Reviewer #1

Thank you to the authors for addressing most of the comments from the first review cycle. I believe the paper is now clearer and more complete.

There are just a few minor corrections left before publication:

We thank the reviewer for these comments. We have modified the manuscript according to their comments, and we indicate our individual answers below each comment, in bold:

• Line 131: The word “using” is repeated.

Thank you, it has been removed

• Line 310: The authors refer to band 709, but Figure 9 displays a plot for 704 nm.

Figure 9 has been adapted so that it states the correct band 709nm for Sentinel-3

• As noted in the initial review, Figure 8 and Figure 9 show a different number of matchups between the bands (53-59 for Figure 8 and 168-179 for Figure 9). In their response, the authors stated: “The scatterplots have been redone removing all spectra that get flagged in one or more bands,” but this does not appear to have been done. Please redo the plots by eliminating entire spectra where at least one band has quality issues, ensuring that the number of matchups is consistent across all bands.

Our apologies for the mix up, now the correct figures 8 and 9 are used with 53 and 168 matchups respectively after removing spectra with a missing band

Reviewer #3

One major concern within the scientific community regarding the use of DINEOF reconstructed data lies in the uncertainty induced by the interpolation process. Review 2 raised a similar concern about the validation part of this work. Personally, I think the authors’ response to the previous reviewers’ comments are adequate. Considering the substantial effort required for comprehensive validation, their approach is acceptable within the scope of this study. Having said that, I think the paper’s discussion needs to be updated to explicitly acknowledge the necessity for further validation. The errors in DINEOF-interpolated results are influenced by both the amount and spatial distribution of missing data (Zhao et al., 2024). Consequently, significant uncertainty may arise in areas with insufficient observations. Adding at least 1-2 sentences to highlight this issue would be necessary especially when discussing results from daily images with a high percentage of missing data.

It was also noted that the authors have cited Becker’s paper but did not mention that it provides a method for estimating the error map associated with the reconstruction. While adding this kind of error map may be overly demanding for this study, referencing this method could offer readers a useful resource for estimating errors in DINEOF-interpolated results.

Lastly, I recommend that the authors continue to refine their writing to improve clarity and readability before publication.

We thank the reviewer for these comments. We have modified the manuscript according to their comments, and we indicate our individual answers below each comment, in bold:

Reference:

Beckers, J. M., Barth, A., & Alvera-Azcárate, A. (2006). DINEOF reconstruction of clouded images including error maps–application to the Sea-Surface Temperature around Corsican Island. Ocean Science, 2(2), 183-199.

Zhao, H., Matsuoka, A., Manizza, M., & Winter, A. (2024). DINEOF interpolation of global ocean color data: error analysis and masking. Journal of Atmospheric and Oceanic Technology, 41(10), 953-968.

Below are some specific comments:
Line 133: ‘SPMand TUR’ -> SPM and TUR.
done
Line 165: The phrase ‘Shifted locations’ is somewhat unclear. I suggest specifying coordinates for clarity.
We have added the shifted coordinates to L165:
Matchups for PANTHYR stations were extracted from locations slightly to the East (RT1_shifted, 51.24643°N, 2.92060°E) near the deployment tower, to avoid platform effects such as direct pixel contamination and shadows, as well as in-water wakes.

Line 198 – 202: Consider rephrasing these sentences for improved readability. Additionally, please clarify the method used for interpolating Sentinel-3 data onto the Sentinel-2 grid—was it nearest-neighbor interpolation? Adding an explanation would be helpful.
You are correct, we have added the used method and slightly rephrased.

“The interpolation of Sentinel-3 data onto the Sentinel-2 grid ***using the nearest neighbour method*** *is done to preserve the size of the matrix, which has to be constant in order to be used in DINEOF, and also to determine the spatial resolution of the final dataset, but no gain in resolution is done at this step.”*

Line 216: This sentence is unclear. Please revise for clarity.
We have rewritten it as follows:
“As DINEOF does not re-grid the data, it is important that the initial data are already grided to the final grid that we want to obtain.”

Figure 6: Does the black vertical line represent the transect? If so, why is the line width inconsistent? A similar issue exists in Figure 7.
Yes this line shows the position of the transect. I think the width change is a plotting artefact. We have provided a version of these two figures with an improved line.

Figure 6 and Figure 7, bottom panels: Isn’t DINEOF only used to reconstruct areas with missing data? If that is the case, what reconstructed data is being used here to calculate the difference map?

No, DINEOF is used to reconstruct all data, also initially present data. This provides an improved estimate in case of presence of noise and outliers in the initial data, and also avoids sharp gradients at the cloud edges between reconstructed data are initial data. Part of the initial variability can be lost but the final product looks more consistent.

Line 279 – 285: On days with almost no data, DINEOF can still provide reconstructions with good spatial variability. However, it is important to acknowledge that the accuracy of these reconstructions depends on both the amount and spatial distribution of the missing. On days with large amounts of missing data, the errors in the reconstructed results may be more significant, especially in areas with insufficient observations. Adding 1-2 sentences to discuss this issue would strengthen the discussion, particularly concerning the performance of DINEOF on days with high missing data percentages.
We have added a sentence explaining this, including a reference to the error estimation by Beckers et al (2006) as requested above:
“The accuracy of the reconstruction can be however affected when persistent clouds obscure a specific region for several days (e.g. Alvera-Azcárate et al., 2005; Zhao et al., 2024). The method proposed by Beckers et al.(2006) would allow to obtain a pixel-by-pixel estimation of

the reconstruction error variance and can be used to assess the influence of persistent cloud cover on the final result."

Line: 321 – 325: This section does not align with Lines 165–175, where the authors explained the use of a 2-hour criterion. If this information is redundant, the authors could remove these sentences to avoid repetition.
We indeed allowed for a 2h time difference between satellite and in situ observations so this sentence was removed as it is redundant:
"For the match-up extraction, a maximum time difference of 1 hour between in situ observation and satellite overpass was allowed."

Line 339: 'Intercalate' or 'interpolate'?
It is "intercalate". As we did with the previous run, we keep images at high resolution and add images at low resolution at some dates (in this case mimicking the Sentinel-2 Sentinel-3 dates).

Figure 10: Clarify the temporal resolution and period of the RT1 measurements. For example, does the data end in August 2020?
This would indeed be useful information, we added this information to L313 and L316:
The accuracy of the DINEOF super-resolution products was validated for the Belgian Coastal Zone region by using the hyperspectral in situ data set from the autonomous PANTHYR systems deployed at Research Tower 1 (RT1) near Oostende to generate an in-situ turbidity product which was directly compared with the satellite derived turbidity products. ***This resulted in a turbidity time series with a temporal resolution of 20 minutes when daylight was available***.

Figure 10 shows the turbidity time series for 2020 overlaying the in-situ data, both the Sentinel-2 and Sentinel-3 turbidity products and the final super-resolution DINEOF gap-filled product showing that the DINEOF product is able to capture the in situ turbidity signal between March and September. In January and February the DINEOF product shows slightly lower values which can be caused by the fact that in those months the availability of cloud-free satellite products from Sentinel-2 and Sentinel-3 is very scarce. ***In situ observations for the period September-December where unavailable as the PANTHYR system was taken down for maintenance.***

Figure 12: Line 346 mentions an initial spatial resolution of 5 km, but the caption refers to 1 km. Please correct this inconsistency. The same issue appears in Figure 14. Ensure that the resolutions of the initial, reference, and DINEOF-estimated data are specified and consistent throughout the text and figures.
Thank you for spotting this, it has been corrected.