

Interactive comment on “Comparison of eddy covariance CO₂ and CH₄ fluxes from mined and recently rewetted sections in a NW German cutover bog” by David Holl et al.

Anonymous Referee #1

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This manuscript reports carbon dioxide and methane fluxes for the period June 2012 to May 2014. Using a combination of a single eddy covariance tower, footprint modeling, and manual spatial cover classification using remotely sensed images, the authors distinguish, separately gap-fill, and quantify annual sums for, both actively mined and recently rewetted peat sections. The authors find that rewetting increases methane and decreases carbon dioxide emissions, but those effects manifest themselves much more strongly in the second year after rewetting, indicating lags.

Overall the paper is clearly written but could be much shorter. The strongest aspects of the study are the comprehensive scholarship and the clarity of the methods. For

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example, there is a clear description of eddy covariance data processing for methane, which seems to have been considered with great care, and is an active area of research in the flux community (e.g., European RINGO initiative, perhaps should be linked more specifically). The exploration of gap-filling approaches is also a nice addition, though I think it takes up too much of the paper overall, given that is not the primary focus of the study (not even in the title). There are however some issues with the paper that I think need to be addressed which I outline below.

Major Comments

Soil conditions In year 2 the authors report a substantial amount of soil data being recorded, including temperature, redox, and water table height. These in turn are included via their variable selection procedure in the predictive models of methane flux. Unfortunately, these data are not presented to the reader at all. This is disappointing as the focus of the paper implied by the title is the difference in fluxes between the two cover types, and soil conditions are likely the mechanism underlying those differences by year 2. I would encourage the authors to explore visualizations of those soil data in the paper, perhaps by substituting it for some of the discussion of either the machine learning or the CO₂ discussion.

Flux Partitioning Why was the net ecosystem exchange flux partitioning done at the monthly timestep? Can this not be performed at half-hour timesteps in EddyPro? I assume this was done intentionally but the justification is not clear.

Synthesis Literature summaries in the introduction and the discussion need to avoid listing. I am referring to the carbon dioxide flux sections, whereas the methane section is better synthesized (I especially like the comparison to IPCC values). The comparisons made in the results to other studies might be better tabulated. If they are noted in the main text, they should be synthesized better.

Machine Learning In Appendices A and B, the authors outline the machine learning approach used (artificial neural networks). Can the authors justify why they used a

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single data split as opposed to a k-fold cross validation approach, which tends to give a more stable performance evaluation? Using the alternative year as a “test” set for generalizability is interesting.

Can the authors also comment on whether gaps were artificially created during validation, or whether the data splits were performed randomly on all observations?

Style I personally enjoyed the descriptive style of the writing, but it is unfortunately much too verbose for a modern readership. I would encourage the authors to mercilessly edit to reduce text. They might be surprised how much shorter the paper is if written in a more declarative style. An example:

“We used a factor of 34 to convert FCH₄ into CO₂e release. This value is given in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5, Myhre et al., 2013), refers to a 100-year time horizon and includes climate–carbon feedbacks”

...could be shortened to:

“We used a CH₄ global warming potential of 34 kg CO₂-eq (IPCC AR5, Myhre et al., 2013), which assumes a 100-year time horizon and includes climate-carbon feedbacks.”

Or:

“Nevertheless, on an annual basis the periods when the sink character of SCrew prevails do not compensate for CO₂ release during periods of reduced plant activity.”

“Nevertheless, annually integrated ecosystem respiration outweighs photosynthesis in SCrew.”

Minor Comments

Page 2 Line 9: Perhaps “land-use or climate change” rather than “men”

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Line 14: “of carbon dioxide”

Line 20: “inheres the potentials” is ambiguous phrasing

Line 29: perhaps “oxidized” rather than “decomposed”

Page 3 Line 3: perhaps “strongly” rather than “gravely”

Lines 4-20: This is a nice minireview, but could be stronger if structured more systematically, or if the points could be linked more, to sound less like a list.

Page 7 Line 14: “brown”

Lines 20-: Can you briefly justify the variable positions of these sensors? How representative is the water-level sensor of the general footprint?

Figure 1: Can you please add some more points for the other sensor installations.

Page 8 Figure 2: This figure can be more useful to visualize how each true calendar year deviates from the long-term average if it just showed the full timeseries in one series (June 2012-May 2014). The problem currently is that it is difficult to visually integrate the deviations from the mean.

Line 8: Is WPL strictly a correction?

Page 18 Table: Acres are not SI units. Please report in m², hectares (ha), or km²

Line 33: I think the values in parentheses should be reversed given the order of the sentence.

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