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Atmospheric Chemistry and Physics Discussions

ACPD
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Interactive Comment

Interactive comment on "Inverse modeling of CH_4 emissions for 2010–2011 using different satellite retrieval products from GOSAT and SCIAMACHY" *by* M. Alexe et al.

M. Alexe et al.

mihai.alexe@jrc.ec.europa.eu

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Interactive comment on "Inverse modeling of CH4 emissions for 2010–2011 using different satellite retrieval products from GOSAT and SCIAMACHY" by M. Alexe et al.

Anonymous Referee 1 Received and published: 5 June 2014

The authors thank the referee for her/his comments. We have included comment-specific replies (AC) in blue below.

General comments: This paper presents a comparison of several inversions to determine methane fluxes, using either a set of surface stations or the surface sta-

tions in conjunction with satellite retrievals. A time period was chosen in which both GOSAT/TANSO-FTS and ENVISAT/ SCIAMACHY measurements are available to allow for evaluation of retrievals from each of these sensors, with three GOSAT/TANSO-FTS retrievals being considered. The results show broad consistency between the results, suggesting that common features are robust, and not particularly sensitive to retrieval, bias correction scheme, or even sensor. This is an important finding, which lends credence to the actual retrieved fluxes.

It is here that the paper is somewhat lacking: the discussion of the retrieved fluxes is quite thin, and as such, the manuscript reads at times more like a technical report than a scientific paper. I would suggest that the discussion of the results be expanded prior to publication.

AC: We will expand the discussion of the inverted fluxes in the revised manuscript, especially regarding the derived spatial emission patterns over North America and tropical Africa (please see also the responses to the comments of the other reviewers).

Overall, the paper is extremely well written and clearly structured, making it easy to follow, and a pleasure to review. As such, it is suitable for publication in ACP after some minor revision, although it would certainly benefit from a deeper discussion of the fluxes themselves.

I had two substantive technical concerns, relating to the calculation of the XCO2 values for the proxy retrievals:

p11500, line 10-15 I imagine that this is simply a problem with the data product as it was supplied to you, but why not use modelled CO2 total columns for 2011 and 2012 as well? This maps the (synoptic) variability from 2010 onto 2011 and 2012. Furthermore, the correction for the trend (2 ppm/year) is not consistent with the calculated annual growth rate, which is well established. Both of these short-cuts unnecessarily introduce errors. As the data providers are co-authors on the paper, this should be correctable.

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At very least, some estimate of the induced bias should be discussed.

AC: We have re-run the RemoTeC Proxy v1.9/v2.0 inversion (S1-GOSAT-SRON-PX) using updated RemoTeC Proxy v1.9/v2.0 retrievals for 2011/2012. These retrievals have been calculated from CO2 fields from CarbonTracker 2013 for the actual years. Furthermore, we note that for the OCPR v4.0 product consistent CO2 fields were used for the whole period until end 2011 (using the MACC-II CO2 fields). This information will be included in the revised manuscript. The figures and analysis in the paper have been updated to reflect the new results. While there are minor quantitative changes in the derived emissions for S1-GOSAT-SRON-PX, they do not change the main conclusions of our work.

p11502, line 5-10: So in this case the correct meteorology is being used, but with fluxes from the wrong year to calculate the modelled XCO2. Was a trend applied, so that the atmospheric growth rate was consistent with what is observed? If so, this is not as critical for the proxy correction as in the RemoTeC case above, but still inconsistent. Is the problem that the up-to-date optimised fluxes were not available when the data product was generated? Again, this is correctable, or at very least the induced bias should be estimated. (Just because it has been published before, doesn't make it right.)

AC: While we agree with the reviewer's comment that the correct CO2 annual trends should have been used, this bias in the XCH4 is likely largely compensated by the bias correction scheme during the inversion (which is constrained by the high-accuracy NOAA-ESRL surface measurements acting as "anchor points" for the bias correction algorithm).

Specific (minor) comments:

p11495, line 18, and caption for Table 4: start sentence with "Two-year" (or even "Two year", if you're averse to hyphenation) instead of "2 year"

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p11496, line 2: insert "anthropogenic" - water vapour is still more important

p11497, line 8: since 2002, no?

p11501, line 1: remove comma

p11510-11511, one long sentence: Several minor problems with commas and use of "allow" without a subject, and hyphen in North-American. Suggested: "While the coarse resolution of the model used in this study and limitations of the inverse modeling system in differentiating between different source categories do not allow for the attribution of these positive emission increments to specific sources, the remarkable qualitative agreement between the GOSAT and SCIAMACHY inversions regarding the redistribution of CH4 emissions over the US warrants a more in-depth analysis of methane emission over the North American continent."

p11513, line 19: reed -> red

p11514, line 12: remove comma between “precision” and “and”

AC: The minor comments listed above will be addressed in the final version of the manuscript.

Figure 6: This figure is somewhat difficult to interpret. There are many plots showing quite similar patterns, and it’s not straightforward to pick out differences from one panel to the next. I wonder if it would be helpful to the reader to combine the zonal plots for the different inversions into one figure somehow to get a better feeling about where the regions of agreement and disagreement between inversions are? If a halfway readable figure can be made compiling this information in one place, it would be useful.

AC: We will re-define the color scale in the panels of Figure 6. With the new color range, the regional differences and similarities between the various scenarios will be easier to recognize. We will also slightly enlarge the figure for clarity.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 11493, 2014.