

Interactive comment on “The FluxEngine air-sea gas flux toolbox: simplified interface and extensions for *in situ* analyses and multiple sparingly soluble gases” by Thomas Holding et al.

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===== General Comments =====

This manuscript describes the new functionality built into the FluxEngine toolbox for calculating bulk fluxes of air-sea gas exchange. These features include the ability to calculate fluxes for additional sparingly soluble gases (e.g., N₂O and CH₄), as well as additional support for *in situ* data analyses, such as user defined grids, time periods, projections, and the ability to reanalyze CO₂ data during the data ingestion procedures. These improvements make the toolbox a more useful tool for the scientific community. The example case studies provided here give the reader context for its usefulness,

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giving some concrete examples of how the community can apply the toolbox. The manuscript is effective in its description of the new features of FluxEngine. The authors provided example configuration files for each of the four case studies presented, which was helpful for following along with how to apply the new features. I have some minor comments. Besides that, I recommend the article for publication.

One possible concern with this manuscript is its shelf life. Unlike previous types of bulk flux scripts (e.g., NOAA COARE) which had unique versions that did not change after publication, this toolbox will presumably continue to change. That may have the effect of causing this article to be difficult to follow even a year or two from now. It would be helpful for someone reading this article in the future to be able to view a version of the toolbox from the time the article was written. I believe that is a function of Git, but I'm not sure how one would accomplish it. If it is possible, it may be worth adding the steps to the instructions pdf and then mentioning it in the main text. That way someone can find the items being described in this paper after they've been modified or removed from the toolbox.

===== Specific Comments =====

Line 45: Add a link to the toolbox in the abstract (if that doesn't violate editorial rules). You'll get more clicks.

Lines 92-93: You mention that there is an option of either bulk formula, equation 1, or equation 2. It might be useful to include the bulk formula as an equation in the paper. The two equations that you do show are different iterations of the bulk formula. So, I'm not sure how the bulk formula option differs.

Line 321: Include link to pangaea.de (my top Google results were for Oklahoma oil and gas data at pangaeadata.com)

Line 345: The text says the intakes were of unknown depth. When doing the reanalysis what depth was entered?

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Line 384: Cruise 4 does not look like its flux magnitudes were much higher than 1 and 2.

Figure 4: Color of xCO₂ is blue, but text says that it's in situ. Shouldn't it be black?

Figure 3 & 4: One says gas transfer velocity was from Ho et al. (2006), the other Ho et al. (2007). Is that correct?

Line 429: The text says that the same method was used to reanalyze Case Study 2 and Case Study 1, but the monthly satellite SST used to reanalyze the SOCAT datasets (seen in Fig. 4a) appears to be a moving average to higher temporal resolution, while Ostergarnsholm was stepped monthly SST values (Fig. 5z). Why the difference?

On the topic of reanalyzed fluxes. . . I understand that the purpose of this paper is to highlight the functionality of FluxEngine, but as long as you're showing data plots it would be good to have a better description of their importance. It doesn't seem likely that the monthly satellite SST is more accurate than high temporal resolution in situ SST measurements obtained at a non-standardized depth. I could be wrong. But if I am it would be good to make that clear. Because that difference appears to be a major driver in CO₂ flux difference between original data and reanalyzed data. So, then statistics, such as 35% difference between original and reanalyzed fluxes, don't mean very much. It just feels like an exercise. Again, I understand that the science questions are not the purpose of the paper. But the examples would be stronger, and more engaging, if it seemed like the differences being shown were indicative of true error in the in situ measurements.

Line 481: The text mentions that Pereira et al. (2018) was used to estimate the degree of surfactant suppression. But what data was used to estimate where surfactants were physically present? Doesn't there still need to be some underlying data layer? Or is the Pereira estimate a blanket effect for all grid cells?

Line 494: I am not sure to what "parts of both" refers. Was it both figures?

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Line 552: What dataset did you use for sea water depths?

Figure 7 caption: Add "annual" after "Mean"

===== Technical Corrections =====

Line 28: Consider changing "our" to "the" (e.g., health of the oceans and changes to the climate). It does not need to be personal.

Line 43: "supress" to "suppress"

Lines 53 - 54: SOCAT and MEMENTO citations don't match in format – one has parentheses the other doesn't.

Line 100: Remove comma after "Shutler"

Line 106: Add comma after "At the time of writing"

Line 120: "as described by" is unnecessary

Line 125: Comma after "Collectively"

Line 328: Comma after "Therefore"

Line 340: Capitalize python

Line 346: Add "on" before "either side"

Line 349: Add comma after "Therefore"

Line 359: Add the following commas: "Here, for simplicity,"

Line 437: Consider starting the sentence that begins "FluxEngine was configured to write output . . ." with "For this case study,"

Line 529: "fig 8" to "Fig. 8" or "Figure 8"

Line 556: Add comma after "Collectively"

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Line 596: Capitalize python

Line 598: Add comma after “Collectively”

Line 601: Change “agreed” to “agreed-upon” or “established” or similar

Figure 3 caption: change “detailed in (Ho et al. 2007)” to “detailed in Ho et al. (2007)”

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