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Comment on acp-2021-911

Anonymous Referee #1

Referee comment on "Updated Global Fuel Exploitation Inventory (GFEI) for methane emissions from the oil, gas, and coal sectors: evaluation with inversions of atmospheric methane observations" by Tia R. Scarpelli et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-911-RC1>, 2021

Title: Updated Global Fuel Exploitation Inventory (GFEI) for methane emissions from the oil, gas, and coal sectors: evaluation with inversions of atmospheric methane observations
Author(s): Tia R. Scarpelli et al.
MS No.: acp-2021-911
MS type: Research article

This manuscript presents updates global inventories for methane emissions from oil, gas, and coal sector (GFEI v2). The inventories are made based on national emissions reported to UNFCCC and shows emissions for years 2010-2019 on $0.1^\circ \times 0.1^\circ$ grid. The manuscript presents changes between GFEI v1 and v2 which come from difference in national emissions reported to UNFCCC. The manuscript concentrates mostly on emissions for 2019, but the trend of emissions from oil, gas and coal sector between 2010 and 2019 is also presented. The manuscript also examines results of already published articles of global inversions of atmospheric methane, made based on GFEI v1. The manuscript has detailed methods, results are interesting and presented in a clear way, and is well written. Therefore, I suggest publication after minor revisions.

General comments

Authors used global inversions based on GOSAT and GLOBALVIEWplus. However, authors do not describe how satellite measurements and in situ observation were made. Please, be aware not all readers know these methods and thus, you should shortly explain how measurements are made using satellite and measurement network.

The general discussion of uncertainties of GFEI is missed, both on global and country scale. Please, specify.

The manuscript shows updated version of GFEI inventories. However, the manuscript should be independent from the article describing previous inventories, so readers can easily understand presented work without need to read also the previous version. Please correct the manuscript to make it more independent from the previous article, especially by extending method explanation of construction GFEI v2.

The manuscript should be focused on inventories, including more detailed methods descriptions. However, in present version, the inversion methods are better described, and authors devote more space for inversions, which have already their own publications, than for inventories which should be the core of the manuscript. Please revise the manuscript to keep better proportion between these two parts.

Compared emissions are calculated for different years and Lu21 inversions are calculated for period 2010-2017. How does it affect comparison and what bias come from comparison of emissions for different years? Also, how does one averaged emission for the period 2010-2017 for Lu21 can affect comparison?

Specific comments

L45: "they may have large uncertainties, particularly for the oil/gas sector" – Where the uncertainties come from and why they are particular for the oil and gas sector?

L73-74:" The atmospheric observations and the transport model are prone to their own errors." Which errors and how they affect calculations? Please specify.

L98: How UNFCCC emissions were disaggregated and then allocated to subsector to obtain GFEI v1

L120-121: Please add short explanation why Nigeria emissions are higher in the recent national report and how much.

L123: "we start from the same spatial infrastructure" – what exactly?

L177: Please describe what is emission factor

L226: Which global inversions and for which year?

L302: Which inversions?

L303: Please describe more dependence of the inversion results on priori estimate, e.g., what affect this dependency, what is a role of wetlands?

Figure 6 and everywhere else: Lu21 made inversion calculation for period 201-2017, which value was taken to compare with others? The average for a whole period or something else?

L321: why GFEI v1 and v2 underestimates emissions? Is it possible that rather inversion overestimate emissions?

L364: Should be added: than used for GFEI v1?

L366: Both GFEI v1 and v2?