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Abstract. Coastal Surveillance Through Observation of Ocean Color (COASTℓOOC) oceanographic expeditions were conducted in 1997 and 1998 to obtain a synoptic view of the spatial distribution of different biological, chemical and physical variables across the land-to-sea gradient along the European coasts. A total of 379 stations distributed in six areas were visited: (1) 39 in the Adriatic Sea, (2) 38 in the Atlantic Ocean, (3) 57 in the Baltic Sea, (4) 85 in the English Channel, (5) 61 in the Mediterranean Sea and (6) 99 in the North Sea. A particular emphasis has been dedicated to the collection of a comprehensive set of apparent (AOPs) and inherent (IOPs) optical properties to document carbon fluxes at both the local and global scales. These radiometric quantities have been measured using traditional ship-based sampling, but also from a helicopter in shallow estuaries, which are more difficult to access from boats. Although that the COASTℓOOC campaigns were carried out more than 20 years ago, the rich and historical dataset that has been collected has great potential to contribute to the development and evaluation of new bio-optical models adapted for optically-complex waters. Given that this unique dataset is still today frequently requested by other researchers, we present the result of an effort to compile and standardize data that will facilitate their reuse in other oceanographic studies. The dataset is available at https://doi.org/10.17882/75345 (Massicotte2022).

1 Introduction

Since the launch of the Coastal Zone Color Scanner (CZCS) by NASA in 1978, ocean color remote sensing has been used to monitor the state and the evolution of global marine ecosystems both in time and space. In open oceans, the main component that affects the variations in the inherent (IOPs) and apparent (AOPs) optical properties of seawater is phytoplankton, which is usually represented by the concentration of chlorophyll-a ((Morel and Prieur, 1977)). Many simple empirical spectral band ratio algorithms have been developed to link changes in remotely-sensed ocean color (OC), measured as reflectance, to the variations in chlorophyll-a concentration (see OReilly2019 for an extensive evaluation of OC band ratio algorithms). Because these algorithms perform surprisingly well, a plethora of studies have been conducted, notably about phytoplankton phenology (e.g., Vargas et al. 2009) and phytoplankton primary production (see Carr et al. 2006 and references therein).

2 Study area and sampling overview

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2.1 Study area and general sampling strategys

During the COASTℓOOC campaigns, a total of 420 locations were visited. These locations were spread out along the coasts of the Mediterranean Sea (n = 41 in case 1 water, n = 61 in case 2 water), Adriatic Sea (n = 39), Baltic Sea (n = 57), North Sea (n = 99), English Channel (n = 85) and Atlantic Ocean (n = 38) Within each area, the stations were generally distributed along across-shore or along-shore transects to capture the land-to-sea gradients and document river plumes (Fig. 1B). Stations were sampled either with a helicopter or a ship between 1997-04-02 and 1998-09-25 (Fig. 2A). Compared to traditional ship-based sampling, the helicopter platform allowed to efficiently sample shallow estuaries, which can be difficult to access by boat (some samples were collected in waters as shallow as 1 m, Babin 2003). Combining both ship and airborne sampling approaches allowed covering the whole inshore to open-ocean aquatic continuum. The bathymetry (**?**) varied greatly across the stations, where it averaged 10 meters in the Adriatic Sea and 2 600 meters in the Case 1 Mediterranean Sea (Fig. 2B).

2.1.1 HEADING

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3 Conclusions

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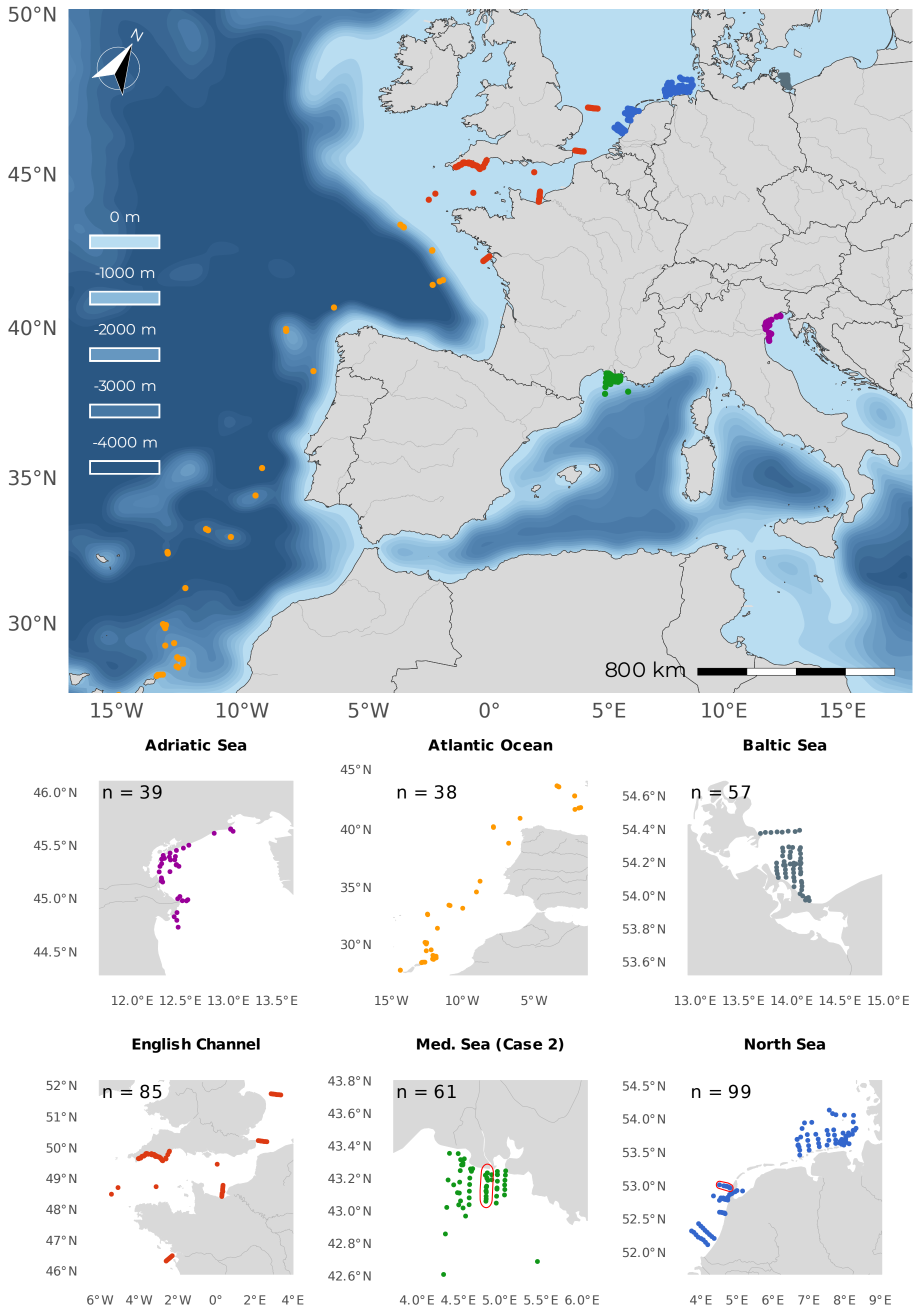


Figure 1. My caption

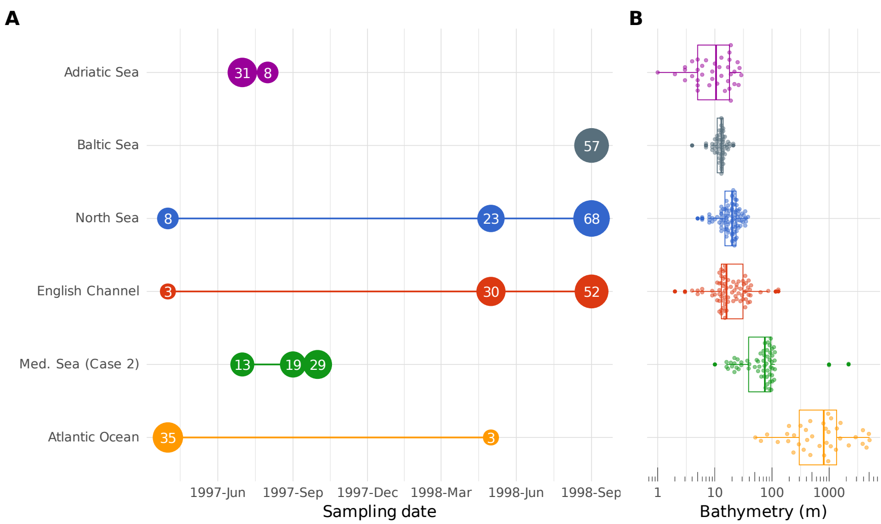


Figure 2. My caption

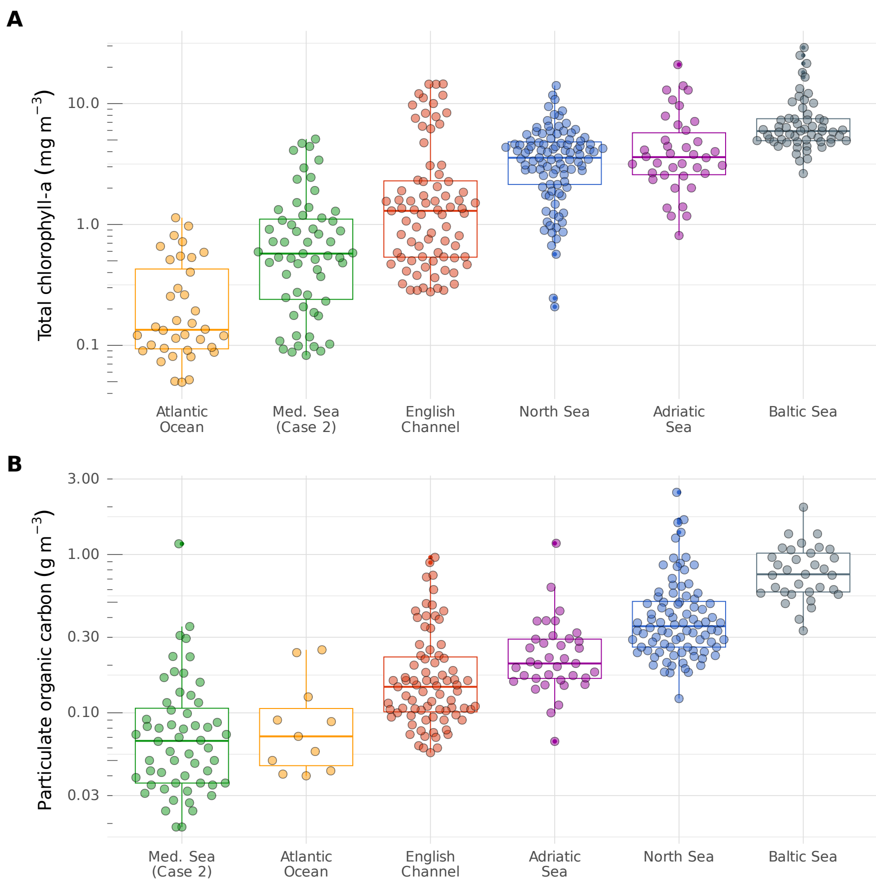
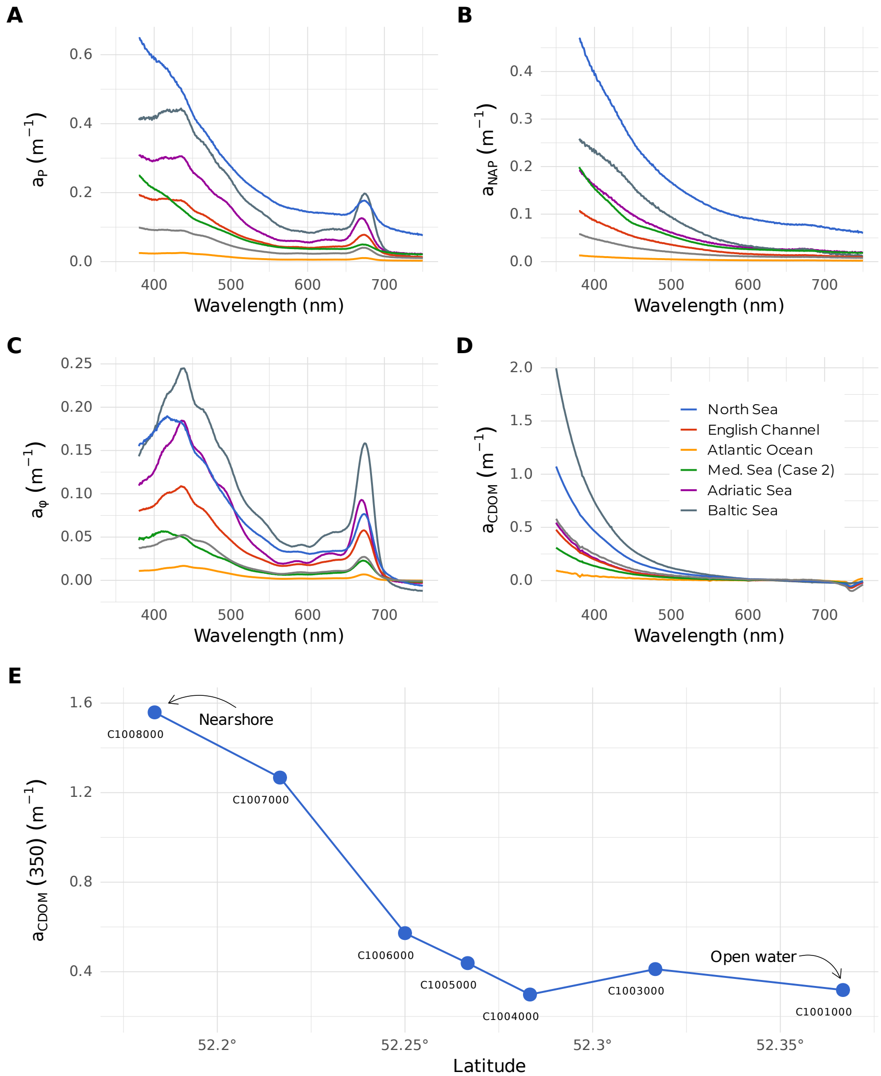


Figure 3. My caption



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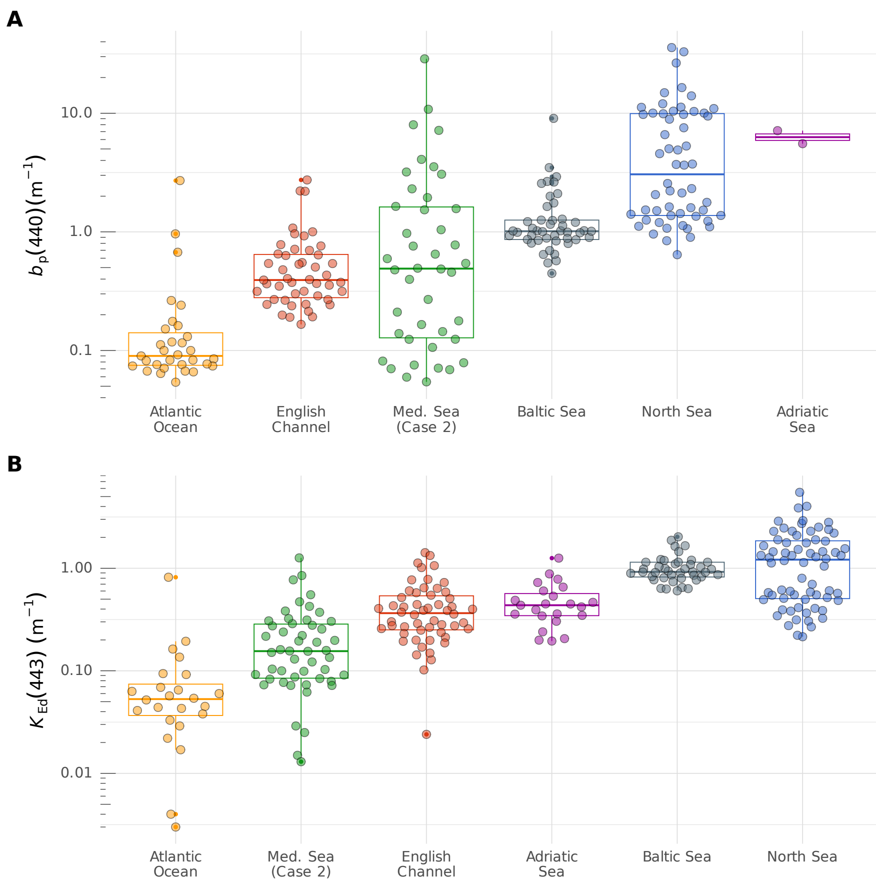

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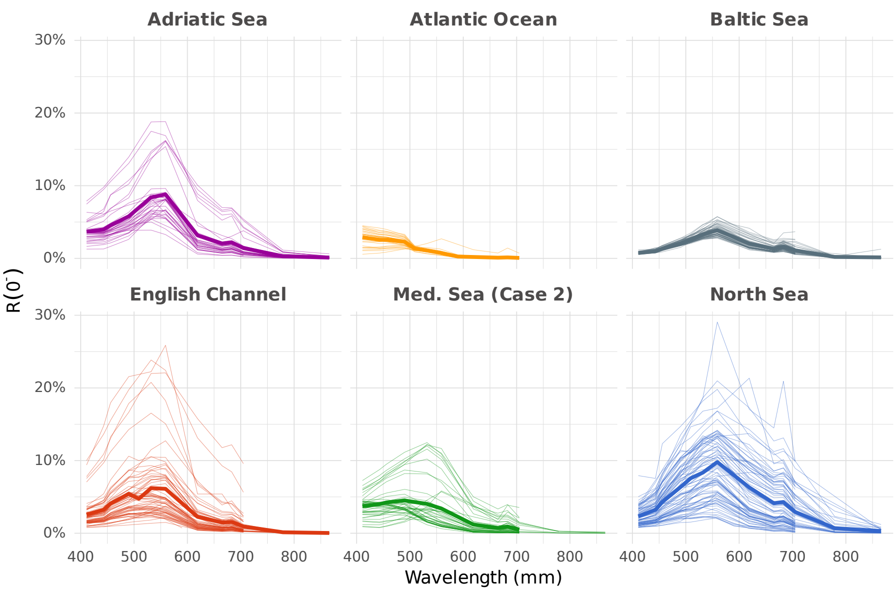

Figure 6. My caption

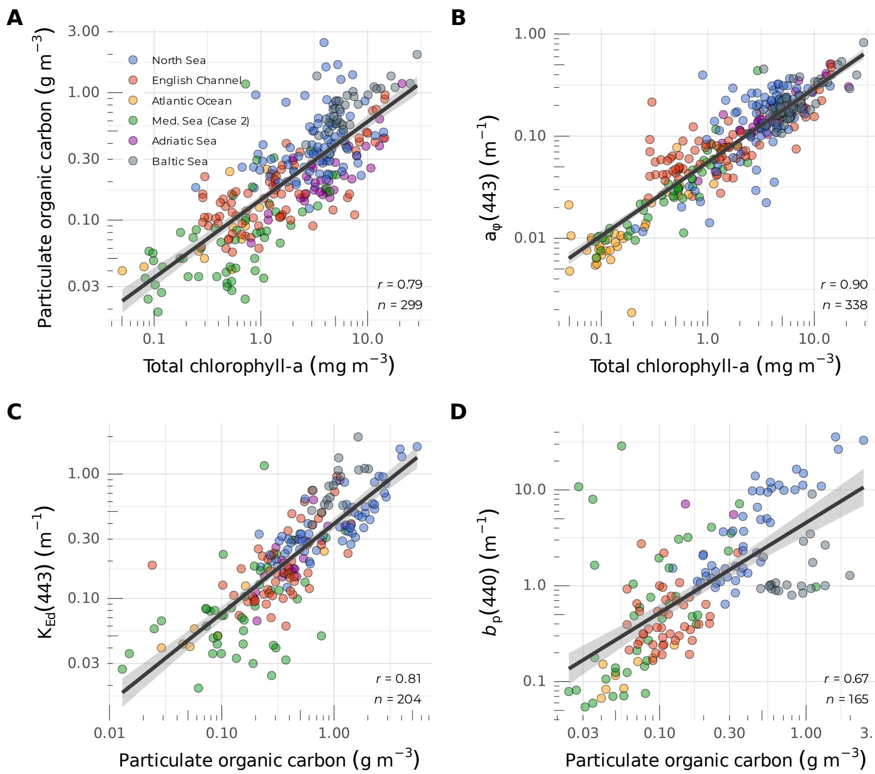

Figure 7. My caption

Table 1: Areas visited during the COASTlOOC campaigns C1 to C6 and the corresponding number of stations visited.

Area	Cruise	N	Sampling period
Atlantic Ocean	C1	35	1997-04-05 1997-04-22
English Channel	C1	3	1997-04-03 1997-04-04
North Sea	C1	8	1997-04-02 1997-04-02
Med. Sea (Case 2)	C2	13	1997-07-18 1997-07-19
Adriatic Sea	C3	39	1997-07-28 1997-08-02
Med. Sea (Case 2)	C4	48	1997-09-28 1997-10-09
Atlantic Ocean	C5	3	1998-05-08 1998-05-08
English Channel	C5	30	1998-05-09 1998-05-14
North Sea	C5	23	1998-05-13 1998-05-16
Baltic Sea	C6	57	1998-09-22 1998-09-25
English Channel	C6	52	1998-09-01 1998-09-05
North Sea	C6	68	1998-09-11 1998-09-18

Table 2: List of measured parameters

Source file	Variable	Units	PI	Description
absorption.csv	wavelength	nm	M. Babin	
absorption.csv	a_p_m1	m^{-1}		Total particulate absorption
absorption.csv	a_nap_m1	m^{-1}		Non-algal absorption
absorption.csv	a_nap_adjusted_m1	m^{-1}		Non-algal absorption adjusted for...
absorption.csv	a_cdom_m1	m^{-1}		Chromophoric dissolved organig matter absorption
absorption.csv	a_cdom_adjusted_m1	m^{-1}		Chromophoric dissolved organig matter absorption with background baseline removed
absorption.csv	a_phy_m1	m^{-1}		Phytoplankton absorption
absorption.csv	background_a_p_m1			Baseline background of total particulate absorption
absorption.csv	background_a_cdom_m1			Baseline background of chromophoric dissolved organig matter absorption
absorption.csv	background_a_nap_m1			Baseline background of non-algal absorption
ac9.csv	a_m1	m^{-1}		Total non-water absorption coefficient
ac9.csv	c_m1	m^{-1}		Total non-water attenuation coefficient
ac9.csv	bp_m1	m^{-1}		Particle scattering coefficient
bathymetry.csv	longitude	Degree decimal		Longitude of the pixel used to extract the bathymetry
bathymetry.csv	latitude	Degree decimal		Latitude of the pixel used to extract the bathymetry
bathymetry.csv	bathymetry_m	m		Bathymetry depth at the sampled stations
irradiance.csv	eu_w_m2_um	$w\ m^{-2}\ \mu m^{-1}$		Upward irradiance just beneath the water surface (Eu0-)
irradiance.csv	ed_w_m2_um	$w\ m^{-2}\ \mu m^{-1}$		Downward irradiance just beneath the water surface (Ed0-)
irradiance.csv	k_eu_m1	m^{-1}		Attenuation coefficient for upward irradiance (just beneath the water surface)
irradiance.csv	k_ed_m1	m^{-1}		Attenuation coefficient for downward irradiance (just beneath the water surface)
reflectance.csv	measured_reflectance_percent	Percent		Surface water reflectance

Table 2: List of measured parameters *(continued)*

Source file	Variable	Units	PI	Description
spectral_slopes.csv	s_cdom_nm1	nm^{-1}		Spectral slope that describes the approximate exponential decrease in aCDOM
spectral_slopes.csv	s_nap_nm1	nm^{-1}		Spectral slope that describes the approximate exponential decrease in aNAP
spectral_slopes.csv	a_cdom443_m1	m^{-1}		
spectral_slopes.csv	a_nap443_m1	m^{-1}		
stations.csv	station			Unique ID of the sampled station. Can be used as unique key to merge the data across other files.
stations.csv	date			Date at which the measurement was made
stations.csv	depth_m	m		Depth at which the measurement was made
stations.csv	longitude	Degree decimal		Longitude of the sampling station
stations.csv	latitude	Degree decimal		Latitude of the sampling station
stations.csv	area			Region where the measurement was made. One of: (1) North Sea, (2) English Channel, (3) Atlantic Ocean, (4) Med. Sea (Case 2), (5) Adriatic Sea, (6) Baltic Sea
stations.csv	system			
stations.csv	gmt_time			
stations.csv	solar_zenith_angle	degree		Angle of the sun from the vertical
pigments.csv	chlorophyll_a_mg_m3	mg m^{-3}		Chloropyll-a
pigments.csv	chlorophyll_b_mg_m3	mg m^{-3}		Chloropyll-b
pigments.csv	chlorophyll_c_mg_m3	mg m^{-3}		Chloropyll-c
pigments.csv	pheopigment_mg_m3	mg m^{-3}		Pheopigment
pigments.csv	fucoxanthin_mg_m3	mg m^{-3}		Fucoxanthin
pigments.csv	hexanoyloxyfucoxanthin_19_mg_m3	mg m^{-3}		Hexanoyloxyfucoxanthin-19
pigments.csv	butanoyloxyfucoxanthin_19_mg_m3	mg m^{-3}		Butanoyloxyfucoxanthin-19

Table 2: List of measured parameters *(continued)*

Source file	Variable	Units	PI	Description
pigments.csv	alloxanthin_mg_m3	mg m^{-3}		Alloxanthin
pigments.csv	zeaxanthin_mg_m3	mg m^{-3}		Zeaxanthin
pigments.csv	prasixanthin_mg_m3	mg m^{-3}		Prasixanthin
pigments.csv	neoxanthin_mg_m3	mg m^{-3}		Neoxanthin
pigments.csv	violaxanthin_mg_m3	mg m^{-3}		Violaxanthin
pigments.csv	diatoxanthin_mg_m3	mg m^{-3}		Diatoxanthin
pigments.csv	diadinoxanthin_mg_m3	mg m^{-3}		Diadinoxanthin
pigments.csv	peridinin_mg_m3	mg m^{-3}		Peridinin
pigments.csv	carotene_mg_m3	mg m^{-3}		Carotene
pigments.csv	lutein_mg_m3	mg m^{-3}		Lutein
carbon.csv	suspended_particulate_matter_g_m3	g m^{-3}		Suspended particulate matter
carbon.csv	particulate_organic_nitrogen_g_m3	g m^{-3}		Particulate organic nitrogen
carbon.csv	total_particulate_carbon_g_m3	g m^{-3}		Total particulate carbon
carbon.csv	particulate_organic_carbon_g_m3	g m^{-3}		Particulate organic carbon
carbon.csv	dissolved_organic_carbon_g_m3	g m^{-3}		Dissolved organic carbon
SPMR	Cast	1		Processed cast number
SPMR	Depth	m		Depth of vertical bin, e.g. -1.00 representing the depth bin [-0.90, -1.10 m]
SPMR	TmpWat	Degree celcious		Water temperature
SPMR	Cond	ms cm^{-1}		Conductivity
SPMR	Salin	PSU		Salinity
SPMR	SigmaT	1		Density of sea water
SPMR	TiProf	Degree		Tilt of profiling radiometer
SPMR	TiRef	Degree		Tilt of reference radiometer

Table 2: List of measured parameters *(continued)*

Source file	Variable	Units	PI	Description
SPMR	VSpeed	m s^{-1}		Vertical speed
SPMR	Altim	m		Altimeter sounding of distance from the ocean ground
SPMR	N_OBS	1		Number of observations within depth bin
SPMR	EUnnn	w m^{-2} μm^{-1}		In-water upwelling irradiance at wavelength nnn
SPMR	EDnnn	w m^{-2} μm^{-1}		In-water downwelling irradiance at wavelength nnn
SPMR	ERnnn	w m^{-2} μm^{-1}		In-air downwelling irradiance at wavelength nnn
SPMR	KUnnn	m^{-1}		Diffuse attenuation at wavelength nnn calculated from the upwelling irradiance
SPMR	KDnnn	m^{-1}		Diffuse attenuation at wavelength nnn calculated from the downwelling irradiance
SPMR	PAR_ABS	μmol m^{-2} s^{-1}		Phytosynthetically Active Radiation (PAR)
SPMR	PAR%SRF	Percent		PAR at depth z relative to PAR on the sea surface
SPMR	K_PAR	m^{-1}		Diffuse attenuation for PAR

4 Code availability

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5 Data availability

TEXT

6 Code and data availability

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Sample availability. TEXT

Video supplement. TEXT

Appendix A

A1

Table A1: Scientific articles in peer-reviewed journals using or referencing COASTLOOC

Publications
Babin, M., Stramski, D., Ferrari, G. M., Claustre, H., Bricaud, A., Obolensky, G., & Hoepffner, N. (2003). Variations in the light absorption coefficients of phytoplankton, nonalgal particles, and dissolved organic matter in coastal waters around Europe. Journal of Geophysical Research: Oceans, 108(C7).
Begouen Demeaux, C., & Boss, E. (2022). Validation of Remote-Sensing Algorithms for Diffuse Attenuation of Downward Irradiance Using BGC-Argo Floats. Remote Sens. 2022, 14, 4500.
Belanger, S., Babin, M., & Larouche, P. (2008). An empirical ocean color algorithm for estimating the contribution of chromophoric dissolved organic matter to total light absorption in optically complex waters. Journal of Geophysical Research: Oceans, 113(C4).
Beltrán-Abaunza, J. M., Kratzer, S., & Brockmann, C. (2014). Evaluation of MERIS products from Baltic Sea coastal waters rich in CDOM. Ocean Science, 10(3), 377-396.
Blix, K., Li, J., Massicotte, P., & Matsuoka, A. (2019). Developing a new machine-learning algorithm for estimating chlorophyll-a concentration in optically complex waters: A case study for high northern latitude waters by using Sentinel 3 OLCI. Remote Sensing, 11(18), 2076.

Table A1: Scientific articles in peer-reviewed journals using or referencing COASTLOOC *(continued)*

Publications
Caillault, K., Roupioz, L., & Viallefont-Robinet, F. (2021). Modelling of the optical signature of oil slicks at sea for the analysis of multi-and hyperspectral VNIR-SWIR images. Optics Express, 29(12), 18224-18242.
Chami, M., & Platel, M. D. (2007). Sensitivity of the retrieval of the inherent optical properties of marine particles in coastal waters to the directional variations and the polarization of the reflectance. Journal of Geophysical Research: Oceans, 112(C5).
Claustre, H., Fell, F., Oubelkheir, K., Prieur, L., Sciandra, A., Gentili, B., & Babin, M. (2000). Continuous monitoring of surface optical properties across a geostrophic front: Biogeochemical inferences. Limnology and Oceanography, 45(2), 309-321.
D'Alimonte, D., Zibordi, G., Kajiyama, T., & Berthon, J. F. (2014). Comparison between MERIS and regional high-level products in European seas. Remote sensing of environment, 140, 378-395.
Defoin-Platel, M., & Chami, M. (2007). How ambiguous is the inverse problem of ocean color in coastal waters?. Journal of Geophysical Research: Oceans, 112(C3).
Doerffer, R., & Schiller, H. (2007). The MERIS Case 2 water algorithm. International Journal of Remote Sensing, 28(3-4), 517-535.
Doron, M., Babin, M., Mangin, A., & Hembise, O. (2007). Estimation of light penetration, and horizontal and vertical visibility in oceanic and coastal waters from surface reflectance. Journal of Geophysical Research: Oceans, 112(C6).
Doron, M., Babin, M., Hembise, O., Mangin, A., & Garnesson, P. (2011). Ocean transparency from space: Validation of algorithms estimating Secchi depth using MERIS, MODIS and SeaWiFS data. Remote Sensing of Environment, 115(12), 2986-3001.
Dransfeld, S., Tatnall, A. R., Robinson, I. S., & Mobley, C. D. (2005). Prioritizing ocean colour channels by neural network input reflectance perturbation. International Journal of Remote Sensing, 26(5), 1043-1048.
Ferrari, G. M. (2000). The relationship between chromophoric dissolved organic matter and dissolved organic carbon in the European Atlantic coastal area and in the West Mediterranean Sea (Gulf of Lions). Marine Chemistry, 70(4), 339-357.
Groom, S., Martinez-Vicente, V., Fishwick, J., Tilstone, G., Moore, G., Smyth, T., & Harbour, D. (2009). The western English Channel observatory: Optical characteristics of station L4. Journal of Marine Systems, 77(3), 278-295.
Jamet, C., Loisel, H., & Dessailly, D. (2012). Retrieval of the spectral diffuse attenuation coefficient Kd (lambda) in open and coastal ocean waters using a neural network inversion. Journal of Geophysical Research: Oceans, 117(C10).
Kratzer, S., & Moore, G. (2018). Inherent optical properties of the baltic sea in comparison to other seas and oceans. Remote Sensing, 10(3), 418.
Loisel, H., Stramski, D., Mitchell, B. G., Fell, F., Fournier-Sicre, V., Lemasle, B., & Babin, M. (2001). Comparison of the ocean inherent optical properties obtained from measurements and inverse modeling. Applied Optics, 40(15), 2384-2397.
Loisel, H., Vantrepotte, V., Ouillon, S., Ngoc, D. D., Herrmann, M., Tran, V., ... & Van Nguyen, T. (2017). Assessment and analysis of the chlorophyll-a concentration variability over the Vietnamese coastal waters from the MERIS ocean color sensor (2002–2012). Remote sensing of environment, 190, 217-232.
Loisel, H., Stramski, D., Dessailly, D., Jamet, C., Li, L., & Reynolds, R. A. (2018). An inverse model for estimating the optical absorption and backscattering coefficients of seawater from remote-sensing reflectance over a broad range of oceanic and coastal marine environments. Journal of Geophysical Research: Oceans, 123(3), 2141-2171.

Table A1: Scientific articles in peer-reviewed journals using or referencing COASTLOOC *(continued)*

Publications
Matsuoka, A., Hill, V., Huot, Y., Babin, M., & Bricaud, A. (2011). Seasonal variability in the light absorption properties of western Arctic waters: Parameterization of the individual components of absorption for ocean color applications. Journal of Geophysical Research: Oceans, 116(C2).
Matsuoka, A., Babin, M., Doxaran, D., Hooker, S. B., Mitchell, B. G., Bélanger, S., & Bricaud, A. (2014). A synthesis of light absorption properties of the Arctic Ocean: application to semi-analytical estimates of dissolved organic carbon concentrations from space. Biogeosciences, 11(12), 3131-3147.
Morel, A., & Bélanger, S. (2006). Improved detection of turbid waters from ocean color sensors information. Remote Sensing of Environment, 102(3-4), 237-249.
Neukermans, G., Loisel, H., Mériaux, X., Astoreca, R., & McKee, D. (2012). In situ variability of mass-specific beam attenuation and backscattering of marine particles with respect to particle size, density, and composition. Limnology and oceanography, 57(1), 124-144.
Oubelkheir, K., Claustre, H., Bricaud, A., & Babin, M. (2007). Partitioning total spectral absorption in phytoplankton and colored detrital material contributions. Limnology and Oceanography: Methods, 5(11), 384-395.
Schroeder, T., Behnert, I., Schaale, M., Fischer, J., & Doerffer, R. (2007). Atmospheric correction algorithm for MERIS above case-2 waters. International Journal of Remote Sensing, 28(7), 1469-1486.
Schroeder, T., Schaale, M., Lovell, J., & Blondeau-Patissier, D. (2022). An ensemble neural network atmospheric correction for Sentinel-3 OLCI over coastal waters providing inherent model uncertainty estimation and sensor noise propagation. Remote Sensing of Environment, 270, 112848.
Shahraiyni, T. H., Schaale, M., Fell, F., Fischer, J., Preusker, R., Vatandoust, M., ... & Tavakoli, A. (2007). Application of the Active Learning Method for the estimation of geophysical variables in the Caspian Sea from satellite ocean colour observations. International Journal of Remote Sensing, 28(20), 4677-4683.
Tassan, S., Ferrari, G. M., Bricaud, A., & Babin, M. (2000). Variability of the amplification factor of light absorption by filter-retained aquatic particles in the coastal environment. Journal of Plankton Research, 22(4), 659-668.
Tassan, S., & Ferrari, G. M. (2002). A sensitivity analysis of the 'Transmittance–Reflectance' method for measuring light absorption by aquatic particles. Journal of Plankton Research, 24(8), 757-774.
Wei, J., Wang, M., Jiang, L., Yu, X., Mikelsons, K., & Shen, F. (2021). Global estimation of suspended particulate matter from satellite ocean color imagery. Journal of Geophysical Research: Oceans, 126(8), e2021JC017303.
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Yu, X., Lee, Z., Shen, F., Wang, M., Wei, J., Jiang, L., & Shang, Z. (2019). An empirical algorithm to seamlessly retrieve the concentration of suspended particulate matter from water color across ocean to turbid river mouths. Remote Sensing of Environment, 235, 111491.
Zhang, T., Fell, F., Liu, Z. S., Preusker, R., Fischer, J., & He, M. X. (2003). Evaluating the performance of artificial neural network techniques for pigment retrieval from ocean color in Case I waters. Journal of Geophysical Research: Oceans, 108(C9).
Zhang, T., & Fell, F. (2004). An approach to improving the retrieval accuracy of oceanic constituents in Case II waters. Journal of Ocean University of China, 3(2), 220-224.
Zhang, T., & Fell, F. (2007). An empirical algorithm for determining the diffuse attenuation coefficient Kd in clear and turbid waters from spectral remote sensing reflectance. Limnology and Oceanography: Methods, 5(12), 457-462.

Table A1: Scientific articles in peer-reviewed journals using or referencing COASTLOOC *(continued)*

Publications
Zheng, G., & Stramski, D. (2013). A model based on stacked-constraints approach for partitioning the light absorption coefficient of seawater into phytoplankton and non-phytoplankton components. Journal of Geophysical Research: Oceans, 118(4), 2155-2174.

Author contributions. TEXT

Competing interests. TEXT

Disclaimer. TEXT

Acknowledgements. TEXT

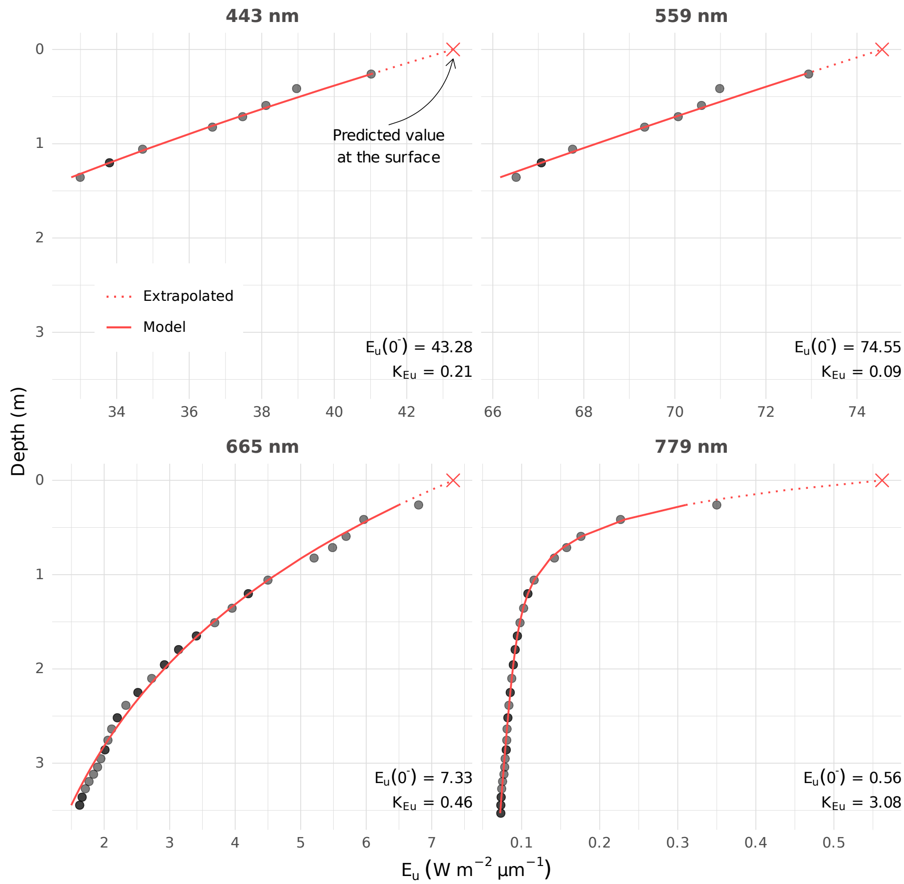

Figure A1. My caption

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Babin, M.: Variations in the Light Absorption Coefficients of Phytoplankton, Nonalgal Particles, and Dissolved Organic Matter in Coastal Waters around Europe, Journal of Geophysical Research, 108, 3211, https://doi.org/10.1029/2001JC000882, 2003.

Carr, M.-E., Friedrichs, M. A., Schmeltz, M., Noguchi Aita, M., Antoine, D., Arrigo, K. R., Asanuma, I., Aumont, O., Barber, R., Behrenfeld, M., Bidigare, R., Buitenhuis, E. T., Campbell, J., Ciotti, A., Dierssen, H., Dowell, M., Dunne, J., Esaias, W., Gentili, B., Gregg, W., Groom, S., Hoepffner, N., Ishizaka, J., Kameda, T., Le Quéré, C., Lohrenz, S., Marra, J., Mélin, F., Moore, K., Morel, A., Reddy, T. E., Ryan, J., Scardi, M., Smyth, T., Turpie, K., Tilstone, G., Waters, K., and Yamanaka, Y.: A Comparison of Global Estimates of Marine Primary Production from Ocean Color, Deep Sea Research Part II: Topical Studies in Oceanography, 53, 741–770, https://doi.org/10.1016/j.dsr2.2006.01.028, 2006.

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