Response to Anonymous Referee 1 (RC1)

We would like to thank the reviewer for the positive evaluation and for the useful feedback. Responses to comments are posted below the relevant comment. Referee comments are italicized.

P2 L17-20: You list these other gridded CH4 inventories here but do not seem to compare to them later. I would like to see a comparison to at least some of them added, since at the moment you only compare to EDGAR, which is not sectorally resolved.

Thank you for this suggestion. We have added a comparison to the UK gridded inventory to the revised manuscript.

P3 L19: Why did you choose the year 2016? Comment on 2016 emissions in the context of interannual emission trends in emissions eg. was it a particularly low/high/normal year? Can you add a figure showing interannual emissions from these sectors and perhaps subsectors also for a relevant time range eg. 2000-2019?

This year was chosen because at the time of inventory construction it was the most recent year available for Annex I national emissions from the UNFCCC. We have clarified this in the text. The UNFCCC (https://di.unfccc.int/detailed_data_by_party) allows you to access data regarding interannual emissions trends.

P5 L10-11: How old were the estimates in the US inventory? Is the balance between sectors likely to have changed eg. as the energy landscape has changed? Did you need to account for this at all?

Yes, it is likely that in the US there have been changes to the energy landscape from the US inventory year in 2012 to 2016. The scaling we mention in the text is done by subsector (we have added this to the text) so subsector emissions and the balance between sectors will match the national emissions reported to the UNFCCC for 2016. As the US EPA inventory is updated we will be able to substitute the new EPA gridded inventory for the Maasakkers et al. 2016 version to account for any spatial changes in emission sources.

P8 L28: Why would the Global Carbon Project bottom up estimates be so much higher than your estimate? What differences are there in the calculation approach that would cause this?

We have removed this sentence from the text because the bottom-up estimates are based primarily on outdated inventories including EDGAR v4.2 and the US EPA which uses outdated national emissions reported to the UNFCCC.

P10 L19: How valid is this assumption, ie. what do you mean by "slowly"? Can you give a time and error range? Perhaps using activity data for 2013 emissions is fine but 1990 or 2030 emission spatial distribution may not be similar.

The rate of spatial change in emissions and the degree of the spatial variability will be very country specific, so it is hard to make any general statement. We have added a statement to that effect in the introduction of the text.

P4 L3-5 seems to relate to P3 L30 with other information in between – this paragraph could be restructured to present the information more clearly.

Done.

P4 L27-31: You say "notably" to one or two countries for each case here. Are these the only countries for each case? Or the only countries with emissions above a certain level? If the latter, what cut off level did you use to define "notably"?

Clarified.

P5 L18-19: DrillingInfo.com is now enverus.com. Change in your reference list so that the link continues to be valid but add info also relevant to when you accessed it.

Done.

P6 L3-4: Again you use "notably" – please state more clearly how you defined this, eg. "the top five emitters in this category were..." or similar.

Clarified.

P8 L25-26: similar...to

Corrected.

Response to Anonymous Referee 2 (RC2)

We would like to thank the reviewer for the positive evaluation and for the useful feedback. Responses to comments are posted below the relevant comment. Referee comments are italicized.

Page 2 lines 14-15: What are some of the other regional and global multi- species emission inventories? Suggest naming a few.

We now name the inventories.

Page 2 line 30: Why was the year 2016 chosen for the study?

This year was chosen because at the time of inventory construction it was the most recent year available for Annex I national emissions from the UNFCCC. We have clarified this in the text.

Page 6 lines 28-33: Is the refining rate threshold based on the largest refinery? Does it mean the same for processing plants, storage facilities, and compressor stations?

Yes, an effort was made to find the largest processing plant and refinery. This is now stated. For storage, as we state in the text we simply use the US storage capacity and for compressor stations we use the upper limit of expected distances between stations. These are conservative thresholds and we have clarified this in the text. Our goal is to avoid false "hotspot" emissions at facilities rather than accurately estimate if facilities are missing. We now say this in the text.

Page 5 line 19: Drillinginfo is now enverus. Please make the changes to the manuscript.

Done.

Page 4 line 9: The emission inventories over the US are for which year?

Clarified.

Page 8 line 32 Page 9 line 1: What do the authors mean to say in the line 'Oil and gas emissions . . . of the two fuels'?

Clarified.

Response to Short Comment 1 (Tonatiuh Guillermo Nuñez Ramirez)

Thank you to Tonatiuh Guillermo Nuñez Ramirez for providing short comments. We found the comments helpful and have added a map of facilities to Figure 3 and a comparison with the UK gridded inventory to Figure 7. We also thank you for the suggestion of other possible data sources and will consider them for incorporation in any future updated versions of the inventory.

Response to Short Comment 2 (Gabriel Oreggioni)

Thank you to Gabriel Oreggioni for pointing out the new version of EDGAR and for providing additional details on this dataset. It will be useful to compare the fuel specific emissions available with EDGAR v5.0 with our work in the future. We now cite EDGAR v5.0 as the most recent version available.