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Interactive comment on "Assessing 5 years of GOSAT Proxy XCH$_4$ data and associated uncertainties" by R. J. Parker et al.

Anonymous Referee #1

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This manuscript presents 5 years of GOSAT XCH$_4$ retrieved using the proxy approach, which relies on modelled XCO$_2$ to obtain the column-averaged mole fractions of methane. The associated uncertainty is assessed through the use of an ensemble of XCO$_2$ models. The estimation of the uncertainty contribution associated with the model XCO$_2$ in the proxy approach is a new concept, which is of interest to the community. The manuscript fits in the scope of the journal and I recommend publication after the following comments have been addressed.

General Comments:

Please write somewhere in the manuscript if the XCH$_4$/XCO$_2$ ratio component of the proxy retrieval (without model XCO$_2$) and the uncertainty associated with the model

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XCO_2 are part of the product.

Please comment on the compatibility of the assumption that the a posteriori error reduces with the square root of the number of soundings with the XCH_4 model assumptions being used when assimilating satellite data (see also specific comments).

Specific comments:

Page 5939 Lines 4-7: Please use the same number of digits for the percentages of the biases (0.27% vs. 0.3%).

Page 5939 Lines 17-20: Please highlight the assumption here that the a posteriori error reduces with the square root of the number of measurements.

Page 5945: Please add an additional table with the XCH_4 validation results showing the comparison statistics for each TCCON site similar to Table A1.

Page 5946 Lines 14-16: Please provide the spatial resolutions of the models and the time intervals they cover. What is done when no model data is available? For example there is no CT2013B data for the year 2013. How is the ensemble approach affected by the different spatial resolution and temporal coverages of the individual models?

Page 5947: Please also discuss the station-to-station biases and the share within the median model XCO_2 for each model when evaluating if there is one model which most accurately represents the true atmosphere.

Page 5948, Line 14: Why is the uncertainty larger for the latter years? Is this related to not all models being available for the latter years?

Page 5949 and Figure 6: That the a posteriori error reduces with the square root of the number of soundings is an important assumption in assessing if information will be provided to the inversion. Is this also assumed in the MACC XCH_4 model when assimilating satellite data? Please elaborate on the model inversion and if the $\frac{\cdot}{\sqrt{N}}$-assumption is compatible with the assumptions used in the model to assimilate the

satellite data. It would also be interesting to see time series of N and the a posteriori error without division by $\sqrt{N}$.

Page 5953, Lines 19-22: Please use the same number of digits for the percentages of the biases (0.27% vs. 0.3%).

Page 5954, Line 9: Please highlight the assumption that the a posteriori error reduces with the square root of the number of soundings.

Figure 1: Please explain why the sampling changes between Summer and Autumn 2010.

Figure 6: Please replace "a posteriori error is a random error" by "a posteriori error is assumed to be a random error".

Table A1: Please add station-to-station biases, mean precision and share within the median model XCO_2 used in the final proxy XCH_4 for each model.

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