Atmos. Meas. Tech. Discuss., 8, C3001–C3004, 2015
www.atmos-meas-tech-discuss.net/8/C3001/2015/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Assessing 5 years of GOSAT Proxy XCH_4 data and associated uncertainties" *by* R. J. Parker et al.

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Received and published: 16 September 2015

We would like to thank Referee #2 for their help and constructive comments in reviewing our submission. We are extremely grateful to them for taking time to provide feedback and have addressed each of their comments below.

Comment 1 – TOMCAT vs MACC Stratosphere p5943 line 20

The TOMCAT and MACC-II CH4 profiles can differ significantly, particularly in regards to the gradient above the tropopause. The TOMCAT model run we are using as the stratospheric component of our a priori has been validated against ACE-FTS satellite data and agrees better with this validation data.

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Comment 2 – Surface pressure threshold p5944 line 1

As the referee suggests, we do indeed use a high resolution DEM to interpolate and adjust the ECMWF surface pressure to the GOSAT footprint. We will adjust the text so that it does not imply otherwise. Regarding the threshold of 30 hPa used, the proxy retrieval is relatively robust in the presence of clouds and aerosols and is capable of providing useful data even in the presence of low clouds, hence the relatively large threshold. In reality, the standard deviation of the ECMWF-retrieved surface pressure is a few hPa so the threshold could be reduced without significantly impacting upon the data.

Comment 3 – Correlation coefficients p5945 line 19

We will amend the text referring to the correlation coefficient as "good". For completeness we would prefer to keep the correlation coefficients included, as as the referee comments, they do provide useful information on the phasing of the datasets. We will however amend the text to focus more on the statistics for the biases than the correlation.

Comment 4 – Relative accuracy p5946 line 1

We will amend the text to clarify that the statistics for the ratio component of the proxy are comparable to those for the final proxy product itself. Note that this paper does not include any discussion on the full physics XCH4. There appears to be some confusion regarding this aspect of the paper and we will attempt to clarify this in the text. This paper solely discusses the proxy XCH4 data product and its components (the XCH4/XCO2 ratio and the model XCO2). It is beyond the scope of this paper (and indeed a separate study) to compare the proxy XCH4 to the full physics XCH4 data.

Comment 5 – XCO2 model details p5946 line 15

The three XCO2 models do not necessarily assimilate the same datasets or for the same time periods. We will amend the text to discuss this in more detail.

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Comment 6 – CarbonTracker extension p5946 line 15

Where no model data is available, we take the previous year and increment it by the NOAA annual growth rate. We will amend the text to clarify this.

Comment 7 – TCCON/Model Comparisons p5947 line 1

The intention of the comparison was to validate the XCO2 models as used as a component in the proxy retrieval, rather than to explicitly validate the models themselves. For this reason, it was decided to treat them as "pseudo measurements" and perform the validation in the same way as the satellite validation is performed, at the satellite sounding location with the averaging kernels applied. We will amend the text to highlight this point.

Comment 8 – Rewording of text p5949 line 8

The text has been amended as per the suggestion.

Comment 9 – Full Physics XCH4 p5949 line 17

The a posteriori error refers to the error in the Proxy XCH4 data product. There are NOT two different retrievals discussed in this paper, we focus solely on the Proxy XCH4 data and its components. Again, we will amend the text to make this clearer as it seems to have been a point of confusion.

Comment 10 – Model Comparisons p5950 line 14

The three-model ensemble is an ensemble of XCO2 models used to calculate the model XCO2 component of the proxy XCH4 product. There is no such ensemble of XCH4 models so we compare to the MACC-II XCH4 which is the most complete and readily-available model XCH4 dataset that we have available. In the future, such an ensemble may be possible as CabonTracker CH4 data is now available, albeit for a limited time period.

Comment 11 – Biomass Burning p5951 line 21

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As discussed above, there is only one XCH4 model (MACC-II) compared to the GOSAT XCH4. This does however appear to agree better with the satellite data for 2010 over South America and this may well be related to biomass burning. We intend to study this and other similar features in the future.

Comment 12 – Biases – p5952 line 6

As well as scattering-related biases, the proxy method will also minimise instrumental (and spectroscopic) biases in the data (anything that affects the light-path), both of which may contribute to M gain related biases. We will amend the text to clarify this.

Comment 13 – p5953 line 1

The referee makes a good point and we will amend the text to discuss this in more detail. It is also the reason why we consider both the mean and standard deviation of the XCH4 difference and not solely the standard deviation.

Comment 14 – Rewording p5954 line 6

Text amended to remove the ambiguity in the phrasing.

Comment 15 – Reference p5955 line 3

Reference to Pandey et al. will be included

Comment 16 – Timeseries

Again, this relates to the fact that there are XCO2 models (CarbonTracker, MACC-II and GEOS-Chem) as well as an XCH4 model (MACC-II) used in this publication. The XCO2 models are used to form an ensemble and are provided for every GOSAT sounding for the full timeseries (with the latter year(s) extrapolated as discussed above). The comparison to the MACC-II XCH4 model is only performed up until the end of 2012 due to model availability. We will clarify this in the text to attempt to remove any confusion.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 5937, 2015.