

## ***Interactive comment on “A Decade of GOSAT Proxy Satellite CH<sub>4</sub> Observations” by Robert J. Parker et al.***

**Anonymous Referee #1**

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This paper presents the latest GOSAT methane product from U. Leicester including excellent information on how it was produced, data density, validation, and main features. GOSAT methane is a very important Earth Science data product for understanding methane sources and trends, and the previous versions of the Leicester retrieval have been used extensively in the literature. This new product will be eagerly used by the research community. The paper is very well written and a pleasure to read. It could be published as is. I just have a few suggestions for the authors to consider:

1. Abstract: I think it is important to mention that TM5 assimilates NOAA background data, because it is in fact unclear how much of the comparison to GOSAT reflects consistency of GOSAT with NOAA vs. with the TM5 methane budget and transport. This lack of clarity should be acknowledged, not necessarily in the abstract but surely

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in the text (it's kind of there, could be made stronger).

2. Page 4, around line 5: mention that GOSAT also operates in target mode. Hasn't it been doing so increasingly in recent years? This provides additional info but also disrupts the time series. I also don't think that the time series have been kept at consistent locations for the 10 years – they seem to shift. But the authors would know for sure.

3. Page 5, line 26: Maasackers et al. 2019 comment on OH variability but attribute most of the 2010-2015 GOSAT trend to tropical wetlands and livestock.

4. Page 6, Section 4: I'm surprised that the role of aerosols (e.g., dust plumes) is not mentioned anywhere in this section.

5. Page 9, Section 7: see comment in the abstract. In comparisons over broad regions like in Figure 12 one wonders how much of the fit is due to the assimilation of NOAA data in the model.

6. Page 21, line 12: two good references for model biases in the stratosphere are Patra et al. ACP 2011 and Saad et al. ACP 2016.

7. Page 21, line 14: Turner et al. ACP 2015 also have a quadratic polynomial correction for model-GOSAT bias vs latitude.

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