

Review 2020-286

Overall: an amazing urgent essential compilation presented with an excellent comprehensive manuscript. 'Chapeau' to authors.

Excellent product for ESSD as well. Please regard comments and suggestions that follow as small improvements to overall readability.

Line 85: "they **only** became the dominant source of anthropogenic emissions"

Line 114: "(including coasts and territorial **seas**) ??

Lines 116 to 119: "The global emissions and their partitioning among the atmosphere, ocean and land are in reality in balance, however due to imperfect spatial and/or temporal data coverage, errors in each estimate, and smaller terms not included in our budget estimate (discussed in Section 2.7), their sum does not necessarily add up to zero." Revise to:

Global emissions and their partitioning among the atmosphere, ocean and land are in reality in balance. Due to some combination of imperfect spatial and/or temporal data coverage, errors in each estimate, and smaller terms not included in our budget estimate (discussed in Section 2.7), their sum does not necessarily add up to zero."

Line 129: I do not know prevailing lingo, but "territorial" and "consumption-based" are not comparable. "Consumption-based estimates still rely on territorial boundaries? Better to write "production-based vs consumption-based"? Throughout the text you refer to countries or nations but rarely to territories? Or you refer to "national territories"? Reader does not encounter careful definition of "territorial emission inventories" until line 315. Some clean up and consistency needed here?

Line 167 'most recent' rather than "last"?

Line 201: "estimates of EFOS rely primarily" should be E_{FOS} ?

Line 278 to 291, cement carbonation: good up-to-date discussion but Guo et al. is not cited in references?

Line 381: "in place for six weeks before they ease" By the time of publication we ay know that easing has not worked and that lockdowns - based on erratic or absent national policies - have resumed in many locations. Economic impacts uncertain everywhere; one does not want to see these authors or this product 'chase' political changes. Better to state impacts so far as known and documented but to stay away from Covid-19 projections?

Line 400, 401: a separate crowd-sourced tracking of aviation data currently in ESSD discussion (<https://doi.org/10.5194/essd-2020-223>, who knows how it got in ESSD and one scarcely knows if or how to credit it) shows a much steeper decline in aviation travel than mentioned here. Again, although they want to keep current and alert, we really do not want GCB authors trying to keep up with rapidly-moving hardly-certified external activity indicators? Better that they declare uncertainty - as they do elsewhere - rather than publish today what will change tomorrow? Alert but a bit more cautious; authors will know best approach.

Line 406: Do we need a reference to EDGAR here? (As you do later at line 900.) Or we assume readers find it in Liu et al. online? This entire section gets a bit speculative, a departure from past reliability of GCB?

Line 426 and several times following: If “Carbon Monitor” represents one of your reliable documented sources for 2020 emissions (e.g. appears frequently in text as well as in Table A8) we need a standardized reference?

Line 480 to 482 - meanwhile, FAO data and definitions also undergo update and - to a smaller degree - revision (e.g. <https://doi.org/10.5194/essd-2020-203>); perhaps not yet valid for this edition of GCB but something to take account of in future versions?

Lines 493-494 - emissions from drained soils discussed in <https://doi.org/10.5194/essd-2020-202>?

Line 505: LUH2 never defined? I think you mean Hurtt et al. 2020 but not clear how one would access that reference? The landing page for the PCMDI DOI only lists a 2017 version plus the option for updates. No valid reviewed reference to LUH2?

Line 517: Likewise, FAO / FRA much used but never defined nor properly referenced.

Line 528: “anomalous fire season in Southeast Asia.” Also (both 2019 and 2020) in Siberia, North America, Amazonia, etc. What seemed anomalous in the past now proves regular and expected albeit still unquantified? For both accounting through 2019 and projection for 2020, the fire term grows increasingly unknown and uncertain? How does growing uncertainty in fire emissions contribute to overall E_{LUC} uncertainty?

Line 576: no definition of CRU nor of JRA although you use those acronyms frequently throughout this section.

Line 621, 622: “scale almost linearly with GFED over large areas (van der Werf et al., 2017)” out of date or no longer valid?

Line 632: authors have no doubt done expert assessment, but “pan-tropical fire emissions” in 2020 only two-thirds of 2019 seems counter to most reports? Give your readers some basis for confidence in this statement?

Line 723: SOCAT, should have been defined a few lines earlier?

Line 867: You have not explained xCO_2 . For a broad range of readers, you will need to carefully explain all terms.

Line 880: Something weird here?

Line 1258 - New / updated information on SO sinks emerging recently and continually? Hard to keep a reliable annual budget going against the ‘noise’ of new ocean data, but possible changes in SO estimates might need a mention here? Or, wait until next version?

Line 1326 - Here a reader encounters “column CO_2 products” rather than (as earlier) xCO_2 . Some clarification needed?

Lines 1338 to 1340, discussion of uncertainties in NH land sink: substantial redundancy here?

Line 1473, Section 3.4.2: Numeric errors here, corrected already by authors according to text supplied by editor? Someone needs to read the final (proof) version carefully to confirm final numbers.

Line 1521: “suggests we do not yet have a complete understanding of the underlying carbon cycle processes.” The manuscript carries a necessary overall uncertainty: how much uncertainty of each component arises from reporting deficiencies and how much from missing processes? Here the authors seem to point to missing processes but much reporting earlier in the manuscript focussed on reporting (or, modeling) uncertainties. No hard line between weak reports and missing processes, but can authors give a clearer sense of where the problem lies? This sentence confuses rather than clarifies? Discussion that follows in this paragraph perpetuates this duality: some improvements might come from “improving the underlying data and statistics”, from “scrutiny of carbon variability in light of other Earth system data”, and from “higher resolution and process knowledge at the regional level”. If these expert authors truly do not know the best route toward improvement (reducing BIM), then say so explicitly. In which case the introductory sentence at line 1521, with its apparent focus on processes rather than underlying data, remains misleading at best? This reader very much appreciates subsequent discussion of uncertainties in southern ocean, in NH LUC, etc, as well as good estimates of how long (decade or decades) one would need to detect a change in a statistically-robust manner. Lines 1581 and 1582 belong in the abstract as well, to alert readers who only browse?