Response to Referee #2

Dear reviewer,

I am very happy to have received your comments. I sincerely appreciate the time you spent reading the manuscript and the comments were very helpful. I will respond to each of these comments point-by-point in the document below.

Best wishes,

Yuqing Wang (on behalf of the author team)

Question 1: *Surface waters? Rivers...lakes...not underwater water resource.*

Response 1: Thank you for your suggestion, I have made a change to the title and the whole text accordingly.

Page1, Line1-2：

Is It Feasible to Use a Single Remote Sensing Optical Water Index for Rapid Mapping of Surface Water?

Page1, Line15-17:

Surface water is an important component of the earth's system, and the frequent occurrence of floods and droughts in the context of current climate change makes rapid and accurate monitoring of these resources even more essential.

Page1, Line24-25:

Our work provides prior experience for fast and accurate surface water mapping in case of floods or droughts.

Page5, Line113-115:

In this work, we aim to quantify the strengths and weaknesses of the twelve OWIs, which can provide technical and theoretical support for better surface water monitoring and rapid mapping in case of related disasters.

Question 2: Please provide some of the metrics to show the quality of each index applied to each water body.

Also, each of the water groups (turbid...green...etc) are not a standard nomenclature...which can cause some misinterpretation...

Response 2: Sincerely thank you for your comment, this issue is indeed our shortcoming, as mentioned by the first reviewer. 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 3: *I suggest rewrinting this sentence expanding to some of the differences between optical and radar remote sensing...to contextualize the use of indexes...*

Response 3: Sincerely thank you for your advice and I very much recognize your point of view. The difference between microwave and optical hydrography is that microwave hydrography is not as accurate as optical hydrography. Changes have been made in the manuscript accordingly.

Page2, Line33-35:

It is also widely used in hazard mapping in conjunction with Synthetic Aperture Radar (SAR) because the most serious problem with optical imaging is the influence of clouds (Psomiadis et al., 2020). However, SAR struggles to identify water with the same accuracy as optical images (Cho and Qi, 2022).

Question 4: *this sentence looks confusing to me. Is this a "methodology"?*

Response 4: Sincerely thank you for your question. The sentence did seem a bit confusing and I have removed it from the manuscript.

Question 5: *Please, provide a reference for that.*

Response 5: Sincerely thank you for your comments, references have been added.

Page2, Line52-53:

Most OWI methods are constructed on the basis of Landsat series images(Adrian et al., 2016; Liu et al., 2016).

Question 6: *Please provide more references for that.*

Response 6: Sincerely thank you for your comments, references have been added.

Page2, Line55-56:

The emergence of Sentinel-2 has significantly enhanced the monitoring of water areas via remote sensing owing to its higher spatial resolution and increased spectral bands (Zeng et al., 2022; Jiang et al., 2021).

Question 7: *This sentence looks confusing. something wrong here...It looks something is wrong here...*

Response 7: Sincerely thank you for checking and I apologize for my mistakes. I made the correct changes in the manuscript and again sincerely apologize.

Page3, Line72-75:

They concluded that a single-band difference would not be sufficient to eliminate all sources of interference. To address this issue, they introduced the Enhanced Water Index (EWI), which combines the NDWI and MNDWI. This is the first study in which the effects of a dry river on water extraction have been reported.

Question 8: *You should cite the table before showing it in the text...*

Response 8: Sincerely thank you for your comment, changes have been made accordingly. Use the cross-reference function after adding a caption to a table.

Page5, Line107:

Although many OWIs are available (Table 1), they can be deceptive.

Question 9: *It looks similar...*

Response 9: Sincerely apologize for my mistake. I have scrutinized the manuscript and made corrections for this and similar errors. I promise that similar problems will never occur in a further revised manuscript. Sincerely thank you for your comments.

Question 10: *I believe there is a need for a table displaying the main characteristics of each lake, as well as some of the constituents or limnological features, to enhance the applicability range of each index tested.*

Response 10: Sincerely thank you for your comments, which have been very helpful in improving the quality of my manuscript. I agree with you that the addition of a table does make the presentation clearer. However, rather than focusing on the full range of hydrologic characteristics of these waters, I believe the content of the table should emphasize their typicality as study areas. This would make the center of the manuscript more prominent.

Page6, Line153-154:

Table 1: Correspondence table between the study area and water types.

Water type	Turbid water	Green water	Salt water	Shaded water	Swamp water
Name of water area	Yellow River Blue Nile	Danube River Taihu Lake	Namtso Lake Lake Eyre	Lake Geneva Charles River	Poyang Lake Lake Okeechobee

Question 11: *Please, explain what type of grond-truth observation is this...and also include it in a table ...*

Response 11: Thank you sincerely for your comment. The presentation here is indeed not very clear. Our field data are meant to be validated against the manually digitized results from the accuracy validation. They are no longer presented in tables because they are very voluminous. I have made the corresponding changes in the manuscript as follows.

Page7, Line164:

We also combined ground-truth observation data as validation data for accuracy validation.

Page11, Line208-209:

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

Question 12: *The previous table will help even more to understand those characteristics...*

Response 12: Sincere thanks for your comment. I believe this is a combined comment with comment #10 and have made the appropriate changes in the manuscript.

Question 13: *The K-Means is applied before the indexes? this should be included in the flowchart...*

Response 13: Sincerely thank you for your question, it has been very helpful in enhancing my manuscript as well as subsequent writing. K-means comes after exponential computation. Our description in the manuscript is shown below. "In this study, the results of calculating twelve OWIs were classified using the K-means method." The original flowchart in the manuscript was really not clear in its presentation, and I have modified it accordingly, as shown below.

Page10, Line203:

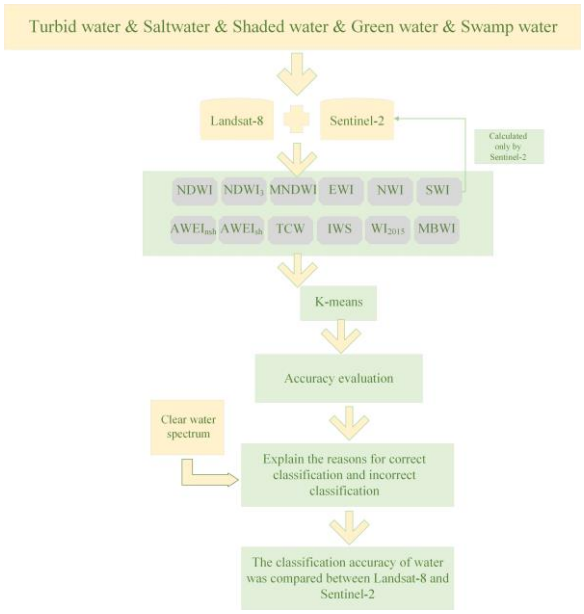

Figure 1: The overall workflow of this study.

Question 14: *Please, define what is an "unclear water"...*

Response 14: Thank you sincerely for your comment. The expression “unclear water” is inappropriate, I wanted to express that there are many different types of water in nature and not all of them are ideally clear (the spectral curve decreases in reflectance as the wavelength increases). In addition to these changes, of course, we still need to define “unclear water”. We define unclear water as one that has a significant change in its spectral profile from that of primary source water. I have modified the manuscript accordingly.

Page8, Line177-178:

These OWIs behave differently in recognizing water in nature, which are diverse and not always ideally clear (the spectral curve decreases in reflectance as the wavelength increases).

Page8, Line186-187:

We define unclear water as one that has a significant change in its spectral profile from that of primary source water.

Question 15: *Please, take a look in the meaning of "signifies" in this sentence...*

Response 15: Sincerely thank you for reading, your suggestions have been very helpful in improving the quality of my manuscript. The “signifies” here is indeed an error that needs to be corrected, and I have made the appropriate changes to the manuscript.

Page8, Line184-186:

where δ *represents the percentage increase or decrease in each band for different types of water,* $\beta_{unclear}$ *denotes the reflectance of each band of the unclear water, and* β_{clear} *denotes the reflectance of each spectral band of water in the first-class water source protection area.*

Question 16: *In situ?*

Response 16: Thank you sincerely for your question. The sampling point data here are derived from remote sensing imagery, and I have made changes in the manuscript accordingly.

Page8, Line187-189:

Spectral samples of clear water were obtained from satellite imagery of the Danjiangkou Reservoir, the largest artificial freshwater lake in Asia and a national first-class water source protection area (Pan et al., 2021).

Question 17: *Where are those samples come from? I mean, the spectral signature...it looks very high spectral resolution.*

Response 17: Sincere thanks for your comments, these samples are from Landsat images from our ten study areas. Our text in the manuscript reads as follows. "The spectral data of the remaining five water types and various background features were acquired from 10 study areas via the Landsat-8 dataset (Figure 2)." I'm guessing your problem is that green water has a very high reflectance in the near infrared band. This is because the sampling point of Lake Taihu is included here, and the problem of water bloom in Lake Taihu is very serious, and we have repeatedly verified that the spectral curve of this region is indeed so. We have provided additional information in the manuscript, taking into account the comments of the first reviewer.

Page6, Line132-134:

At present, the water bloom in Taihu Lake is 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 18: *ROIs?*

Response 18: Thank you for your suggestion. It is indeed ROIs and has been changed accordingly in the manuscript.

Page11, Line209-210:

As accuracy verification results can be significantly influenced by the selection of validation samples (Adrian et al., 2016), we adopted a systematic approach by selecting 100 ROIs, each measuring 6 km×6 km.

Question 19: *The colors on Figure 4 should guide the reader for the results...*

Response 19: Sincerely thank you for reading. Warmer colors in Figure 4 represent higher recognition accuracy, and cooler colors represent worse recognition accuracy, and I have made changes in the manuscript accordingly.

Page11, Line230-231:

Warmer colors in Figure 4 represent higher recognition accuracy, and cooler colors represent worse recognition accuracy.

Question 20: *I would separate the discussion aiming on each of the "classes" previously stated: Turbid, Saltwater, Shadead Water, Green Water and Swamp.*

Response 20: Sincerely thank you for your suggestion, which made my discussion section clearer. I have made the appropriate changes in the manuscript.

Question 21: *How did you calculated that?*

Response 21: Your comments are sincerely appreciated. The variations in the individual bands are relative to the data sampled from the remote sensing images at Danjiangkou Reservoir. I have

discussed this in detail in the Methods section of the manuscript. “These OWIs behave differently in recognizing water in nature, which are diverse and not always ideally clear (the spectral curve decreases in reflectance as the wavelength increases). We quantified spectral variations in different water types by calculating the percentage change relative to clear reference water across various bands in five categories: turbid, green, shaded, swamp, and saltwater. The calculation formula is as follows:

$$\delta = \frac{\beta_{unclear} - \beta_{clear}}{\beta_{clear}} \times 100\%$$

where δ represents the percentage increase or decrease in each band for different types of water, $\beta_{unclear}$ denotes the reflectance of each band of the unclear water, and β_{clear} denotes the reflectance of each spectral band of water in the first-class water source protection area. We define unclear water as one that has a significant change in its spectral profile from that of primary source water. Spectral samples of clear water were obtained from satellite imagery of the Danjiangkou Reservoir, the largest artificial freshwater lake in Asia and a national first-class water source protection area (Pan et al., 2021).”

Question 22: *Figures are too small and hard to understand...*

Response 22: I very much recognize your point of view and have modified all such images in the discussion section. I have copied one of them as follows.

Page17, Line330-333:

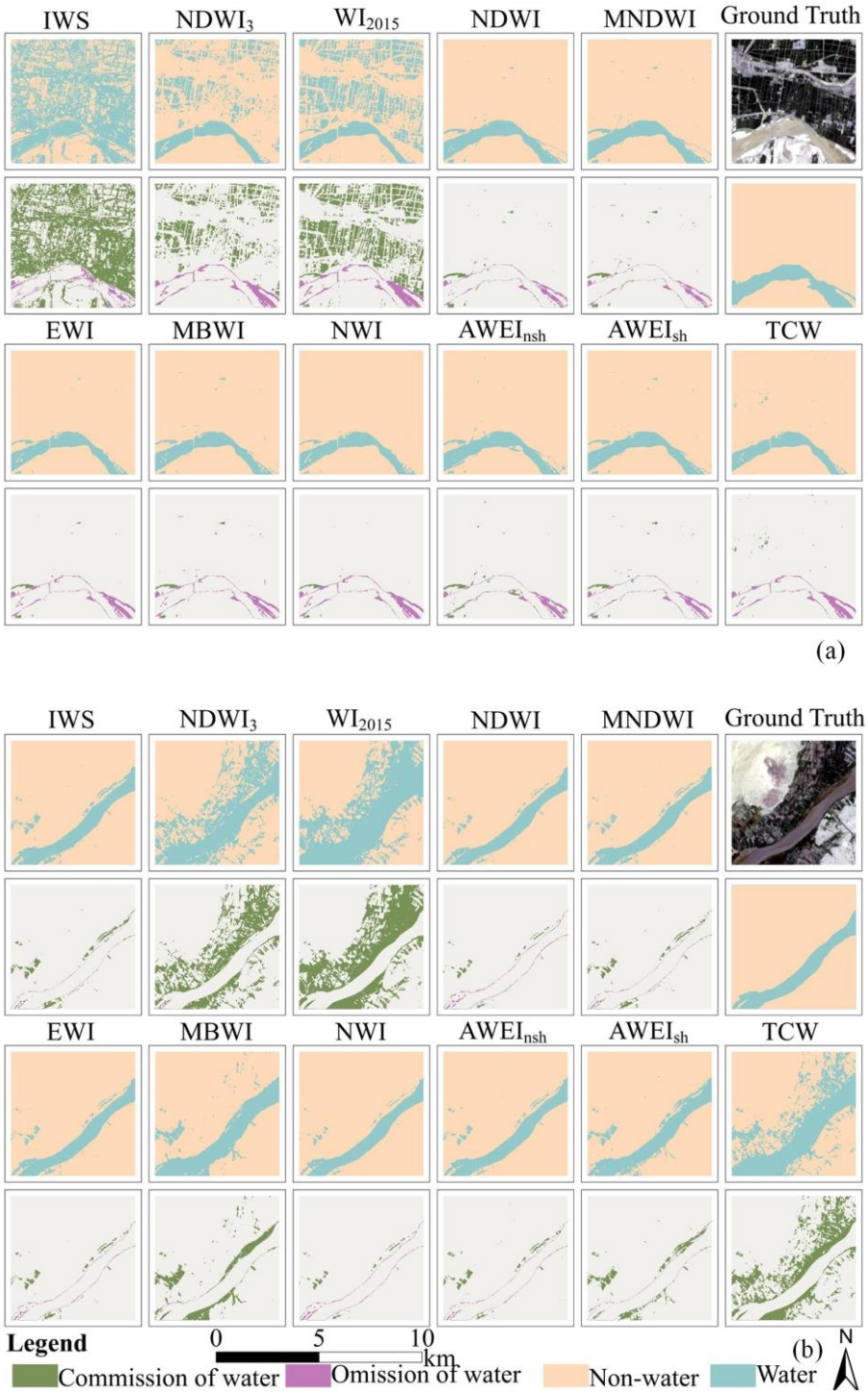

Figure 2: Recognition of turbid water by OWIs. (a) the Yellow River and (b) the Nile River. All remote sensing images are from Landsat-8 data provided by the GEE platform.

Question 23: *???? Not clear for me...*

Response 23: Sincerely, we thank you for reading it, and we have revised the manuscript accordingly, as follows.

Page30, Line483-484:

The diversity of surface water across the earth system results in varying spectral characteristics for

different water types.

Reference

Adrian, Fisher, Neil, Flood, Tim, and Danaher: Comparing Landsat water index methods for automated water classification in eastern Australia, Remote Sens. Environ., 175, 167-182, https://doi.org/10.1016/j.rse.2015.12.055, 2016.

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Jiang, W., Ni, Y., Pang, Z., Li, X., Ju, H., He, G., Lv, J., Yang, K., Fu, J., and Qin, X.: An Effective Water Body Extraction Method with New Water Index for Sentinel-2 Imagery, Water, 13, 1647, https://doi.org/10.3390/w13121647, 2021.

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