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Chromophoric Dissolved Organic Matter (CDOM) as a predictive tool for assessing the dynamics of DOM in Mediterranean lagoons

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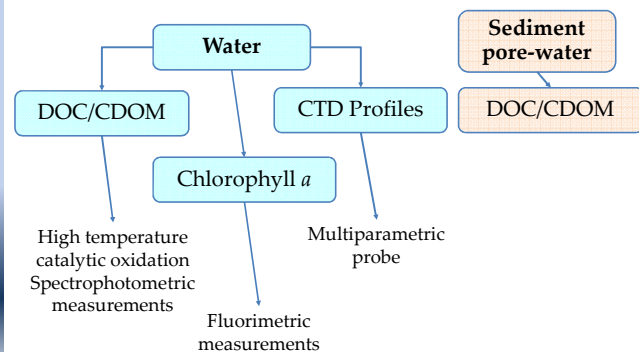
Background

The assessment of Dissolved Organic Matter (DOM) composition and dynamics in aquatic ecosystems represents a crucial topic for understanding biogeochemical processes and its interactions with pollutants. DOM budget estimation, by dissolved organic carbon (DOC) concentration and/or by chromophoric dissolved organic matter (CDOM), is still not routinely included in lagoon biogeochemical studies, suggesting the need to increase the knowledge of their dynamics in order to know better the critical role of coastal areas in the carbon cycle.

Objective

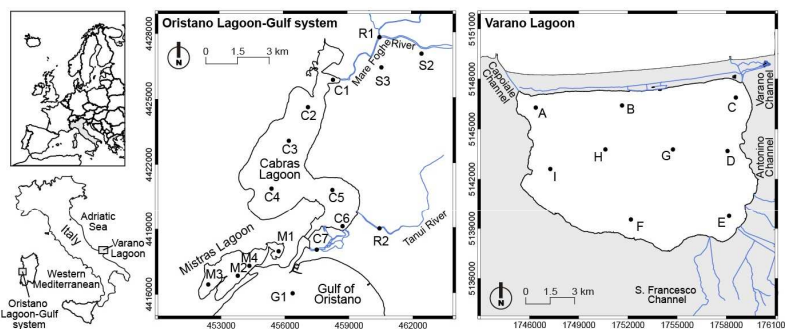
Evaluate the ability of CDOM indices (absorption coefficients, spectral slopes and SUVA₂₅₄) to assess DOM dynamics in Mediterranean lagoon systems.

Methodology

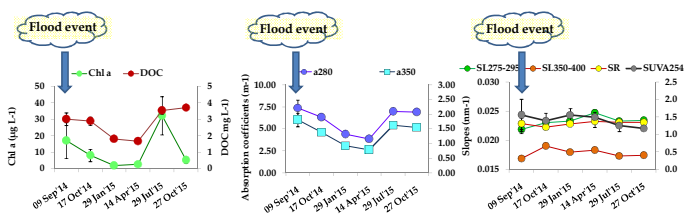


Case studies

The Oristano Lagoon-Gulf system (OLG, western Sardinia) and the Varano Lagoon (VL, Adriatic Sea) with different geographical settings, environmental conditions and anthropogenic pressures.



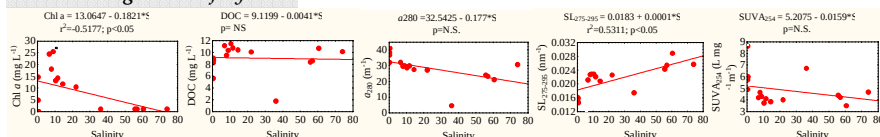
Results



Monthly trend for trophic and optical variables in Varano Lagoon.

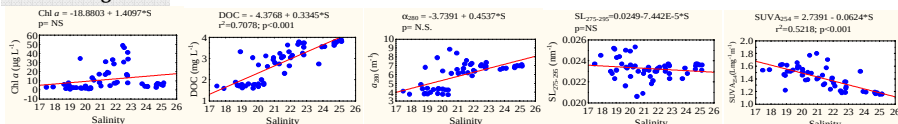
Varano Lagoon: Homogeneous salinity distribution. Significant ($p < 0.001$) temporal differences for DOC/CDOM. Higher trophic variables in summer. Higher CDOM at the beginning and the end of the sampling period. DOM with higher molecular weights a month later the flood event.

Oristano Lagoon-Gulf System

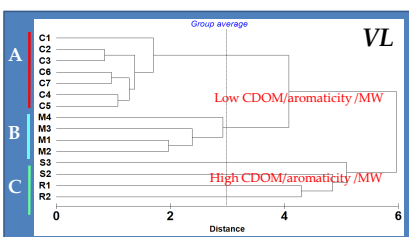


Positive correlations between salinity and spectral slopes indicate a DOM shift from high molecular weight (MW), with an higher proportion of terrigenous CDOM, to low molecular weight (MW), with increasing salinity. Freshwater input for Chl a.

Varano Lagoon

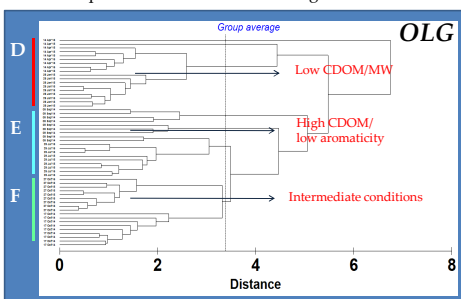


DOC concentrations vary linearly and positively with salinity, while a higher aromatic content of the DOM characterize lower salinity waters.



Varano Lagoon (VL): three clusters: D with the lowest trophic conditions, belong to the winter-early spring period, low CDOM with a higher proportion of aromaticity; E grouping the dry months, with the highest trophic conditions, high CDOM and low aromatic content; F representing the autumn season, with intermediate trophic conditions and intermediate optical variables.

Oristano Lagoon-Gulf System (OLG): three clusters: A and B highly eutrophic, with low molecular weight DOM mainly dominated by protein-like components of autochthonous origin; C mainly dominated by humic-like fluorophores from riverine discharges.



Oristano Lagoon-Gulf System: significant β between Chl a/DOC and spectral slopes; in addition, more significant regressions for DOC estimation by using salinity as independent variable.

Varano Lagoon: Chl a changes mostly related to the absorption coefficient at 350 nm and SL₂₇₅₋₂₉₅. DOC dynamics mostly related to slope ratio, absorption coefficients and aromatic content of organic matter.

Oristano Lagoon - Gulf system							
Chl a	adj R ²	p	β SL ₃₅₀₋₄₀₀	β SR	β SUVA ₂₅₄	intercept	ANOVA p
	0.6	0.00240	0.98	0.84	0.50	-503.2	0.00
DOC			β S	β a ₂₈₀	β SL ₂₇₅₋₂₉₅		
	0.76	0.00012	-0.49	0.6	1.06	-7.45	0.00
			β S	β SL ₂₇₅₋₂₉₅	β SUVA ₂₅₄		
	0.44	0.01785	-0.83	1.08	-0.01	-1.98	0.00
Varano lagoon							
Chl a	adj R ²	p	β S	β SL ₂₇₅₋₂₉₅	β a ₃₅₀	intercept	ANOVA p
	0.47	0.00060	-0.59	-0.76	1.52	-2814.8	0.00
DOC			β S	β a ₂₈₀	β SUVA ₂₅₄		
	0.99	0.00000	0.085	0.68	-0.43	2.48	0.00
			β SL ₂₇₅₋₂₉₅	β a ₂₈₀	β a ₃₅₀		
	0.91	0.00000	0.44	1.74	-0.54	-10.66	0.00

Multiple regression coefficients of determination (adj R²), model probability (p), intercept and probability of ANOVA between dependent trophic variables (Chl a and DOC) and some independent variables (optical properties) in the water of the two studied systems.

Conclusions

- DOC/CDOM content in the Oristano Lagoon-Gulf System was two-three times higher than that found in Varano Lagoon, as an indication of very different trophic conditions;
- Beside those differences, spatial and temporal dynamics of trophic and optical variables showed a constant DOC-CDOM relationships irrespective of the study areas;
- DOC-CDOM coupling can be a useful tool to study DOM dynamics in coastal lagoons affected by terrestrial input, freshwater discharges and ecosystem processes essentially linked to primary production

Acknowledgments

This study was supported by the Italian Flagship Project RITMARE for the Oristano Lagoon-Gulf system and by the Apulian Regional Agency for Environmental Protection (Grant n. 19266 to RD) for the Varano Lagoon. The Executive Programme of Scientific and Technological Cooperation between Italy and China (2010-2012) of the Ministry of Foreign Affairs of Italy granted to PM and LH is also acknowledged.

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