Review of "Snapshots of ice-free season dynamics in the near-shore water column of the northern Gulf of St. Lawrence, Canada", by Arsenault et al.

General comment

The manuscript describes an oceanographic dataset collected from 35 sites along the northern Gulf of St. Lawrence coastline from May to October of 2022. The data were collected using a CTD probe equipped with PAR, turbidity and chlorophyll fluorescence sensors. This dataset is a valuable contribution to the study of the temporal and spatial variability of key oceanographic variables, such as water temperature, salinity, irradiance, turbidity, and in vivo chlorophyll fluorescence (an index of phytoplankton biomass), during the ice-free season. Crucial variables for coastal zone management and modeling, such as stratification intensity and the depths of the thermocline, halocline, pycnocline, euphotic zone, and subsurface fluorescence maxima, can be derived from these data. These variables are also useful for modeling phytoplankton blooms and declines in nearshore environments and for understanding how small and major rivers influence marine water properties. However, revisions are necessary before the manuscript can be published. Below are some comments and suggestions that I hope will help the authors revise the manuscript.

General comments

The writing of the paper could be improved.

The general and specific objectives of the study are not clearly defined and are scattered across the last two paragraphs of the introduction. In addition, the last paragraph contains redundancies.

Some details are missing from the Materials and Methods section (see Specific comments),

Graphs in Figures 4-7 are not effective (see Specific comments).

The description of the temporal and spatial variability of the oceanographic variables could be improved. The authors should include a table showing the mean, standard deviation, and range of each variable measured in the surface water of the three site zones for each month of sampling. Another table can show the depth of the thermocline, halocline, pycnocline, euphotic zone, and subsurface fluorescence maxima, as well as the stratification index, for the three site zones.

It would be also interesting to calculate the diffuse light attenuation coefficient (k_d) and perform a regression analysis between k_d and in vivo chlorophyll fluorescence and turbidity, as these factors affect PAR transmission in the water column.

Specific comments

Title: The title could be improved to more accurately reflect the content of the paper.

Line 16: Change "sensor" to "probe".

Line 20: Change “parameters” to “variables”. Variables are quantities that vary from individual to individual. In contrast, parameters do not relate to actual measurements or attributes but to quantities defining a theoretical model (Altman and Bland, 1999). For example, in the linear regression equation, y = mx + b, m (slope) and b (intercept) are parameters. x is the variable.

Line 34: Change sea-ice” to “sea ice”.

Line 38 and throughout the manuscript: List citations in alphabetical order.

Line 42: Change “al. 2022” to “al., 2022”.

Lines 50-54: River plumes are always stratified.

Lines 67-74: This paragraph needs to be rewritten, as the objective of the work is unclear.

Line 68: Change “sensor” to “probe”,

Line 68: Change “temperature, salinity and fluorescence” to “salinity, temperature and in vivo chlorophyll fluorescence”. Why is turbidity excluded here?

Lines 67-69: This information should be moved to the Materials and Methods section.

Line 69: Change “phytoplankton biomass based…instrument.” to “phytoplankton chlorophyll *a* biomass.”.

Line 98: Define “PSI”.

Line 104: Change “(Shaw et al., 2019)” to “(Shaw, 2019)” or “(Shaw et al., 2022)”.

Lines 106-108: Suggestion: “The vertical profiles were obtained with a CTD probe equipped with sensors that measure temperature and salinity (Sea-Bird ADD THE MODEL), photosynthetically active radiation (PAR; ADD THE MODEL), turbidity (Seapoint…) and in vivo chlorophyll fluorescence (Seapoint…).”

What was the CTD’s descent speed?

What type of sensor was used to measure underwater PAR? Was it a cosine-corrected sensor (2 pi) or a spherical quantum sensor (4 pi)? Please clarify.

Was the in vivo fluorescence sensor calibrated using collected water samples?

Line 110: Brunt-Väisälä frequency

Line 113: Change “2022,)” to “2022 (“.

Line 116: Who is providing the meteorological data?

Line 116: Change “(Table 1)” to “(Table 1A)”.

Line 143: Change “(2024-5),” to (2025)”.

Line 148: Change “temperature” to “the water temperature”.

Line 153: Change “Fig.” to “Figs.”.

Line 179: A stratification intensity index could have been calculated. This index would demonstrate significant temporal and spatial variability along the coast.

Lines 182-184: These two sentences are difficult to understand.

Line 184: Change to “…and had no missing values, which made visualization easier.”.

Line 196: “Change to “…and Ste-Marguerite rivers”.

Lines 201-202: As expected, the water temperature decreased with depth, while salinity increased. Cold, saline water has a higher density than warm, fresh water. Generally, surface water is warmer in turbid rivers or river plumes than in rivers or river plumes with low turbidity. Since suspended particles absorb and scatter light, turbid surface waters should be warmer and have reduced PAR compared to clear waters. Is this the case along the coast?

Line 211: Define “FTU”.

Line 224: Was the in vivo fluorescence sensor calibrated using extracted chlorophyll *a* samples from the water column? The fluorescence value is surprisingly low in May.

Lines 224-227 and 233-244: It is not useful to present averaged chlorophyll fluorescence and PAR values throughout the water column. Surface in vivo fluorescence and PAR values should be used to describe the seasonal variation along the transect. The presence of a subsurface in vivo fluorescence maximum in July is obvious in the vertical fluorescence profile (see data in the Excel file).

Figures and Table

Figure 1: In the map, change “Matam ec” to “Matamec”. Delete “138” under “Matamec”. Check the spelling of Ste Marguerite (see line 196).

Figures 2, 4, 5, 6: Heatmaps are not the best method for presenting vertical profiles along the transect.

Figure 2: The vertical variations of the water temperature along the coast for each sampling period should be prepared with the Ocean-Data-View software (R. Schlitzer, http://odv.awi.de) or another appropriate software. In addition, the top and the bottom of the thermocline layer could be traced in the figure.

Figure 3: The maximum value of photosynthetically active radiation (PAR) at the Earth's surface during peak sunlight is typically around 2000-2500 µmol photons m^{-2} s^{-1}. The maximum value of PAR measured with a cosine-corrected sensor is 1800 µmole photons m^{-2} s^{-1} and about 2200-2400 µmole photons m^{-2} s^{-1} with a spherical quantum sensor. What type of sensor was used to measure underwater PAR? If a cosine sensor was used, then PAR values > 1800 indicate that the instrument is not correctly calibrated. Some underwater PAR values in the Excel file are very high and therefore suspect.

Figure 5: A title is missing from the vertical axis. The difference in colors is difficult to discern. The pink rectangles are not visible on the heatmaps.

Figure 7: These scatter plots are not useful in their current form. I suggest displaying the changes in the relationship between in vivo chlorophyll fluorescence and the physical variables for each sampling month. These relationships can also be displayed for each site zone and month of sampling.

Table 1: The legend is unclear. Define the 3 zones. Define "IP" in the table legend. Instead of presenting the mean value, present the depth profile range. Indicate the water depth if available.

Reference

Check the references of Shaw (2019).

Appendices

Add the reference for Government of Canada (2025).