Response to Referee #1

Dear reviewer,

Sincerely, thank you for examining the manuscript; these comments have been very helpful in improving this work as well as our subsequent work. I will respond to each of these comments point-by-point in the document below.

Once again, thank you sincerely for your time and dedication to our work.

Best wishes,

Yuqing Wang (on behalf of the author team)

General comments

Question A: *lines 53 to 92, where the water mask indexes are explained, should be in the Methods, not in the Introduction.*

Response A: Thank you for your comments. We have made this part of the text as an Introduction part, which is to organize and summarize the process of development of existing OWIs. The purpose of this manuscript is to investigate the applicability of existing OWIs to support rapid water resources mapping. Therefore, in the Methods section, we focus on the methods used to conduct the applicability study of OWIs rather than the development process of these OWIs. Therefore, we have included lines 53-92 as part of the Introduction rather than as part of the Methods.

Question B: *There is a section "Method" within the section "Material and Methods". There is no section to provide details on the satellite data that were used, there is only one sentence about it in the "Data" section.*

Response B: Thank you for your suggestions, which have been very helpful in enhancing my manuscript. I have modified the Data by adding the corresponding satellite data as shown below.

Page6, Line138-143:

Landsat-8 was launched in 2013 and has now been in service for more than a decade, with a revisit period of 16 days, a total of 9 bands, and a spatial resolution of 30m (Barsi et al., 2014).Sentinel-2 was jointly developed by the European Commission and the European Space Agency under the Copernicus program (Berger et al., 2012), and so far has three satellites, Sentinel-2A/B/C. In this study, we use Sentinel-2A, launched in 2015, which has a revisit period of 10 days, 13 bands, and original spatial resolutions of 10m, 20m, and 60m. We then use the OWIs computed by Sentinel-2 to unify the spatial resolution to 10m in GEE.

Question C: *Lines 252-257 should be in the Discussion section.*

Response C: Thank you very much for your comments. I have made the appropriate changes in the manuscript. Moved this section to Line 364-368 in the Discussion section.

Question D: *Moreover, English language and grammar require critical revision. There are many grammar errors in the text, including verb conjugations, sentences that are too long or built incorrectly, and misspelled words. In addition, there are portions of the text such as lines 98-101, where one sentence is repeated twice, which indicates that the manuscript was not carefully revised by the authors. The poor language makes it often difficult to understand what the authors mean with some* *statements.*

Response D: I sincerely apologize for my mistake and thank you for reading and checking the manuscript. I read the whole text carefully and checked the English grammar. Verbs, sentence structure, spelling mistakes, etc. were corrected. Again, a sincere apology.

Specific questions

Question 1: *The water types are classified as turbid, green, shaded, swamp, and salt waters. However, the criteria for defining these water types are not described.*

Response 1: Thank you for your comments. It is difficult to use a quantitative criterion and absolute uniformity for the delineation of different types of water. In this study, we have not given an absolute delineation criterion, and the amount of work required to achieve this uniformity has detracted from the purpose of our work. However, we select different types of water based on their environmental conditions and water quality typicality, and find that different types of water have different spectral characteristics. I add a discussion of this issue to the Discussion section as follows.

Page18, Line366-368:

On the other hand, it is difficult to quantitatively standardize the classification of water, such as determining how much sand should be classified as turbid water. However, we observed unique spectral characteristics for different water types in these areas, which are indicative of both water quality and the environment.

Question 2: *There is no definition for the term "surface water", often mentioned in the manuscript.*

Response 2: Thank you sincerely for your suggestions. I have revised the manuscript accordingly by adding the definition of surface water.

Page2, Line38-39:

Different studies will define surface water slightly differently; in this work, we define surface water as water that is not covered by features other than aquatic plants.

Question 3: *There are no details about the in-loco observations (field surveys) mentioned in line 104. Conversely, according to Fig. 3, model accuracy was tested by comparing outputs of the different models to the output of SWI. If that's the case, what are the field surveys for? Please explain and organize this explanation in the text.*

Response 3: Sincere thanks for your questions, they are very helpful in enhancing my manuscript. The field survey was designed to validate the literature representations on the one hand and the manual digitization on the other hand. The original text was inappropriately worded in part. Figure 3 caused some improper understanding that we do not use the SWI identification results as a benchmark against the identification results of other OWIs. I have modified Figure 3 and the text accordingly, as shown below.

Page5, Line104-105:

As shown in Figure 1, we selected a total of 10 study areas in this study: the Yellow River, the Nile River, Lake Taihu, the Danube River, Namtso Lake, Lake Eyre, Lake Geneva, the Charles River, Poyang Lake, and Lake Okeechobee.

Page9, Line185-186:

The results of the manual digitization were validated against the data from the field survey.

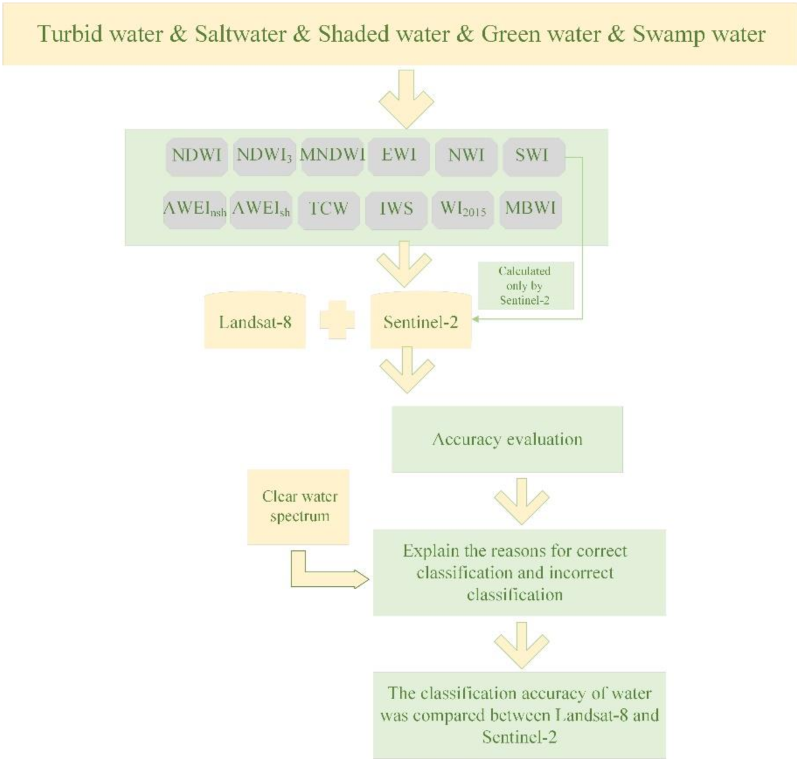

Figure 1: The overall workflow of this study.

Question 4: *Equations for 11 water masks, not 12, are shown in Table 1.*

Response 4: Thank you for checking. AWEI contains two formulas $AWEI_{sh}$ and $AWEI_{nsh}$, the former is used for shaded areas and the latter is used for non-shaded areas, and they have different uses. Therefore, we study them in their entirety according to the 12 formulas.

Question 5: *Thresholds for water classification, for each index, are not provided. The method used to select this threshold is also not provided.*

Response 5: Thank you for your comments. In this study we did not use the thresholding method to partition water from non-water. This is because the determination of the optimal threshold is complex and it is difficult for us to guarantee that the thresholds of all 12 OWIs are optimal. In order to conduct the study more objectively, we chose the K-means classification method in unsupervised classification, which we discuss in the manuscript as follows.

"Classification methods that use OWIs as inputs to classify water and other classes from OWIs can be roughly divided into three categories: supervised classification, unsupervised classification, and threshold methods (Li et al., 2016). Some scholars use the threshold method (Adrian et al., 2016); however, choosing the optimal threshold is very complex and time-consuming (Liu et al., 2023). The Otsu method (1979) is a widely used automatic thresholding method aimed at maximizing interclass variance and minimizing intraclass variance (Du et al., 2016). However, the algorithm does not yield good results for images without bimodal features (Zhou et al., 2015). Supervised classification and its accuracy is depend on the quality of the training samples (Shin et al., 2016). An unsupervised classification algorithm does not rely on training samples and has less subjective interference (Tian et al., 2024). Therefore, we ultimately chose an unsupervised classification method to classify OWI images to pursue objective evaluation results."

"The K-means classification method is widely employed for unsupervised classification. In the K-means algorithm, cluster analysis is utilized to randomly determine the central locations of clusters and subsequently group the objects that are closest to these centers (Piloyan and Konečný, 2017). Through iterative calculations, the values of each clustering center are updated individually until the optimal clustering outcome is achieved. In this study, the calculation results of twelve OWIs were classified via the K-means method. Specifically, the K-means classification method was employed to partition the images into five categories through ten iterations. Each scene contains approximately five categories: water, vegetation, impervious cover, bare ground, and swamp-and 10 iterations constitute the number of iterations with the highest accuracy that we obtained after repeated experiments. These categories were then aggregated into two overarching groups, 'water' and 'non-water', and the merging process compared true color images, thereby constructing a binary representation."

Question 6: *Paragraph of line 90 should be in the legend of Table 1, since it describes the table content, and the table legend itself is incomplete.*

Response 6: Sincerely thank you for your advice, it is very useful in enhancing my manuscript. I have already made the appropriate changes in the manuscript.

Page3, Line86-91:

Table 1. Formulas for the optical water index, where β_{blue} refers to the reflectance of the blue band (B2 of Landsat-8 and Sentinel-2), β_{green} refers to the reflectance of the green band (B3 of Landsat-8 and Sentinel-2), β_{red} refers to the reflectance of the red band (B4 of Landsat-8 and Sentinel-2), β_{nir} refers to the reflectance of the near-infrared band (B5 of Landsat-8, B8 of Sentinel-2), β_{swir1} refers to the reflectance of the first shortwave infrared band (B6 of Landsat-8, B11 of Sentinel-2) and β_{swir2} refers to the reflectance of the second shortwave infrared band (B7 of Landsat-8, B12 of Sentinel-2), and β_{vre1} refers to the reflectance of the vegetation red edge 1 band (B5 of Sentinel-2).

Question 7:*Line 116-117: in "At present, the water bloom in Taihu Lake is still serious.", please explain what a "serious bloom" is.*

Response 7: Sincerely thank you for your suggestion, it makes my manuscript more in-depth. Although the water bloom of Taihu Lake has been improved, there are still very serious water bloom problems, the biodiversity of Taihu Lake is reduced, the drinking water safety of the surrounding residents is threatened, and hundreds of thousands of people are involved in the salvage of water bloom every year. I have made corresponding changes in the manuscript.

Page5, Line113-116:

At present, the water bloom in Taihu Lake remains severe (Wang et al., 2020). This has led to a reduction in the biodiversity of Taihu Lake, threatened the drinking water safety of surrounding residents, and resulted in hundreds of thousands of people being involved in water bloom salvage efforts every year.

Question 8: *Legends of all figures and tables are too short and do not explain what the content is.*

Response 8: Thank you for your comments. I have made the appropriate changes in the manuscript.

Question 9: Section 4.1: What phenomenon?

Response 9: Sincere thanks for your question, which improve the quality of my manuscript and guide subsequent writing. I have revised the manuscript accordingly, as follows.

Page14, Line267:

4.1 Reasons for omissions and confusion

Reference

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Zhou, C., Tian, L., Zhao, H., and Zhao, K.: A method of Two-Dimensional Otsu image threshold segmentation based on improved Firefly Algorithm, 1420-1424 pp., https://doi.org/10.1109/CYBER.2015.7288151, 2015.