Response to Reviewer 1

This study provides an alternative approach for monitoring inland lakes with higher spatial and temporal resolution compared with VIIRS-M and Sentinel-3 OLCI, especially considering the recent degradation of MODIS observations. Overall, the methodology is reasonable, the results are reliable, and the current organization of the dataset is appropriate. The data format is well designed, with the products provided in NetCDF format following common practices in the community, which facilitates data accessibility, interoperability, and further applications. Providing the original source data and related information is also helpful for users to understand, evaluate, and reuse the dataset. However, several aspects, particularly regarding model accuracy and limitations, need further clarification. Below are my comments and suggestions.

Response: Thank you for the positive assessment and constructive suggestions. We clarified the processing of native 375-m I1 observations and added image comparisons in Fig. A1. We also added an SDD-stratified assessment, discussed the potential complementary use of the 750-m M-band product for clear waters, described per-pixel valid-observation counts, and compared the long-term trends with previous studies. Our point-by-point responses follow.

Major comments:

1. I understand that the VIIRS-I band reflectance was generated through interpolation from VIIRS-M bands following Wang et al. (2018). Although the validation results appear satisfactory, more details regarding the interpolation procedure would be helpful. For example, how is the 375 m VIIRS-I reflectance derived using the 750 nm information? Are there any assumptions involved in this process? In addition, providing some examples of lake images comparing the 638 nm VIIRS-I band and the 671 nm VIIRS-M band would be helpful to evaluate the spatial patterns and reflectance characteristics.

Response: Thank you for these constructive comments. Our original wording could be misinterpreted. The native VIIRS I1 detector measures top-of-atmosphere radiance at 638 nm at 375-m resolution. The water-leaving signal is retrieved after atmospheric correction; it is not spectrally interpolated from the 671-nm M-band water signal. The M-band observations are used to retrieve the atmospheric contribution. Rayleigh and aerosol radiances are estimated at

the M-band scale and applied to the corresponding I1 subpixels, after which they are removed from the native I1 top-of-atmosphere radiance.

We revised Sect. 3.2 to explain the processing sequence and assumptions(line 189-202): *"The 375-m Rrs(638) product is derived from the native I1 top-of-atmosphere radiance rather than by spectrally interpolating the 671-nm M-band water signal. In the mixed-resolution MSL12 implementation, the four 375-m I-band subpixels collocated within each 750-m M-band pixel (with their corresponding geo information) are reorganized as four pseudo-M bands and processed together with the M-band observations. Atmospheric optical terms, including Rayleigh-scattering and aerosol radiances, are estimated at the M-band scale and applied to the corresponding I1 subpixels; the atmospheric path radiance is then removed from the native I1 radiance to obtain nLw(638) and Rrs(638). This treatment assumes that atmospheric variability is spatially smoother than subpixel aquatic variability and requires accurate I/M-band co-registration (Wang and Jiang, 2018). To illustrate the spatial patterns and radiometric characteristics of the I1- and M-band products, Fig. A1 compares the native 375-m nLw(638) and 750-m nLw(671) images for representative lakes spanning turbid, intermediate, and clear optical conditions, alongside the corresponding VIIRS RGB composites and 750-m nLw(551) images."*

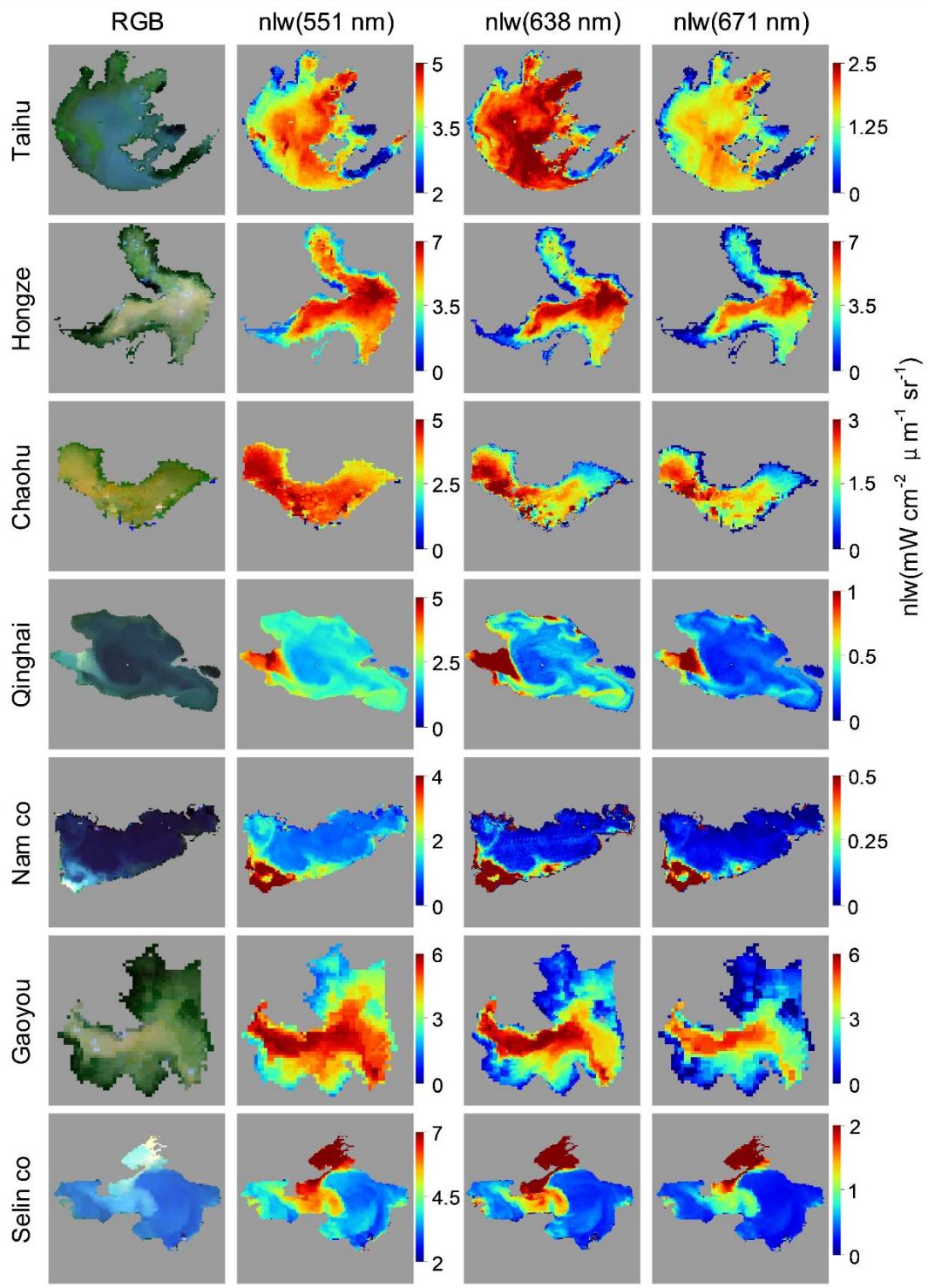


Figure A1. Examples of VIIRS RGB composites, 750-m nLw(551), 375-m nLw(638), and 750-m nLw(671) for representative lakes spanning turbid, intermediate, and clear optical conditions.

2. The Secchi Disk Depth (SDD) model uses only one spectral band, and the suitability of the I1 band for this purpose is both interesting and somewhat fortunate. From a physical perspective, the red band has a strong relationship with suspended matter concentration, particularly in medium- to highly turbid waters (Neil et al., 2011, Remote Sensing of Environment, 115(12), 3719–3730). However, some Chinese lakes are relatively clear, where phytoplankton-related optical properties are generally considered dominant and blue-green bands are commonly used. Beyond the current validation results, it would be helpful to provide a stratified evaluation of model performance for high, medium, and low SDD levels.

Response: Thank you for this suggestion. Table 3 now presents an SDD-stratified assessment of all 905 valid matchup pairs. This assessment includes model-development pairs and is distinct from the independent validation using 271 pairs in Fig. 7b. For the low-, medium-, and high-transparency groups, the multiplicative MAE values were 1.46, 1.54, and 1.54, respectively, and Bias values were 1.06, 0.69, and 0.67. Thus, overall bias is small in the low-transparency group, whereas SDD is underestimated in clearer waters.

We describe this assessment and its limitations in Sect. 5.2 and Table 3(line 390-400): *"To examine performance across the observed SDD range, we also stratified all 905 valid satellite–in situ pairs by measured SDD (Table 3). This assessment includes model-development pairs and is distinct from the independent validation in Fig. 7b. The pairs were divided into low-transparency (0–2 m), medium-transparency (>2–5 m), and high-transparency (>5 m) groups. Across all 905 pairs, MAE was 1.47 and Bias was 0.98. The low-transparency group contained 732 pairs and had a MAE of 1.46 and Bias of 1.06. The medium- and high-transparency groups each had a MAE of 1.54, with Bias values of 0.69 and 0.67, respectively. Thus, multiplicative error magnitudes are similar across groups, but underestimation is more pronounced in clearer waters. This limitation is consistent with the weak water-leaving signal at 638 nm in clear lakes, where blue-green wavelengths provide more information on underwater light attenuation."*

Table 3. SDD-stratified performance across all 905 valid satellite–in situ pairs, including model-development and validation pairs. MAE and Bias are dimensionless multiplicative metrics. This assessment is distinct from independent validation in Fig. 7b.

In situ SDD class	Valid N	R^2	MAE	Bias
0–2 m	732	0.43	1.46	1.06
>2–5 m	120	0.29	1.54	0.69
>5 m	53	0.14	1.54	0.67
All valid samples	905	0.79	1.47	0.98

3. Many clear-water lakes are large lakes, particularly those on the Tibetan Plateau. The blue-green bands from VIIRS-M may potentially provide higher accuracy for SDD retrieval in these waters. Although the manuscript mentioned that the performance may not be satisfactory (Line 506), I wonder whether a combined strategy using both VIIRS-M and VIIRS-I bands could improve SDD estimation for clear lakes. Since clear lakes usually have relatively homogeneous spatial characteristics, slightly reduced spatial resolution with improved spectral information may be a reasonable strategy. This approach does not necessarily need to be included in the current dataset, but it could be discussed as a potential direction for improving future products.

Response: We agree that the spectral–spatial trade-off should be treated differently for clear and turbid waters. We therefore expanded the algorithm-uncertainty discussion to propose an optical-water-type-dependent product: using the native 375-m I1 model for turbid, heterogeneous, nearshore, and smaller lakes while using the 750-m M-band blue-green information for large, spatially homogeneous clear lakes. The relatively weak sub-kilometer heterogeneity of clear lakes helps offset the spatial-resolution loss.

We added the following discussion in Sect. 7.3(line 610-621): *"Although the single-band I1 model performs well over most Chinese lakes, retrievals in very clear waters tend to underestimate SDD and remain sensitive to the weak water-leaving signal at 638 nm, especially on the Tibetan Plateau. In such waters, Rrs(638) is very low, whereas blue-green bands retain stronger information on the transparent spectral window and on phytoplankton- and CDOM-related absorptions. Future CLWC-375 products could therefore explore an optical-water-type-*

dependent strategy: native 375-m I1 retrieval for turbid or spatially heterogeneous waters, multispectral 750-m M-band retrieval for large homogeneous clear lakes, and uncertainty-weighted spatial fusion to preserve I-band shoreline detail. Because clear lakes generally exhibit weaker sub-kilometer spatial heterogeneity, the gain in spectral information can partly offset the reduced native resolution. Additional high-SDD field observations and cross-sensor evaluation with OLCI and Landsat will be required before an operational fusion rule is established."

4. The current organization of the dataset is appropriate. Regarding data uncertainty, it would be helpful to include additional information in the distributed NetCDF files. Although empirical models do not provide formal uncertainty estimates, an additional layer describing the number of valid observations would be useful for users to evaluate data quality and determine whether the dataset is suitable for subsequent analyses.

Response: We added a valid-observation-count variable, n_valid_obs, to each monthly NetCDF file. It records the number of quality-controlled daily SDD retrievals contributing to each pixel in the monthly composite. This layer indicates sampling support rather than formal retrieval uncertainty. The updated dataset has been uploaded, and Sect. 4 and Table 2 now describe this variable(line 341-345): *"Each monthly file also contains n_valid_obs, an integer layer recording the number of quality-controlled daily SDD retrievals contributing to the monthly composite at each pixel. A value of zero indicates that no valid observation was available. Although n_valid_obs is not a formal estimate of retrieval uncertainty, it allows users to assess sampling support and apply application-specific minimum-observation thresholds."*

5. Section 6.2 presents long-term SDD variations, and the results appear generally reasonable. It would be helpful to compare these trends with previously published studies to demonstrate whether the observed patterns are consistent or different. In addition, briefly discussing the potential drivers of long-term SDD changes would improve the interpretation of these results.

Response: Thank you for these suggestions. We added comparisons with previous records in Sect. 7.2 (line 557-570): *"The national mean increase derived from CLWC-375 (0.28 m decade^{-1}, equivalent to 2.8 cm yr^{-1}, during 2012–2025) is broadly consistent with earlier*

MODIS-based estimates of 2.77 cm yr^{-1} for 412 lakes during 2000–2018 (Liu et al., 2020) and 3.3 cm yr^{-1} for 153 large lakes during 2000–2017 (Wang et al., 2020b). These studies consistently show a stronger clearing tendency in western and plateau lakes than in eastern lowland lakes. Feng et al. (2019) also reported increasing SDD in many large Yangtze Plain lakes during 2003–2016, whereas the recent EPL trend in CLWC-375 is weaker (0.11 m decade^{-1}) and spatially mixed. For the overlapping May 2016–April 2018 period, the low clarity and pronounced seasonality of large EPL and NPML lakes are consistent with the Sentinel-3 OLCI observations from Shen et al. (2020). Over longer periods, Tao et al. (2022) reported widespread clearing across China during 1984–2018, and Wang et al. (2026) found an average increase of 0.019 m yr^{-1} across Tibetan Plateau lakes during 1986–2024. Direct numerical agreement is not expected because the studies differ in time window, seasonal aggregation, sensor, atmospheric correction, retrieval algorithm, spatial resolution, lake-size threshold, and lake sample, etc."

We also discussed potential drivers as hypotheses rather than causal findings from this dataset (Sect. 7.2) (line 571-585): *"The observed regional trends may reflect several interacting processes. In shallow lakes, stronger winds enhance sediment resuspension and can reduce SDD, whereas weaker winds and deep water depths can suppress resuspension (Zhang et al., 2014). Precipitation may decrease clarity by increasing sediment and nutrient runoff, but it may also increase lake level and storage and thereby dilute optically active constituents (Shen et al., 2022), consequently, its effect can vary among basins and seasons. Increasing catchment NDVI can reduce soil erosion and external suspended-matter inputs (Hou et al., 2017). On the Tibetan Plateau and in other western regions, lake-area and storage expansion associated with climate warming and enhanced precipitation can dilute suspended and dissolved materials (Wang et al., 2026), and recent Landsat analyses identified NDVI, lake area, and temperature as important factors associated with SDD change (Zhang et al., 2025). In eastern China, watershed restoration and pollution control may improve clarity, whereas eutrophication, hydrological regulation, browning, and wind-driven resuspension can counteract these gains (Feng et al., 2019). These mechanisms are literature-supported hypotheses rather than causal conclusions from the CLWC-375 dataset itself."*

6. There are several spelling errors and inconsistencies throughout the manuscript. In addition, some references appear repeatedly in the text (e.g., Lines 65–67 and Lines 494–498), which may be related to EndNote formatting issues. Please carefully check and correct these problems. Specific suggestions are listed below.

Response: We have revised/corrected spelling, grammar, terminology, lake-zone abbreviations, and figure and table references. We also corrected malformed citations and consolidated the duplicate Liu et al. (2020) reference.

Minor comments:

1. Line 34, the reported performance should be revised to "determination (R^2 = 0.87) and uncertainty of 27.34%" according to the main text.

Response: The abstract has been revised. In response to Reviewer 2's recommendation, we now report multiplicative MAE (1.40) and Bias (0.95) for the independent validation, rather than the earlier percentage-error metric. The model-development R^2 is reported separately in Sect. 3.4.2 and Fig. 7a.

2. Line 55, suggest correcting the typographical error "occu" to "occur".

Response: Corrected.

3. Lines 121–122, suggest revising the lake-zone names and abbreviations to "the Eastern Plain Lake Zone (EPL), the Northeast Plain and Mountain Lake Zone (NPML), the Yunnan-Guizhou Plateau Lake Zone (YGPL), the Inner Mongolia-Xinjiang Lake Zone (IMXL), and the Tibetan Plateau Lake Zone (TPL)" to ensure consistency with Fig. 1 and the terminology used elsewhere in the manuscript.

Response: The five lake-zone names and abbreviations have been standardized in the manuscript text and captions.

4. Line 124, suggest changing "The EPL and NPL" to "The EPL and NPML".

Response: Corrected.

5. Line 127, suggest changing "the MXPL is dominated" to "the IMXL is dominated" to use

the revised abbreviation consistently.

Response: Corrected.

6. Line 132, suggest deleting the stray backslash before the caption of Fig. 1 and changing "TPGL" to "YGPL".

Response: Corrected.

7. Line 164, suggest changing "Fig. 1" to "Fig. 3", because the distributions of Chl-a, SPM, and SDD described here are presented in Fig. 3.

Response: Corrected.

8. Line 172, suggest revising the caption to "Table 1. Statistical results of in situ water transparency (SDD) in different lake zones in China...".

Response: Corrected.

9. Line 242, suggest changing "Fig. 2" to "Fig. 4".

Response: Corrected.

10. Line 318, suggest changing the variable name "Zsd" to "SDD" and revising "Secchi Disc Depth" to "Secchi Disk Depth" in Table 2.

Response: Table 2 now uses SDD (Secchi Disk Depth), consistent with Sect. 4, and includes the n_valid_obs variable for valid-observation counts.

11. Line 352, suggest changing "Zhang et al. (2025)" to "Zhang et al. (2021)".

Response: Corrected.

12. Line 363, the font size of "a" in Fig. 7 is inconsistent with other plots.

Response: The font size and style of panel label "a" were standardized to match panels "b–d".

13. Line 380, suggest changing "in the east China Plain (a and b)" to "in the east China Plain (a)"; changing "Tibetan Plateau (c and d) (August 8, 2015)" to "Tibetan Plateau (b) (August 8, 2015)".

Response: Corrected.

14. Line 397, “Changan” and “Bositeng” should be corrected to “Chagan” and “Bosten”.

Response: The manuscript text and Fig. 9 caption use Chagan and Bosten.

15. Line 397, “January SDD” is unclear.

Response: The sentence was rewritten to specify that January values are omitted because of ice cover.

16. Line 424, suggest changing the study period from “2012 to 2021” to “2012 to 2025”.

Response: Corrected.

17. Line 448, suggest adding the missing unit and revising “0.36 decade^{-1}” to “0.36 m decade^{-1}”.

Response: The missing unit was added.

18. Line 469, “Lui et al. (2020)” should be corrected to “Liu et al. (2020)”; “(Shen et al. 2020)” should be revised to “Shen et al. (2020)”.

Response: Corrected.

19. Line 505, suggest correcting “the Tibetan Platea lakes” to “the Tibetan Plateau lakes”.

Response: Corrected.