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Atmospheric Measurement Techniques Discussions

Interactive comment on "Temporal co-registration for TROPOMI cloud clearing" *by* I. Genkova et al.

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Dear Editor:

On behalf of the authors of

'Temporal Co-Registration for TROPOMI Cloud Clearing'

Author(s): I., Genkova et al.

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I would like to sincerely thank the Referees for their time and valuable comments on the significance, quality and content of our paper.

Please find below our responses to their comments.

We are also very grateful for the technical comments, which provided a great help for enhancing the quality of this paper. Whenever a detailed answer to a comment is not given (see responses to Referee #2), please be assured that the suggestion will be incorporated in our final manuscript version.

Sincerely Yours,

Iliana Genkova, on behalf of the authors

Authors Comments to Anonymous Referee #1

1. The manuscript highlights several times that the study is triggered by the need for a reliable cloud mask when aiming at methane (sometimes "methane and aerosol") retrievals. Unfortunately, there is no effort to quantitatively relate methane retrieval errors to residual cloud contamination. The cloud screening requirements should be based on methane error estimates but they are arbitrarily assumed 2% and 1%.

Relating the methane retrieval errors to residual cloud contamination in a quantitative manner would definitely strengthen the scientific significance of the presented study, thus we appreciate the Referee's comment. However, we find that by doing so the paper's scope will become too broad. Instead, in the Final Manuscript Version we will add references to materials which have already addressed the link between the accuracy of methane retrievals and cloud contamination. Possible references:

Sneep, M., J. de Haan, and P. Veefkind, 2011, Cloud retrieval using the oxygen A-band in support of trace gas retrievals from TROPOMI, European Geosciences Union General Assembly, Vienna, Austria, 03 – 08 April 2011

S. Noel, 2007, Description of the AMC-DOAS algorithm, IFE-TN-AMCDOAS-001, 21 August 2007

2. There are substantial differences between the maximum allowable temporal mis-

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match derived from SEVIRI 15-min and GOES-10 1-min data. This questions the general applicability of the conclusions.

- The sensitivity studies CASE A, B, C might hint at the conclusions actually depending on sensor resolution.

- The study only addresses mid-latitudes. Do the conclusions depend on the region chosen? What about the tropics?

- GOES-10 1-min data cover only a single day. I would doubt that general conclusions can be derived from this sparse dataset.

The study should investigate to what extend the conclusions are dependant on sensor resolution, choice of the region, sparseness of the dataset.

While the authors find this comment useful to potentially improve the quality of the paper, addressing it by additional and further investigation is unfortunately impossible – the GOES-10 data set with 1 minute temporal resolution is available only for a limited time period (during the transition from over North to over South America). In addition, data was collected only over the Southern Grate Planes and the Gulf of Mexico. Please note that we acknowledge the sparseness of the data and we recommend the temporal co-registration requirements to be revised when VIIRS data becomes available (p.6260, l.4-6).

3. Are the cloud detection algorithms able to identify cirrus clouds of small optical thickness? The latter substantially affect methane retrievals in the SWIR spectral range and thus, cirrus screening would be important.

Both cloud detection algorithms are capable of identifying cirrus clouds. The MSG SEVIRI cloud detection algorithm is using information on cloud phase, and the GOES-10 algorithm includes a spatial variability test combined with BTD threshold tests. However, detecting very thin cirrus clouds is a well-known issue with satellite passive remote sensing techniques.

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Authors Comments to Anonymous Referee #2

1. The abstract is way too long. Introduction of the TROPOMI project does not have to be so extensive.

It will be addressedin the Final Manuscript Version (also applied to comments 3,4,6,9)

2. I feel that the comparison to results of Krijger et al. on page 6256 is not thought through. First of all, they should mention the value that Krijger et al. got. Secondly, does the difference between the percentage values mean anything? Your data sets are from 2006 and they contain 72 days and 1 day from SEVIRI and GOES-10, respectively, for specific locations, whereas Krijger et al. used global data from 2004 for 48 days. Due to these significant differences in the data sets, I'm not sure if you can draw any conclusions based on the differences in the amount of clear pixels? Why should they be the same?

We mention Krijger et al. results as an illustration that spatial resolution is important when deriving amount of clear pixels. His results differ from ours and we believe it's due to using data (from MODIS) with different spatial resolution. In our study we use data from MSG SEVIRI and GOES-10, and different cloud detection algorithms, however the spatial resolution between the data sets is similar. Thus, the differences in the percentages of clear pixels should be attributed to temporal effects.

8. If 1%-2% of the retrievals are allowed to contain cloud contamination how does it affect the accuracy of the aerosol and methane products? Overall, I think this should be thought the other way around; how much cloud contamination can be allowed until the errors in the aerosol or methane products grow too large?

Perhaps it is a good idea to first answer the question 'How much cloud contamination can be allowed . . . ' and then define the temporal co-registration requirements, however at the time of conducting our investigation the CH_4 and aerosol retrievals for TROPOMI were under development. Also relating the methane retrieval errors to residual cloud

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contamination requires an effort beyond the scope of this paper. Additional references on this topic will be included in the final version of the manuscript.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 6249, 2011.