Biogeosciences

Discussions

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Interactive comment on "Exploring Constraints on a Wetland Methane Emission Ensemble (WetCHARTs) using GOSAT Satellite Observations" *by* Robert J. Parker et al.

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Response to RC1 Review Comments

(Original Comment, Our Response, New Manuscript Text)

Firstly, we would like to express our gratitude to the editor and reviewers for providing a thorough review of our paper. We appreciate their efforts, especially in these difficult times.

Specific comments:

P3,4: Global scale factor on the fig.1 is obviously not the same thing with "s" in equa-

tion1, although the first paragraph on page 4 says otherwise. The right equation for "s" is given by equation 3 in [Bloom et al., 2017b]. It takes its own value for each of the 18members of the ensemble.

You are correct. In an attempt to be concise, we omitted this detail and accept that we need to be clearer in the text. We will modified the text to clarify this and reference the Bloom paper in more detail.

s is a model-specific scaling factor (Bloom et al., 2017), derived such that model annual emissions amount to either 124.5, 166 or 207.5 Tg/yr (see Figure 1 for model configuration details).

P3: "V1.2.1 of WetCHARTs has improved North American wetlands". This seems to need some explanation.

We will clarify by adding the following statement to the text:

WetCHARTs v1.2.1 wetland extent across Lehner & Doll (2004) wetland complex classes 0-25%, 25-50% and 50-100%, were scaled by 12.5%, 37.5% and 75%, respectively.

P3: I would also recommend to mention Eliseev et al. 2008 paper.

Noted, citation added.

Section 2: No information on temperature data used for q10 dependence.

We have clarified this in the text (and please see similar RC2 comment).

ERA-Interim skin temperature is used as the underlying temperature driving data.

P4: Non-wetland CH_4 emissions for TOMCAT are set using EDGAR (v4.2) data. Are such data available for the simulated period (2009-2017)?

The EDGARv4.2 database runs up to 2012, and we repeated the 2012 emissions for the remaining years, with no seasonal cycle applied. For the wetland regions in which

we're interested, any local seasonal cycle due to anthropogenic flux is likely very small compared to the natural sources, but we now note this possibility in the text.

The EDGARv4.2 database runs up to 2012, and we repeated the 2012 emissions for the remaining years, with no seasonal cycle applied. As we focus primarily over wetland emission areas, the local seasonal cycle due to anthropogenic fluxes is likely very small compared to these natural sources. We do however note the possibility that this effect could be a source of uncertainty.

Section 6: "The wetland extent is found to be the dominant explanation for the variance in all regions". Unfortunately, only one model of soil heterotrophic respiration (CARDAMOM) is used in this work. Based on formula 1 in this paper and fig. S2 in [Bloom2016], the strong divergence between the data from different models, especially in the tropics, can significantly affect the variations in the seasonal cycle of methane. For some regions (especially S.E. Asia and Indonesia) low correlation may be partly due to the use of annually-repeating values for rice paddy emissions. They can be comparable or even exceed wetland emissions, have their own seasonal cycle, and are highly dependent on the same meteorological parameters (temperature and precipitation).

We realise that we have not been clear enough in this section and we will rectify that in the revised manuscript. For clarity, this assessment of the variance is an assessment of the input driving WetCHARTS (Extent, Temperature, Respiration) vs the CH_4 emissions generated by WetCHARTs. It is not meant to be taken as a general statement about the importance of these parameters to explaining the variance in the real world. There are other factors that would need to be included to accomplish that. It is purely an assessment of how important these factors are and their influence on the resulting WetCHARTs modelled CH_4 fluxes. This assessment is useful as if a certain driver is dominating the response in WetCHARTs emissions and we subsequently observe discrepancies to the CH_4 measurements, it indicates further evaluation of that driving data may be useful in explaining these. We will add a statement similar to above to

clarify this in the manuscript.

To clarify, this analysis is purely an assessment of the WetCHARTs CH_4 emissions against its own driving data used to generate the emissions. It is not intended to be interpreted as a general statement about the importance of these parameters to explaining the variance in the real world. This assessment is useful as if a certain driver is dominating the response in WetCHARTs emissions and we subsequently observe discrepancies to the CH_4 measurements, it indicates further evaluation of that driving data may be useful in explaining these.

In addition, in specific relation to the comment above regarding soil heterotrophic respiration, we will add in a statement to explicitly acknowledge the under-representation of Rhet uncertainty in the discussion section.

Although for the extended period examined here we only have 1 heterotrophic respiration model available, the contribution of heterotrophic respiration uncertainty within the WetCHARTs Full Ensemble is considerable due to model disparities in mean emission rates and the corresponding seasonal cycles (see Figure 6 in Bloom et al., 2017, attached to this response as Figure 1). Ultimately further expansion and exploration of the heterotrophic respiration model ensemble may prove useful for robustly representing the terrestrial C cycling uncertainty.

Technical comments:

P2, L25: "wetland CH_4 seasonal cycle", which does make sense, transforms to P5,L25: "CH_4 wetland seasonal cycle", which does not, and then just to "wetland seasonal cycle" (seems incorrect) mostly used till the end of the paper. I would recommend to use the 1st sentence throughout the manuscript.

Noted and modified in the text.

P8, L5: "observed emissions". I think here should be something like "variations in the WetCHARTs emissions"

C4

Noted and modified in the text.

P14, Fig.10 caption: ror

Noted and modified in the text.

P23, L17: the sentence "argument for the approach that WetCHARTs takes in its ensemble approach" needs revision

Noted and modified in the text.

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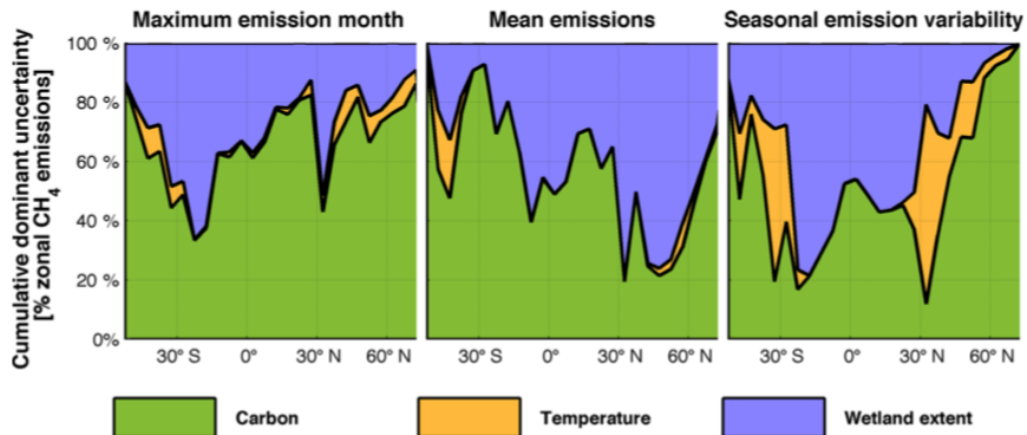
Fig. 1. Figure 6 from Bloom et al., 2017 - The dominant uncertainty attribution in WetCHARTs