General comments:

The structure and writing style of the article is good. I could easily follow and read it, and the sections are well-differentiated. The topic is also very interesting, as I agree that emission from lakes and ponds are underestimated by current inventories.

There are some general pieces of information or values, like the emission rates of small ponds, sensitivity thresholds and spatial resolution from the satellite instruments, that are repeated too many times throughout the manuscript. I would suggest reducing the number of times the information comes up, as it gets repetitive.

On a negative note, I am a bit concerned with the scope and base of the study. Without wanting to discourage or offend the authors, the study feels like a literature review at the beginning of a project, not a synthesis of a research area.

The subject of the minimum detection threshold or limit is widely mentioned, but I cannot see key references on it like the ones I add below. In these studies, they talk about how the detection limit of an area flux mapper depends on parameters such as pixel size, wind speed (related to the escape time of the gas inside a pixel) and revisit time.

- Jacob, D.J. et al., 2022: Quantifying methane emissions from the global scale down to point sources using satellite observations of atmospheric methane
    - https://acp.copernicus.org/articles/22/9617/2022/
- Dubey et al. 2023: Minimum detection limits of the TROPOMI satellite sensor across North America and their implications for measuring oil and gas methane emissions
    - https://www.sciencedirect.com/science/article/pii/S0048969723008380

Regardless of the articles above, the fact that the emission rates of small lakes and ponds are far below the current sensitivity of satellite approaches is already understandable in existing literature. My point is that there is no existing literature merging both topics because the sensitivity limitations from satellite instruments are rather well-stated.

You repeatedly discuss point-source imagers and their detection limit. It is of course important to define the limits of this approach. However, the problem you are researching is not a point-source but an area source. Thus, this technology is neither designed nor intended for your source. You point it out well in the article, but I believe it is too much of a central part of your discussion, when perhaps it should not.

On a positive note, I enjoyed more the research and discussion on the optical proxies. It seems that, along with modelling and validation from in situ measurements, it would be

the most likely option to succeed in bridging both disciplines. Thus, I perhaps would have liked to see a larger focus on this topic. The points you make in the discussion sections related to it are good.

If you indeed believe optical proxies are the best option, the question that comes to my mind is: Given X spatial resolution or instrument characteristics, which percentage of the lakes and ponds of your dataset could be monitored?

Since you are reviewing these different methods, I would appreciate seeing more discussion of the specific potential of each of them, should the research be funded.

I understand that this study is focused on literature reviewing, so I would not expect you to implement any method. But I feel that as it is, it does not add substantial value to the discussion of limitations and potential uses of satellite RS to the field of Limnology.

Specific comments:

Page 3, Line 70-75 → Line 62 already states the origin of the data for Figure 1. I would skip detailing how the plot was produced and only add necessary information in the figure's caption.

Page 5, Line 124-126: It's unfair to say there's a scarcity of papers dealing with the subject, when it's not even feasible to look at small water bodies to current sensitivity of satellite instruments.

Page 9, line 201-202: Shouldn't the units of total emission rates and fluxes be the same in the description?

Page 10, line 215-220**:** I would recommend the last sentence right after mentioning "detection limits in line 215

Page 11, Table 4:

- The title is a bit misleading. The algorithms are not specifically used for aquatic environments, but for any other application.
- The spatial resolution of the matched filter algorithm is sensor and platform dependent, not ~30m as stated.
- The output of the Remotec algorithm is total column mean-mixing ratio or column-averaged concentrations [ppb]
- Daily global coverage is not a processing speed

- Specify that the quantity stated for point sources in the detection scale row is a sensitivity threshold

Page 11, line 237: I disagree with the statement that radiative transfer models are sidestepped by the MF algorithm. RTM's can be used to generate a target spectrum under specific conditions, thus used along the MF algorithm (often).

Page 12, table 5: Add EMIT and ENMAP to the point source imagers list, since you refer to them earlier.

Page 12, line 166: The matched filter algorithm, used by PRIMA and Sentinel-2 is not calibrated for any sort of targe. The nature and sensitivity of the algorithm and the instrument can just detect concentrations above a certain threshold.

Page 13, line267: The 3 citations in this line are more related to satellite remote sensing than eutrophic ponds. Their location is misleading since it seems they refer to the ponds.

Page 13, line 270-275: This has already been mentioned before. The pixel size mentioned here is different to the one stated in Table 4. Why? I believe 5.5x7 is the correct one.

Page 13, line 276: Meter-scale resolution is not the same as 20-60 meter spatial resolution.

Page 14, line 286-289: The emission values from small water bodies has been mentioned before. Phrasing it here does not add value to the narrative.

Page 14, line 289-298: Repetition of facts stated in the same section. They do not add value.

Page 14, line 301-302: I agree that the better instrumentation gets, the closer to tackling this problem we will be. However, the problem you are tackling would not be solved by a detection threshold of 10 Kg/hr or slightly below.

Page 14, Table 17: The detection threshold for are flux mappers is rather dynamic. What is the basis for the ~15 kg/pixel value?

Page 15, line 331-333: I would phrase this statement differently. It's not so much the design of the sensor, but the sensitivity of the technology.

Page 16, line 368-373: I agree with the first statement, that optical proxy retrievals are a promising option. Thus, it feels off to bring back point source imagers to the discussion.

Technical corrections:

I am not an English native speaker, so apply those corrections that you consider valid.

Page1, line 6: that dominate ~~the~~ Gemany's

Page1, line 8: but "their" monitoring..

Page1, line 12: and sensitivity mismatch**.** Typical**..**

Page1, line 16-17: Sentence is repeated twice.

Page1, line 19: Upscaling of what? Perhaps spatial resolution?

Page1, line 21: observation-based

Page 2, line 29: The abbreviation CO2 has not been introduced 1 line above

Page 2, line 31: The abbreviation CO has not been introduced

Page 2, line 33: ~~planet's~~

Page 2, line 47: in small aquatic systems

Page 4, line 81: Only (instead of ((

Page 4, line 82: In 2017, the launch..

Page 4, line 82: a 5.5 x 7 Km spatial resolution

Page 4, line 93: Policy-making ?

Page 4, line 95: process-based

Page 4, line 136: nature of this research. Satellite-based…

Page 4, line 137: retrievals

Page 7, line 170: satellite-based methods

Page 8, line 173: provided – ~~in~~/ by small lakes

Page 8, line 174: chlorophyll-a

Page 8, line 175-176: nitrogen-rich

Page 8, line 186: hotspot phenomena (lowercase)

Page 10, line 223**:** RS studies that have been reviewed in this study

Page 10, line 225**:** algorithms

Page 10, line 227**:** physics-based

Page 10, line 229**:** achieves what?

Page 10, line 233**:** physics change

Page 10, line 237-238: Mistyped the question

Page 12, line 254: recent turbidity models based on Sentinel-2 observations

Page 12, line 259: are divided

Page 12, line 261: “rather than bridging” sounds out of place

Page 12, line 265: spatial resolution

Page 12, line 266: detection thresholds

Page 15, line 311: S2 and L8 retrieve it – What is the meaning of “it”?

Page 16, line 362: a secondary finding/ secondary findings