

Interactive comment on “Aircraft-based inversions quantify the importance of wetlands and livestock for Upper Midwest methane emissions” by Xueying Yu et al.

Anonymous Referee #2

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The paper “Aircraft-based inversions quantify the importance of wetlands and livestock for Upper Midwest methane emissions” by Yu et al., presents an interesting piece of research regarding the estimates of methane emissions in the upper Midwest US based on aircraft measurements. The authors apply multiple inversion approaches to quantify the methane emissions for three seasons and conclude that wetland emissions are the largest methane source in Midwest US, next by livestock emissions. Generally, the paper is well-written, and the methodology is sound. However, I feel the section 4 and 5 need to be presented in a clearer way. I also have a few questions regarding the methods and conclusions, mostly about the wetland methane:

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- Given such large uncertainty in wetland emissions and wetland extent, how sensitive are the model results and conclusions to the choice of a wetland prior? How reliable is the conclusion based on one wetland methane product? There are a few recent bottom-up ensemble wetland estimates (Saunois et al., 2020) with different wetland extents using different wetland models. Will applying a different wetland prior lead to different conclusions? This would also be helpful to further inform the wetland methane community.

The setup of prior emissions for wetlands. I found the treatment of scaling up the WetCHART ensemble mean by 10% is not justified and it's unclear how this treatment affects the conclusions that wetland methane is the largest source in the study region. Livestock emissions could also be systematically underestimated, which is suggested by the authors and by Wolf et al., (2017). In addition, WetCHART is a global methane wetland product - Why would it need to be scaled up to match the other global estimate (Kirscheke et al., 2013)? Also, Kirscheke et al., (2013) estimates for wetland emissions are not up-to-date. There are a few more recent estimates such as Saunois et al., (2020), which suggests the ensemble mean of bottom-up estimates for wetland CH₄ is likely at the low end of the range of the WetCHART estimates.

- I would suggest the authors include their findings of the livestock in the abstract regarding whether the inventories underestimate the livestock as found by Wolf et al., (2017). I found it's discussed in the main text but it is not mentioned in the abstract.

Specific comments:

Equation 2: how does the wetland extent vary with time while using two static wetland extent products (i.e. GLOBCOVER and GLWD)?

Line 122: If I remember it correctly, EDGAR v4.3.2 only has yearly estimates. it's not clear how you obtain the seasonal emissions from EDGAR.

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