

Interactive comment on “Consistent regional fluxes of CH₄ and CO₂ inferred from GOSAT proxy XCH₄:XCO₂ retrievals, 2010–2014” by Liang Feng et al.

Anonymous Referee #1

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General comment: The paper is of great importance. It provides a useful method to infer regional flux of CH₄ and CO₂ based on GOSAT XCH₄:XCO₂ combined with the ground-based observations. The result is convincing that the ratio-based posterior estimation reduced the uncertainties compared to flux only inferred from in-situ. The authors then discuss the regional differences. Although it is certainly not a surprise the largest differences found in the regions with sparse measurements, e.g. tropics and tropical south America, it is very interesting that a clear increase of CH₄ emission in the tropical land and the decrease in the south land is shown in the GOSAT version. Overall, this paper is well written. Its topic and quality is suitable for publication in the journal. I only recommend that the authors to consider the minor comments and

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suggestions as below.

Specific Comments:

- 1) Please comment on the how sensitive the inversion results are to the transport and chemical scheme of the model? I suppose that the results shown here is under the assumption that the transport of model brings fewer uncertainties compared to the uncertainties of input flux. But I think more cautions should be taken for this assumption.
- 2) Please comment on how much the results could change when a different region definition is used, e.g. the comparison of the results based on TransCom regions and higher-resolved region definition in this study. I guess the result could be sensitive to how much ground sites are included in each region. So a coarse definition of the regions perhaps favors the in-situ results more than ratio results, is that true?
- 3) The authors explained and showed in Figure 1 how they defined the regions for the Basis Function. But for the discussion of the results, North lands, Tropical lands and South lands are used. Although they referred the definition to Chevallier et al. 2014, it will be better to show the regions on the map in Figure 1, for example, overlaid on the basis function regions.
- 4) Line 56 and 400, the name of the region with 'temperate' is wrongly typed as 'temperature'.
- 5) Line 278, the region should be 'Eurasian temperate' for more accuracy. Please comment on the large decrease of CH₄ in Eurasian temperate region in the GOSAT inversion. From my point of view, two inversions go to opposite direction only in this region for CH₄. And there are only 4 sites for CH₄ and 3 sites for CO₂ (if I count right in Figure 1). How does the GOSAT XCH₄:XCO₂ data show (large spatial or temporal variation)? Do you see large annual variability or increase tendency in the GOSAT retrieval or GOSAT ratio-based inversion?
- 6) In the caption of Figure 2, color for in-situ experiments should be blue but not green.

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7) In the first line caption of Figure 7, 'TAB' instead of 'TBA'. The same for line 360 and 368 on page 10.

8) On page 9, line 329-330, please add a comma after 'Because the in situ flux far away'.

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