at least discussed. The last paragraph is a repetition of the paragraph just before. Please reduce.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 1, 2014.