Review of “Paleoclimatic value of sediment pixel intensity time series from Lago Argentino, Patagonia”
Anonymous Referee #2

Referee comment on "Paleoclimatic value of sediment pixel intensity time series from Lago Argentino, Patagonia" by Maximillian Van Wyk de Vries et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2022-29-RC2, 2022

General comments

The manuscript by Van Wyk de Vries et al. investigates the potential of sediment color data (referred to as pixel intensity, PxI) to reconstruct paleoclimate variables and to understand sedimentation processes at Lago Argentino, Patagonia. This is a relevant scientific question given the paucity of paleoclimate data from the region. The main conclusion of the analysis is that paleoclimate reconstructions from this method at this site would yield untrustworthy results due to potential non-stationary and non-unique proxy-climate relationships. Nonetheless, the authors find significant relationships between PxI and sediment elemental compositions (from scanning XRF), as well as meteorological datasets. These relationships provide insights on sedimentation processes at Lago Argentino.

The paper is logically structured, and the conclusions are appropriate given the results. I think certain aspects of the analysis are very well-considered, such as conducting the correlation analysis with meteorological data with an ensemble of possible age-depth models. Nonetheless, some aspects of the discussion and interpretation need to be clarified before I would recommend publication. In general, the paper could benefit from the inclusion of more information about sediment grain size, lake mixing, and sedimentation properties. Reading the author’s recent (2022) publication about Lago Argentino in JGR Earth Surface clarified many aspects of the paper for me, however, the paper would be better understandable if relevant parts of that information was included in this paper.

If the following comments are addressed, I think the manuscript is suitable for publication in Climate of the Past.
Specific comments

The authors report that all cores were scanned for near-UV to near-IR reflectance (line 97), yet in this paper the focus is on RGB data. Why not use the full spectral data for a similar analysis to what has been done here? I also ask this because many references in the introduction refer to studies on reflectance spectra, but in this study only 3 reflectance bands (RGB) are used.

The approach to significance testing of correlations could be improved. In Equation 2, you present a significance threshold that is corrected for multiple testing of PxI and XRF correlations. This is good, but I don’t see any indication of which correlations meet this threshold. Can you include this information in Figure 3 or a supplement? Additionally, it would make sense to also modify the significance threshold for multiple testing for the correlations between PxI and meteorological data rather than the 0.05 threshold indicated in Figures 4-6. Furthermore, for both PxI vs XRF and PxI vs meteorological data correlations, autocorrelation likely reduces the degrees of freedom, and this should be considered in significant tests (see Hu et al., 2017). One could also envisage calculating validation statistics such as Reduction of Error (RE), Coefficient of Efficiency (CE) and Root Mean Squared Error of Prediction (RMSEP) using cross-validation, though this is probably not necessary since the proxies will not be used for

The cores listed in Figures 4-6 do not match to the cores on the map. Core 7A is included in the XRF correlations, but not in the meteorological correlations. There are 12 cores on the map rather than 10 as stated in caption. Can you please clarify or correct this issue in the revised version.

In Section 4.2 (see line 187 for example), the authors report correlations between band ratios (i.e. red/blue, red/green) and meteorological data. However, this is not shown in the figures, only correlations with red PxIs are shown. Could you include correlation statistics with the other bands in a supplement?

Additionally, plots showing the PxI and climate variable time series would also be very helpful to include in a supplement.

Line 235: More detailed information about the relationship between PxI and grain size would be valuable for the discussion. What does finer/coarser mean? Please add quantitative information or at least grain size descriptors such as fine silt/clay, etc. Are there significant correlations between PxI and grain size distributions?

Lines 334-335: From the information presented in this manuscript, it is unclear why stratification would promote the settling of dark (coarse) grains, but not also bright (fine) grains. Why would the proportion of dark grains increase with calmer conditions? After
reading Van Wyk de Vries et al. (2022), I could understand this interpretation based on the extremely slow settling time of the fine fraction. This process needs to be explained here.

Is there evidence that temperature is the primary control on lake stratification or lake currents at this site, rather than wind? Sugiyama et al. (2021) report higher water current speeds in Lago Grey during warmer temperatures (not necessarily because of warm temperatures, but because of higher wind speeds at the same time). I wonder, is there clear evidence that leads you to invoke thermal stratification as a mechanism to explain correlations between summer temperature and PxIs? Increased discharge and sediment supply from glacial meltwater would seem to me to be a sufficient mechanism to explain more coarse material during warmer summers.

Data availability: I would encourage the authors to archive the varve count and PxI results in a data archive. Although this could be generated anew from the repository of images, this would be a time consuming task for anybody not routinely doing such analyses. Additionally, the XRF data could be archived, and you might also include a statement in the data availability section about where to obtain the meteorological data.

**Technical comments**

Line 61: correct “and indirect” to “an indirect”

Figure 1: It would be helpful to define SPI and NPI either on the map legend or in the caption. Also, I am unable to find BR anywhere on the map.

I would change grey to gray throughout to maintain a consistent American English style (including figures).

Line 126: This could be written more clearly to state it’s a 5 x 5 mm square that matches the location of each XRF measurement (i.e. state the XRF measurement resolution in this sentence).

I suggest some small changes to improve the readability of figures 4-6. Place a title over the figure stating the climate variable of interest, and a label on the bottom axes indicating that these are core IDs. Perhaps it might also be useful to order the cores from proximal to distal along the x-axis (maybe they are already?), and draw an arrow indicating this pattern.
References

