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Atmospheric Measurement Techniques Discussions



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

**Anonymous Referee #2**

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The paper by Gonzalez Abad et al. describes the newest version of the operational formaldehyde retrieval algorithm for the satellite instrument OMI. Since this product is used by many groups to improve e.g. NMVOC emission inventories a detailed description explaining possible assets and drawbacks is highly needed. In general the paper is well written and merits publication in AMT. However some concepts of the changes in the new product are not explained in a reasonable way. Therefore some major revisions are needed as detailed below.

Detailed comments:

- My major concern is the very weak error analysis. The authors claim to do it in an additional paper. But THIS is the publication on the new algorithm. Therefore at least some details on the possible errors are needed here. In particular the

statement on the errors associated with AMF calculations (30

- Spectral fitting: It is not clear to me which parameters (and for what reason) have been changed compared to the old retrieval. What is the impact of changed cross-sections? Common mode spectrum: What is the impact on the calculated slant columns by including this averaged residual? A correlation plot illustrating this impact should be included. Please give a meaningful physical explanation why this averaged residual is needed. Why is it calculated only between 30°S and 30°N? Equation 1: "ak*Xk are the terms added afterwards, including the common mode spectrum". What else is added afterwards? Detection limit: An RMS of up to 2*10exp-3 corresponds to detection limits around 3*10exp15? Please give realistic numbers!

- Vertical column density determination: I'm wondering how the shape of the H2CO profiles look like. There is a second bulk of formaldehyde in about 4 km altitude. Where does it come from? Again: Please give more details what has been changed in this retrieval step compared to recent versions of the H2CO product.

- Post processing normalization: The users have defined the reference sector between 140°W and 160°W. In northern high latitudes during summer months this area is quite frequently affected by biomass burning with significant emissions of C2HO. What would be the impact of these events on the final product? Figure 8: The authors claim, that there is no large increasing trend for the new retrieval. Applying a reference sector this should be the case by definition for a region just next to it. But for the new retrieval without normalization the time series above the Pacific show a clear positive trend. Any explanation?

  Maybe I missed this point: But how the VCDs are estimated for the new retrieval without reference sector? The new retrieval is based on an earthshine reference and no absolute SCD can be calculated.

- Minor points/corrections



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- Introduction p2 l17: Give a reference to the statement on the lifetime.
- : Introduction p2 l24: Rephrase: Measurements of H2CO from satellites ... can be used as a proxy ...
- Inroduction p3: Peters et al. (ACP 2012) used MAX-DOAS measurements of H2CO to validate satellite data in the Western Pacific. Please include this reference.
- Introduction p3: Please include Vrekoussis et al., (ACP 2010) as a reference for H2CO observations from GOME-2.
- Introduction p3, l10: Rephrase: ... good agreement between the two techniques ...
- Spectral calibration p6 l16-17: What is the sense behind this sentence? BOAS and DOAS are quite similar methods to analyse spectra for absorption features. BOAS is like DOAS applying polynomials to account for low frequency features ("high-pass filtering"). And who said that smoothing is an essential step within DOAS retrievals?
- Conclusions p15 l5: Please remove this sentence. There is no detailed description of the theoretical basis in this paper.

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