

Turbidity and Suspended Matter in Albufera of Valencia (Spain) using Sentinel-2 Images

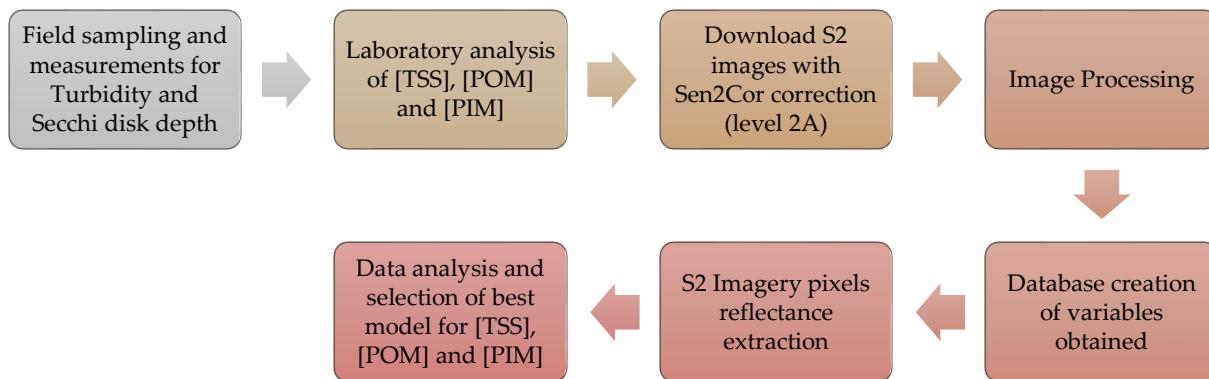
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INTRODUCTION

Increased levels of suspended solids caused by human activities are challenging freshwater ecosystems. This sedimentation disrupts aquatic life and productivity. Turbidity and suspended solids are critical indicators. Remote sensing provides a critical solution for monitoring them. This study develops algorithms for turbidity, total suspended solids (TSS), particulate inorganic matter (PIM) and particulate organic matter (POM) adapted to the Albufera lagoon, using field data from 2018-23 and Sentinel-2 imagery.

METHODOLOGY



RESULTS

Table 1 shows the equations derived during the calibration of the selected models for each variable. P-value < 0.001. Figure 2 shows thematic maps to illustrate the spatial heterogeneity during the same day (09-Jun-22). Areas with the highest turbidity correspond to the highest [TSS] values. Moreover, [POM] exceeds [PIM] in most of the lagoon. The few areas where [PIM] exceeds [POM] are in the southern area, where more transparent water with less phytoplankton enters from the channels.

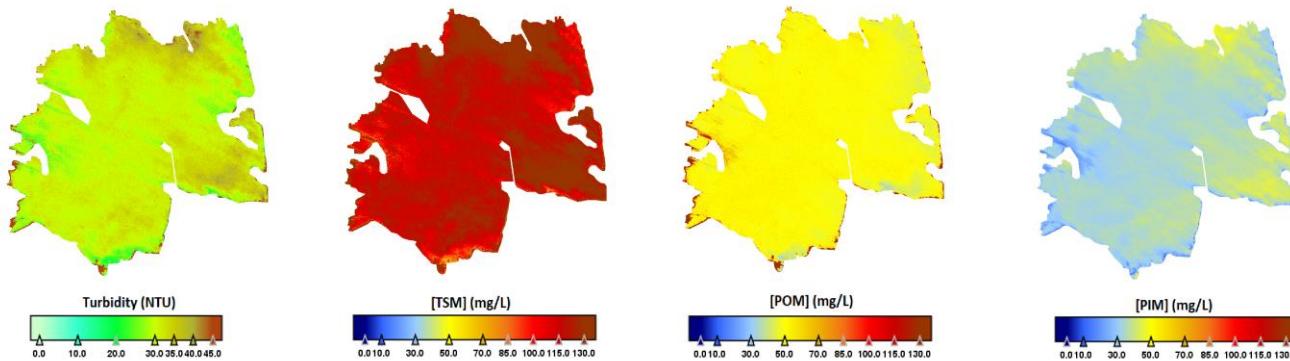


Fig. 2. Thematic maps of studied variables. Date of image from Sentinel-2: 6-jun-2022. Processed using SNAP 9.0.

CONCLUSIONS

- The optical models with best performance are $R783 \times R705/R490$ for turbidity and TSS, $R783/R490$ for organic and $R705$ for inorganic.
- The results are congruent with previous research.
- Future focus will be directed to:
 - Improved dataset quality and specificity.
 - Particulate organic carbon (POC) inclusion in the analysis for its influence in organic solids optical properties.
 - Enhancing understanding about wind influence in estimations through resuspension mechanisms.

STUDY AREA

The Albufera is a Mediterranean coastal lagoon with a eutrophication problem since the 1970s due to nutrient inputs from the canals, which increase phytoplankton biomass and reduce water transparency, leading to the loss of macrophyte meadows. This lagoon has been declared a Natural Park and included in the Ramsar List of Wetlands.

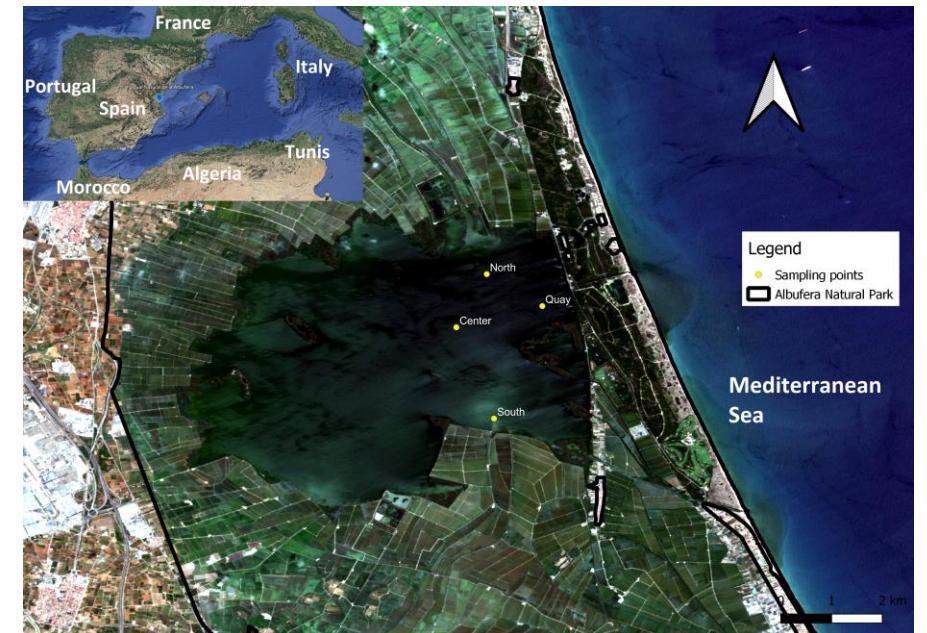


Fig. 1. Location of field sampling points in the Albufera lagoon. Date of image from Sentinel-2: 24-jun-2022.

Table 1. Results of the calibration of the algorithms. Selected algorithms with the best correlations are in bold.

Variables	Algorithm	Calibration R ²	Validation R ²	RMSE	NRMSE
Turbidity	$y = 185.10 \times R783 \times R705/R490$	0.7749	0.81	13.15 NTU	19.68%
	$y = 233.13 \times R705$	0.7622	Not selected	Not selected	Not selected
	$y = 100.51 \times R705 \times R705/R490$	0.7189	Not selected	Not selected	Not selected
[TSS]	$y = 16.95 \times R783/R490$	0.6690	Not selected	Not selected	Not selected
	$y = 705.98 \times R783 \times R705/R490$	0.9137	0.9108	26.64 mg/L	11.67%
	$y = 384.16 \times R705 \times R705/R490$	0.8964	Not selected	Not selected	Not selected
[POM]	$y = 69.70 \times R783/R490$	0.8554	Not selected	Not selected	Not selected
	$y = 872.37 \times R705$	0.8428	Not selected	Not selected	Not selected
	$y = 40.48 \times R783/R490$	0.9132	0.9359	14.42 mg/L	16.60%
[PIM]	$y = 395.80 \times R783 \times R705/R490$	0.9116	Not selected	Not selected	Not selected
	$y = 395.80 \times R705 \times R705/R490$	0.9078	Not selected	Not selected	Not selected
	$y = 509.69 \times R705$	0.9035	Not selected	Not selected	Not selected
[PIM]	$y = 259.40 \times R705$	0.7903	0.8922	25.83 mg/L	16.85%
	$y = 214.42 \times R783 \times R705/R490$	0.7891	Not selected	Not selected	Not selected
	$y = 113.80 \times R705 \times R705/R490$	0.7665	Not selected	Not selected	Not selected
	$y = 20.66 \times R783/R490$	0.7422	Not selected	Not selected	Not selected