

## ***Interactive comment on “Quantifying sources of Brazil’s CH<sub>4</sub> emissions between 2010 and 2018 from satellite data” by Rachel L. Tunnicliffe et al.***

**Anonymous Referee #2**

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### General Comments:

The authors present a detailed top-down quantification of methane emissions from Brazil. They use GOSAT satellite observations to estimate sectoral and regional emissions at a monthly temporal resolution. The analyses are performed in a thorough manner and include multiple sensitivities tests. The inversion estimates larger emissions from Brazil during 2014-2018 than during 2011-2013, which could have contributed to the accelerated global methane growth rate from 2014. The robustness of emission estimates derived here gives confidence in the capability of satellite observations—which suffer from coverage issues over the tropics due to clouds—to provide good emission quantifications from tropical regions. This study provides a demonstration of how the rapidly expanding satellite observation dataset can be used to constrain country scale

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emissions, which can aid in emission reporting and monitoring. The manuscript is well written, with clearly presented results, and it is suitable for publication after some minor issues are addressed.

### Minor comments:

Line 124: A uniform distribution ranging from 0.2 to 200 nmol mol<sup>-1</sup> is used to define the model-measurement PDF. Does this mean that the inversion does not allow the model mixing ratios to be lower than measurements? Why not use a PDF centred around zero?

Line 126: Are there PDFs of the two offsets? I assume that they would be needed for the inversion to decide the relative weights of the emission vs offset adjustments. Or are the offsets evaluated before the emissions in a separate step? Please clarify.

Line 190: Impact of model-CO<sub>2</sub> on the proxy-XCH<sub>4</sub> dataset is crucial for regions like Brazil as they can have strong CO<sub>2</sub> emission interannual variabilities, which would impact proxy-XCH<sub>4</sub>. The CO<sub>2</sub> models assimilating only surface observations might not capture such variabilities well due to lack of surface observation in the region. One way to address this would be to compare the full-physics XCH<sub>4</sub> data with the proxy data for differences in interannual variabilities.

Line 216 to 220: The September 2010 biomass burning emissions difference of between GFED and the inversion is not a good example of “Our analysis shows that individual years exhibit features that are not present in the bottom-up estimates.” as both estimates show 2010 has the highest biomass burning emissions and emission peaks in September.

Line 205: The authors write “The inversion results show that the Biomass burning emission rose by  $1 \pm 0.4$  Tg/yr between 2011-2013 to 2014-2018”. Can this be checked in the GFED data of more recent years?

### Technical Corrections:

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line 11: The sentence is difficult to understand. Writing it as an inline list will make it easier to read.

Line 220: remove the double "is"

Line 345: "modelling but" => "modelling, but"

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-438>, 2020.