

Earth Syst. Sci. Data Discuss., referee comment RC1
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Comment on **essd-2021-140**

Anonymous Referee #1

Referee comment on "The Boreal–Arctic Wetland and Lake Dataset (BAWLD)" by David Olefeldt et al., Earth Syst. Sci. Data Discuss.,
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Synopsis

The manuscript describes the creation of a new land cover classification system designed specifically for quantifying methane emissions from Arctic and Boreal regions. This science has been plagued by the complexity of methane biogeochemistry and the landscape heterogeneity of the region. Thus, estimates of northern high-latitude emissions carry large uncertainty. The authors have somewhat reinvented the wheel by designing a new model grid by combining expert knowledge and machine learning-based techniques to estimate fractional cover of 19 classes within a half-degree grid. They use schemes to harmonize land cover types to reduce double counting issues with bottom up emission budgeting. The large collaborative effort demonstrates that this technique could be widely accepted and highly useful for tracking methane emissions from the rapidly changing north. The article is well written and very near its final form. I can only recommend very minor changes to help improve the clarity and impact of the manuscript.

General Comment

This manuscript was written as a companion to Kuhn et al. 2021 (BAWLD-CH4: Methane Fluxes from Boreal and Arctic Ecosystems), which contains more quantitative methane information for the BAWLD model. Kuhn et al. 2021 is heavily cited in this manuscript, however a better connection to this paper could be made in the introduction and/or the conclusion. This would increase the impact and utility of both papers. A paragraph could be warranted to more clearly and explicitly illustrate/bridge how the two papers are companions to one another. This could also potentially improve on the lack of quantitative

methane information in this manuscript. I was somewhat expecting a new pan-arctic/boreal annual CH₄ estimate based on the BAWLD modeling in either this manuscript or Kuhn et al. 2021, however no global estimate was produced. This seems to be the potential a-priori gridded data that was suggested as highly useful to the inverse modelling community.

Specific Comments

Lines 181-184: Are the 53 variables available in all grid-cells? Do some grid cells contain more/less variables? Probably best to specify/clarify in the text.

Section 2.2.1: Could be really helpful to quickly provide some well-known real geographic examples for some of the main wetland classes.

Line 280: Add comma after "As such"

Line 356: Add an "a" in between "have" and "high"

Line 442: Suggest changing the comma to a period and starting a new sentence with "We henceforth..."

Figure 6: Minor suggestion: add the word "Legend" to the color key to quickly differentiate this wheel from the others. Maybe in the center? Bold? Maybe with a box around it? Take it or leave it, but it is confusing at first. At first glance, I interpreted the legend as a global distribution.