

Earth Syst. Sci. Data Discuss., referee comment RC1
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Comment on **essd-2021-389**

Anonymous Referee #1

Referee comment on "Pre- and post-production processes increasingly dominate greenhouse gas emissions from agri-food systems" by Francesco N. Tubiello et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-389-RC1>, 2021

Overall this is an important contribution, updating one of the major datasets on global food system emissions. However the manuscript requires further work to make transparent key assumptions and issues with the data (scope and uncertainty), while the dataset itself is not sufficiently user friendly and appropriately documented in its current form. Nevertheless, I strongly support this effort and congratulate the authors on their work.

Page 1

Line 28: is it FAO or FAOSTAT (line 20)?

Line 30: "in terms of single GHG" change to "in terms of individual greenhouse gases (GHGs)"

Line 34: the time period (1990-2019) is mentioned twice, at the beginning and end of the sentence

Page 3

Line 2: typo in the first sentence, should read "as well as one of the economic sectors most at risk from it"

Line 8: EDGAR-FOOD would be another important reference to include in this sentence (<https://www.nature.com/articles/s43016-021-00225-9>)

Page 4

Line 31: typo in 2022-2023

Line 35- page 5 line 4: These sentences belong in the subsequent section on uncertainty.

Page 5

Line 5-11: Can the authors restructure to make a clear distinction between emissions sources that are (a) not included because they are indirect and out of scope ("upstream GHG emissions, refining, etc.") and (b) not included because data was not available, even though they are direct and within scope?

It would be important to note in (a) whether or not indirect emissions from electricity use are also excluded, as this is generally the largest indirect source across all sectors; and in (b) how significant these sources are in estimated CO₂ equivalents, and whether this is a complete list of omitted direct emissions sources.

Line 12-21: This is a relatively short discussion of uncertainty – given its importance in the context of food system emissions. As stated above, several sentences from the prior section could be brought down. Several further points could be made:

Does the estimated uncertainty range (“30—70% across many processes (Tubiello, 2019)”) also hold true for this dataset? Please be explicit.

Could uncertainty estimates be provided for sub-components of the data (e.g. by gas, or food system component)? This is critical information for the data users.

To what extent does uncertainty prevent us from making policy relevant statements on (1) total emissions levels, (2) total emissions trends, (3) the relative importance and impact of different food system components?

Does uncertainty increase with decreasing scale (global to regional to country level data)?

Page 6

Line 7: Perhaps state the denominator here too (total global GHG emissions) and its source? It is also not in Table 1. (I see that it appears in the discussion. Please move up here.) You might consider placing it in the abstract too, since the sentence appears there too.

Line 7: What would be the emissions range for the global total (\pm xGtCO₂eq yr⁻¹), given the previously stated uncertainty?

Page 8

Line 2-4: This is an important claim, also in the abstract. Can it be sourced? What is the measure of “national mitigation strategies”? Sector based targets within NDCs?

Line 17-22: Presumably it is also due to shifts in other sectors, e.g. all else equal, reductions in power sector emissions will increase the proportion of food system emissions in the total. And power sector emissions have been declining in most EU countries and the US (e.g. <https://www.tandfonline.com/doi/full/10.1080/14693062.2021.1990831>)

Line 37: The result on F-gases is surprising - and interesting. Can the authors provide a little more detail? Which are the main gases? Perhaps a link could be made to Minx et al. 2021, which corroborates F-gas growth in inventories with atmospheric inversions (Fig 2 <https://essd.copernicus.org/articles/13/5213/2021/essd-13-5213-2021.html>) Also, in Table 5, F-gases were 0 in 1990. Is this a data artefact? Or is it due to Montreal gases being replaced by HFCs/PFCs in the intervening decades?

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Line 1-6: The language here suggests these subcomponents are trivial sources ("only", "mere"). Arguably 15% or even 3-4% is not trivial, so I would simply present the numbers without inferring their importance. If one wants to make a normative point, I would argue that all emissions sources should be considered important and worth policy attention.

Line 12-32: There are multiple typos and phrasing errors here that could be improved. Please carefully check. Please also consider splitting this long paragraph into smaller chunks each with a substantive point.

Other comments on the manuscript:

Table 1: Could headings be added to group these sources into their higher level categories, e.g. as in Figures 1 and 2?

Table 3: You could add the fraction of global food system emissions that the top 10 add up to, in the caption.

What global warming potentials are applied to estimate GHG emissions in CO₂eq?

Comments on the dataset:

My first impression is that the dataset is too large (200mb), unstructured, and lacking important metadata. Together these make it only available for advanced users. Some specific comments:

If one opens the .csv in Excel, a warning comes up that the data is not fully loaded (too many rows). Could it be split into several files? Or could a basic user-friendly excel version be provided alongside the raw csv file, perhaps for a useful series of aggregates (e.g. global emissions by food system component, by gas, by region/country), or the full data just for high emitters/regions? Such simplified sheets would presumably be important to assist national agricultural ministries to better understand emissions along the supply chain (a claim in the manuscript).

There is no explanation of the column headings embedded in the file (What are the flags? What are the codes? Are two codes for years really needed?). For example, a basic user wouldn't know that Area contains both countries and regions, and Element contains two separate variables for five different gases (I would personally split this in two and have a gas column).

There are no country ISO codes, which raises barriers to joining other datasets (e.g. population, gdp).

Most tricky: what is the hierarchy and structure of the "Item" column? If I filter by "World", "2019", and "Emissions (CO₂eq) (AR5)", the sum of Value is 228 GtCO₂eq. So there is double counting among the Items. Which items do I exclude to produce the number in the manuscript – 16.5 GtCO₂eq? I see already that "Energy" is included (37GtCO₂eq) and shouldn't be. How do I know which items are in and which are out of the food system account? Could you add a column for this, so we don't have to use complicated string operations?

Can we have the GHGs in native units, so that different global warming potential metrics can be applied? (Or conversely, a column with the applied AR5 GWPs)?