Supplement material for article:

Dissolved organic carbon (DOC) in coastal waters: global patterns, stocks and environmental physical controls

Authors: Christian Lønborg, Isabel Fuentes-Santos, Cátia Carreira, Valentina Amaral, Javier Arístegui, Punyasloke Bhadury, Mariana Bernardi Bif, Maria Ll. Calleja, Qi Chen, Luiz C. Cotovicz Jr., Stefano Cozzi, Bradley D. Eyre, E. Elena García-Martín, Michele Giani, Rafael Gonçalves-Araujo, Renee Gruber, Dennis A. Hansell, Johnna M. Holding, William Hunter, J. Severino P. Ibánhez, Valeria Ibello, Piotr Kowalczuk, Federica Maggioni, Paolo Magni, Patrick Martin, S. Leigh McCallister, Xosé Anxelu G. Morán, Joanne M. Oakes, Helena Osterholz, Hyekyung Park, Digna Rueda-Roa, Jiang Shan, Eva Teira, Nicholas Ward, Youhei Yamashita, Liyang Yang, Qiang Zheng, Xosé Antón Álvarez-Salgado

Supplementary Information Content:

Supplementary Tables (S1-S6)

Supplementary Figure (S1-S8)

Description of the areas included in the study

Table S1. List of continental shelf typologies, divided into their corresponding MARgin and CATchement segmentation units (MARCATS), which are further divided into Coastal Segmentation and related CATchments (COSCATS) as used in the current study.

MARCAT Segment	MARCAT region	System name	COSCATS (COastal Segmentation and related CATchments)
EBC	2-CAL	CaliforniaCurrent	804; 805; 806; 807; 808
	4-HUM	PeruvianUpwellingCurrent	1112; 1113; 1114
	19-IBE	IberianUpwelling	401; 419
	22-MOR	MoroccanUpwelling	19; 20; 21
	24-SWA	South-westernAfrica	13
	33-LEE	LeeuwinCurrent	1413
WBC	6-BRA	BrazilianCurrent	1106; 1107; 1108
	10-FLO	FloridaUpwelling	826; 827; 828
	25-AGU	AgulhasCurrent	9; 10; 11; 12
	35-EAC	EasternAustralianCurrent	1410
	39-CSK	ChinaSeaandKuroshio	1322; 1323; 1324; 1325; 1326
Monsoonal	27-WAS	WesternArabianSea	5; 6; 1341
	30-EAS	EasternArabianSea	1338; 1339; 1340
	31-BEN	BayofBengal	1336; 1337
Subpolar	1-NEP	North-easternPacific	809; 810; 811
	5-SAM	SouthAmerica	1109; 1110; 1111
	11-LAB	SeaofLabrador	821; 822; 824; 825
	15-SGR	SouthernGreenland	503; 504
	17-NEA	North-easternAtlantic	402; 403
	34-SAU	SouthernAustralia	1411; 1414
	36-NWZ	NewZealand	1406; 1407; 1408; 1409
	42-NWP	North-westernPacific	812; 1314; 1315; 1316
Polar	13-CAN	CanadianArchipelagos	814; 815; 816; 823
	14-NGR	NorthernGreenland	501; 502; 505
	16-NOR	NorwegianBasin	407
	43-SIB	SiberianShelves	1309; 1310; 1311; 1312; 1313
	44-BKS	BarentsandKaraSeas	408; 409; 1307; 1308
	45-ANT	AntarcticShelves	1501; 1502; 1503; 1504; 1505
Marginal	9-MEX	GulfofMexico	832; 833; 834
	12-HUD	HudsonBay	817; 818; 819; 820
	18-BAL	BalticSea	404; 405; 406
	20-MED	MediterraneanSea	1; 2; 3; 414; 415; 416; 417; 418; 1301
	21-BLA	BlackSea	411; 412; 413
	28-RED	RedSea	4; 1344
	29-PER	PersianGulf	1342
	40-JAP	SeaofJapan	1320; 1321
	41-OKH	SeaofOkhotsk	1317; 1318; 1319
Tropical	3-TEP	TropicalEasternPacific	8081; 802; 803; 1115; 1116

	7-TWA	TropicalWesternAtlantic	1103; 1104; 1105; 1103
	8-CAR	CaribbeanSea	830; 831; 1101; 1102
	23-TEA	TropicalEasternAtlantic	14; 15; 16; 17; 18
	26-TWI	TropicalWesternIndian	7; 8
	32-TEI	TropicalEasternIndian	1334; 1335; 1414
	37-NAU	NorthernAustralia	1330; 1333; 1401; 1402; 1403; 1415; 1416
	38-SEA	SouthEastAsia	1328; 1329; 1331; 1332

Table S2. Shelf volume (km^3) considering water depth shallower than 200 m, median annual freshwater discharge into the region ($km^3\ yr^{-1}$), and median concentrations of dissolved organic carbon (DOC in µmol C L^{-1}) for the MARgin and CATchments Segmentation (MARCATS) shelf typologies (EBC - Eastern boundary current margins, WBC - Western boundary current margins, Monsoonal – margins under monsoonal influence, Subpolar margins, Polar margins, Marginal seas – internal marginal seas, and Tropical margins). Region abbreviations and system names are provided. The shelf volumes were calculated using information from [*Laruelle et al.*, 2013] and discharge were also obtained from the same study. Numbers in bold were calculated as DOC measurements were missing in those MARCATS regions, here a composite area-weighted average of other MARCATS of the same shelf typology were used. The median DOC concentrations are reported as well as median values after excluding the highest and lowest 25% of values from the whole dataset (referred to as "25% cut-off total"), where the 25% highest and lowest values in each shelf typology were removed (25% cut-off by shelf) or using depth integrated median concentrations are reported.

MARCAT Segment	MARCAT region	System name	Shelf volume ($10^3\ km^3$)	Discharge ($km^3\ yr^{-1}$)	DOC (median) (µmol C L^{-1})	DOC (25% cut-off of whole) (µmol C L^{-1})	DOC (25% cut-off by shelf) (µmol C L^{-1})	DOC (depth integrated) (µmol C L^{-1})
EBC	2-CAL	CaliforniaCurrent	15.81	428	73	131	73	55
	4-HUM	PeruvianUpwellingCurrent	12.08	120	**190**	**133**	**190**	**164**
	19-IBE	IberianUpwelling	22.16	202	90	95	90	71
	22-MOR	MoroccanUpwelling	12.73	125	376	169	376	248
	24-SWA	South-westernAfrica	20.15	14	**190**	**133**	**190**	**164**
	33-LEE	LeeuwinCurrent	7.35	11	422	193	422	536
WBC	6-BRA	BrazilianCurrent	30.19	1117	331	175	331	198
	10-FLO	FloridaUpwelling	73.8	531	291	176	291	108
	25-AGU	AgulhasCurrent	16.13	657	**213**	**146**	**213**	**118**
	35-EAC	EasternAustralianCurrent	9.71	67	300	170	300	355
	39-CSK	ChinaSeaandKuroshio	78.55	1594	84	103	84	68
Monsoonal	27-WAS	WesternArabianSea	7.88	26	220	182	220	208
	30-EAS	EasternArabianSea	19.39	293	170	170	170	169
	31-BEN	BayofBengal	31.61	1640	247	179	247	232
Subpolar	1-NEP	North-easternPacific	36.94	785	**136**	**125**	**139**	**125**
	5-SAM	SouthAmerica	104.08	289	65	131	65	47
	11-LAB	SeaofLabrador	42.87	1080	184	133	184	217
	15-SGR	SouthernGreenland	12.3	108	73	**125**	**139**	73
	17-NEA	North-easternAtlantic	79.52	498	158	140	159	98
	34-SAU	SouthernAustralia	31.06	66	435	139	435	476
	36-NWZ	NewZealand	25.15	340	**136**	**125**	**139**	**125**
	42-NWP	North-westernPacific	70.39	363	68	88	68	67
Polar	13-CAN	CanadianArchipelagos	66.51	382	71	93	71	70
	14-NGR	NorthernGreenland	29.01	82	87	95	87	77

	16-NOR	NorwegianBasin	17.53	183	108	108	100	109
	43-SIB	SiberianShelves	84.06	801	232	136	232	124
	44-BKS	BarentsandKaraSeas	138.07	1585	240	142	240	130
	45-ANT	AntarcticShelves	48.8	NA	50	90	50	53
	9-MEX	GulfofMexico	28.57	1085	150	130	150	78
	12-HUD	HudsonBay	92.04	666	425	192	425	316
	18-BAL	BalticSea	19.82	376	348	215	348	325
	20-MED	MediterraneanSea	48.06	674	90	104	90	80
Marginal	21-BLA	BlackSea	5.57	360	188	189	188	154
	28-RED	RedSea	9.95	6	79	91	79	65
	29-PER	PersianGulf	8.28	61	**260**	**154**	**260**	**183**
	40-JAP	SeaofJapan	19.81	252	**260**	**154**	**260**	**183**
	41-OKH	SeaofOkhotsk	62.21	539	207	137	207	89
	3-TEP	TropicalEasternPacific	14.36	586	**78**	**99**	**78**	69
	7-TWA	TropicalWesternAtlantic	21.61	8981	120	123	120	**68**
	8-CAR	CaribbeanSea	14.53	941	68	89	68	71
Tropical	23-TEA	TropicalEasternAtlantic	16.77	2762	**78**	**99**	**78**	**68**
	26-TWI	TropicalWesternIndian	2.76	328	172	166	172	177
	32-TEI	TropicalEasternIndian	30.84	1324	74	88	74	76
	37-NAU	NorthernAustralia	120.52	2548	78	93	78	64
	38-SEA	SouthEastAsia	117.09	2872	70	104	70	67

Table S3. Number of data points and range of years samples for each MARgin and CATchments Segmentation (MARCATS) region. Shelf typologies (EBC - Eastern boundary current margins, WBC - Western boundary current margins, Monsoonal – margins under monsoonal influence, Subpolar margins, Polar margins, Marginal seas –internal marginal seas, and Tropical margins), as well as the MARCATS region abbreviation and system name are shown together with their location, number of samples (N), and sampling period. NA – no data available.

MARCATS shelf	MARCATS region	System name	Location		N	Period	
			Latitude (°N)	Longitude(°E)		Start	End
EBC	2-CAL	CaliforniaCurrent	40.91	-122.44	366	1996	2019
	4-HUM	PeruvianUpwellingCurrent	NA		NA	NA	
	19-IBE	IberianUpwelling	40.22	-8.17	13727	1994	2019
	22-MOR	MoroccanUpwelling	22.3	-16.94	57	2016	2021
	24-SWA	South-westernAfrica	NA		NA	NA	
	33-LEE	LeeuwinCurrent	-33.04	115.66	15	2017	2019
WBC	6-BRA	BrazilianCurrent	-22.83	-43.09	217	1998	2020
	10-FLO	FloridaUpwelling	38.97	-74.29	3111	1992	2018
	25-AGU	AgulhasCurrent	NA		NA	NA	
	35-EAC	EasternAustralianCurrent	-35.57	150.45	160	2007	2018
	39-CSK	ChinaSeaandKuroshio	32.88	130.77	2591	1996	2021
Monsoonal	27-WAS	WesternArabianSea	4.64	56.07	114	2001	2005
	30-EAS	EasternArabianSea	15.48	73.79	10	2005	2007
	31-BEN	BayofBengal	21.18	87.44	273	2004	2020
Subpolar	1-NEP	North-easternPacific	NA		NA	NA	
	5-SAM	SouthAmerica	-47.97	-73.57	23	2017	2017
	11-LAB	SeaofLabrador	47.85	-54.12	22	2019	2019
	15-SGR	SouthernGreenland	64.71	-53.01	1	2013	2013
	17-NEA	North-easternAtlantic	53.88	1.39	11474	1991	2022
	34-SAU	SouthernAustralia	-34.55	116	16	2019	2019
	36-NWZ	NewZealand	NA		NA	NA	
	42-NWP	North-westernPacific	59.89	-167.7	37	2002	2019
Polar	13-CAN	CanadianArchipelagos	69.86	-150.76	578	2002	2019
	14-NGR	NorthernGreenland	72.13	-27.28	101	2013	2019
	16-NOR	NorwegianBasin	64.63	10.45	97	2004	2018
	43-SIB	SiberianShelves	73.95	134.02	279	1991	2019
	44-BKS	BarentsandKaraSeas	74.38	59.96	408	1999	2019
	45-ANT	AntarcticShelves	-64.8	-64.06	688	2002	2018
Marginal	9-MEX	GulfofMexico	28.46	-86.74	476	2000	2018
	12-HUD	HudsonBay	55.66	-80.04	11	2017	2017
	18-BAL	BalticSea	58.22	18.82	5208	1996	2021
	20-MED	MediterraneanSea	42.65	13.41	1747	1994	2021
	21-BLA	BlackSea	44.65	31.12	16	2001	2013
	28-RED	RedSea	22.2	39.14	334	2004	2019

	29-PER	PersianGulf	NA		NA	NA
	40-JAP	SeaofJapan	NA		NA	NA
	41-OKH	SeaofOkhotsk	43.59	144.87	157	2012 2015
Tropical	3-TEP	TropicalEasternPacific	NA		NA	NA
	7-TWA	TropicalWesternAtlantic	1.38	-47.03	51	2014 2014
	8-CAR	CaribbeanSea	14.22	-77.24	219	1996 2019
	23-TEA	TropicalEasternAtlantic	NA		NA	NA
	26-TWI	TropicalWesternIndian	-11.34	42.87	45	2004 2005
	32-TEI	TropicalEasternIndian	-15.77	123.94	71	2008 2013
	37-NAU	NorthernAustralia	-18.42	146.29	2452	1997 2021
	38-SEA	SouthEastAsia	15.9	112.43	885	1998 2021

Table S4. Number of data and sampling period in each shelf and segment for the data (depth < 10 m) included in the statistical analysis and descriptive analysis for temperature, salinity and dissolved organic carbon (DOC) concentrations. The descriptive measures include mean, median, standard deviation (SD), 2.5th percentile (P2.5%) and 97.5th percentile of the prediction error (P97.5%) and the interquartile range (IQR). These are reported for the MARgin and CATchments Segmentation (MARCATS) shelf typologies (EBC - Eastern boundary current margins, WBC - Western boundary current margins, Monsoonal – margins under monsoonal influence, Subpolar margins, Polar margins, Marginal seas – internal marginal seas, and Tropical margins).

		N	Period		Temperature (°C)						Salinity						DOC (µmol C L^{-1})					
			Start	End	Mean	Sd	P2.5%	Median	P97.5%	IQR	Mean	Sd	P2.5%	Median	P97.5%	IQR	Mean	Sd	P2.5%	Median	P97.5%	IQR
EBC	Total	14165	1994	2021	15.5	2.5	11.5	15.2	20.7	3.7	33.8	4.1	23.2	35	35.9	1.8	95	31	67	91	133	22
	02-CAL	366	1996	2019	14.9	3.1	7.7	15.1	20.9	3.8	26	12	0.2	33.4	33.8	13.7	115	87	57	75	363	65
	19-IBE	13727	1994	2019	15.5	2.4	11.5	15.2	20.4	3.7	34	3.4	26	35	35.9	1.6	94	23	68	91	129	21
	22-MOR	57	2016	2021	22.8	2.3	19.1	22.5	28.8	2.3	36.5	0.4	35.7	36.6	37	0.3	140	126	68	84	516	32
	33-LEE	15	2017	2019	22	2.7	18.9	21.4	26.7	4	31.6	6.3	19.8	33.8	40.3	7	425	230	108	367	836	291
WBC	Total	6104	1992	2021	19.9	7	5.6	20.9	30.2	10.9	24.5	12	0.1	30.5	36.9	18.4	227	195	65	130	735	205
	06-BRA	217	1998	2020	25.4	2.5	21.6	24.7	30.6	3.7	29.6	4.2	19.8	30.4	34.9	4.8	372	168	142	340	790	228
	10-FLO	3136	1992	2018	20.3	7.2	4.8	21.7	30.1	10.2	21.5	14	0.1	23.3	37	27.3	309	219	74	240	793	363
	35-EAC	160	2007	2018	20.5	6.1	7.8	23	28.5	9.6	21.4	11	0.8	24.5	36	19.9	313	177	74	268	705	238
	39-CSK	2591	1996	2021	18.8	6.8	7.2	19.1	30.4	11	28.1	9.2	0.1	31.5	34.5	5	111	58	62	95	246	47
Monsoonal	Total	397	2001	2020	29.4	2.3	25	29.3	33.5	3.1	22.2	11	1	25.9	37.2	17.1	236	121	72	208	564	125
	27-WAS	114	2001	2005	30.3	1.8	26.3	30.8	33.1	2.3	22.7	11	1.3	26.7	34.9	16	226	106	103	208	471	118
	30-EAS	10	2005	2007	29.3	1.7	27.4	29.4	31.1	3.2	21.1	14	0.3	23.3	34.5	19.9	164	24	124	167	195	29
	31-BEN	273	2004	2020	29	2.4	25	28.8	34	3.3	22	11	1	25	37.2	17.7	242	128	66	215	574	135
Subpolar	Total	11573	1991	2022	12	5.4	2.7	12.2	21.2	9.5	27.4	7.8	5	30.3	35.1	8.8	203	140	65	159	599	134
	05-SAM	23	2017	2017	7.2	3.1	3	6.2	12.7	5	4.1	4.5	0.5	2	14.5	4.8	84	48	38	65	194	48
	11-LAB	22	2019	2019	10.4	5.6	0.4	10.8	19.3	7.2	28.6	7.2	11.7	30	36.7	8.1	217	107	115	184	444	163
	15-SGR	1	2013	2013	2.4		2.4	2.4	2.4	0	32.7		32.7	32.7	32.7	0	73		73	73	73	0
	17-NEA	11474	1991	2022	12.1	5.4	2.7	12.3	21.1	9.5	27.4	7.7	5.3	30.3	35.1	8.8	204	140	66	159	598	135
	34-SAU	16	2019	2019	23.6	2.1	19.2	24.3	25.6	2.3	26.1	10	6.1	28	35.7	12.7	410	237	66	392	804	296
	42-NWP	37	2002	2019	7.4	2.8	-1.5	7.7	10.3	1.7	31.4	0.7	30.5	31.2	32.9	1	75	12	65	68	104	14
Polar	Total	2151	1991	2019	3.5	4.1	-1.5	2.1	14.5	4.5	25.4	11	0.2	30.8	34	12.9	176	178	43	80	622	189
	13-CAN	578	2002	2019	4.8	5.2	-1.8	4.1	17.6	8.3	22.3	13	0.1	28.8	33.9	20.5	175	154	61	83	511	200
	14-NGR	101	2013	2019	3.1	2.6	-0.5	2.5	8.6	3.8	25.9	6	11.6	28.1	32.9	7.3	82	22	46	80	125	28
	16-NOR	97	2004	2018	9	3.2	4	8.9	14.4	5.5	31.7	2.7	25.9	32.3	34.5	1.6	109	25	70	108	185	25

	43-SIB	279	1991	2019	5	4.5	-0.4	3.9	15.3	4.9	16.1	11	0.1	19.9	31	23.4	334	193	79	281	703	330
	44-BKS	408	1999	2019	4.2	1.9	0.4	4.9	8.4	2.1	20.8	11	4.3	21.2	34.2	21.5	319	201	58	294	641	411
	45-ANT	688	2002	2018	0.6	1	-1.4	0.8	2.2	1.5	33.5	0.3	32.6	33.6	33.9	0.4	52	8	42	50	72	8
Marginal	Total	7962	1994	2021	12.9	8.2	0.1	12.8	30	12.2	15.4	15	1.9	7.1	39.4	31.6	295	153	65	325	635	244
	09-MEX	451	2000	2018	24.8	4.7	15.4	25	30.8	7.1	29.8	8.3	1	32.2	36.5	8.1	253	210	75	160	736	183
	12-HUD	11	2017	2017	-0.6	0.6	-1.4	-0.6	0.1	1.2	13.5	12	0.3	14.8	26.1	23	424	201	194	433	781	288
	18-BAL	5208	1996	2021	9.1	6.1	0	9.1	19.1	11.1	5.2	3.2	1.3	4.7	14.1	4.3	377	92	256	356	635	81
	20-MED	1747	1994	2021	17.7	5.4	8.6	18.3	27.3	8.3	36.2	4.4	20.8	37.6	38.6	1.7	113	71	61	95	273	50
	21-BLA	16	2001	2013	9.8	4.8	4.9	7	18	8	18	1.7	16.8	17.7	22	0.8	202	19	171	202	236	24
	28-RED	334	2004	2019	29	3.2	23	29.3	34	5	39.4	0.7	37.9	39.4	40.8	0.9	88	21	64	82	137	23
	41-OKH	157	2012	2015	13.8	6.3	0.2	12.9	23.6	8.2	23.2	8.8	4.6	24.6	32.9	14.6	236	148	62	203	609	174
Tropical	total	3723	1996	2021	26.7	3.2	19.8	27.3	31.5	4.7	31.4	7.6	4.3	34.2	36.7	3.5	116	100	55	83	448	38
	07-TWA	51	2014	2014	28.4	0.7	27	28.3	29.5	1	29.7	11	1.7	34.8	36.8	5.9	151	51	75	145	275	60
	08-CAR	219	1996	2019	28.2	2.8	23.2	28.4	33.9	3.4	33.3	8.1	2.8	36.6	37.3	1.6	171	156	62	89	580	150
	26-TWI	45	2004	2005	27.1	5	15.7	28.1	35	1.8	16.6	10	1.5	13.5	37.2	9	143	55	60	136	239	74
	32-TEI	71	2008	2013	29.9	1.2	27	30.1	31.8	1	28.1	9.6	6.6	32.8	34.5	5.1	107	75	56	79	313	25
	37-NAU	2452	1997	2021	26.4	2.9	20.7	26.7	31.1	4.7	32.9	6.1	10.5	34.9	36.2	1.8	107	91	52	82	394	32
	38-SEA	885	1998	2021	26.9	3.8	16.8	28.3	30.7	4.6	28	8.6	2.2	31.6	34.3	5.7	125	107	66	85	552	54

Table S5. Seasonal patterns of temperature, salinity and dissolved organic carbon (DOC) concentrations for the surface data (depth < 10 m) included in the statistical analysis. Summary description of the fitted GAM: mean latitude of the studied area (mean lat.), number of samples, period in which samples were collected, amplitude: seasonal amplitude, estimated as the range of the fitted cycles. edf: estimated degrees of freedom of the smooth term (month), p-value of the F significance test (p), and percentage of deviance explained (D. exp.). These are reported for the MARgin and CATchments Segmentation (MARCATS) shelf typologies (EBC - Eastern boundary current margins, WBC - Western boundary current margins, Monsoonal – margins under monsoonal influence, Subpolar margins, Polar margins, Marginal seas – internal marginal seas, and Tropical margins).

		Mean lat	N	Period		Temperature (°C)					Salinity					DOC (µmol C L-1)				
				Start	End	Amplitude	edf	F	p	D. exp.	Amplitude	edf	F	p	D. exp.	Amplitude	edf	F	p	D. exp.
EBC	02-CAL	34.38	231	2008	2009	6.17	7.64	181.8	0	86.77%	0.41	6.7	970.4	0	81.40%	14.74	6.4	211.4	0	44.39%
	19-IBE	42.54	12622	2002	2011	5.04	7.89	2614	0	0.6239	1.04	7.38	1574	0	6.42%	18.66	7.21	2897	0	18.47%
WBC	06-BRA	-22.81	186	2013	2014	4.94	4.88	17.5	0	33.17%	8.31	4.65	55.7	0	19.71%	60.31	1.87	7.2	0.012	3.46%
	10-FLO_SAB	31.49	292	2005	2018	18.41	6.91	213.9	0	85.83%	3.12	2.38	11	0.003	2.90%	16.29	0.68	0.94	0.24	0.56%
	10- FLO_MAB	37.82	807	2005	2017	21.23	7.72	361.1	0	78.38%	11.37	5.71	224	0	22.30%	112.89	4.61	22.8	1E-04	3.31%
	10- FLO_Bermuda	32.33	896	2007	2012	10.86	7.13	1103	0	90.87%	0.17	5.39	63.3	0	6.32%	26.3	6.94	193.9	0	12.87%
	39-CSK_China	31.32	870	2008	2021	17.18	4.26	79.2	0	31.82%	4.61	3.46	42.1	0	3.21%	23.94	3.65	16.4	0.001	1.14%
	39- CSK_Japan	36.21	1530	2008	2021	16.7	7.19	501.8	0	72.56%	1.83	5.64	81.8	0	3.01%	39.19	5.59	446.7	0	13.95%
Subpolar	17-NEA_DK	55.44	173	2001	2005	15.96	7.59	212.7	0	91.21%	8.62	7.23	179.2	0	36.84%	98.3	6.05	111.2	0	39.97%
	17-NEA_NE	52.4	9556	1991	2005	14.7	7.87	8253	0	87.37%	1.34	4.06	89.8	0	0.61%	46.46	6.75	313.7	0	1.94%
	17-NEA_UK_south	50.34	225	2002	2003	9.25	4.38	89.1	0	67.26%	1.34	0.71	1	0.231	0.77%	11.84	1.47	4.1	0.047	1.49%
	17-NEA_UK_west	53.22	46	1998	1999	9.85	3.63	147.2	0	94.78%	1.58	4.57	118.5	0	75.28%	71.65	4.72	142.8	0	59.88%
Polar	16-NOR	64.39	83	2017	2018	7.43	3.33	29.5	0	75.96%	1.76	2.79	28.6	0	17.80%	22.94	3.25	22.5	0	18.62%
	44-BKS	70.44	44	2017	2018	6.51	4.61	12.8	0	73.37%	0	0	0	0.953	0.00%	0	0	0	0.74	0.00%
Marginal	18-BAL_DE	54.23	541	2010	2020	16.4	6.17	573.8	0	89.63%	3.94	4.94	189.6	0	24.67%	36.81	4.86	270.1	0	25.91%
	18-BAL_SE	63.91	3235	2000	2021	16.13	7.49	2381	0	0.8553	1.06	7.49	229.4	0	0.0684	48.82	6.95	200.2	0	0.0381
	20-MED_Adriatic	44.9	590	2000	2021	15.74	5.6	601.6	0	89.26%	1.9	5.24	290.7	0	15.37%	36.15	4.77	169.9	0	13.83%
	20-MED_Blanes	41.67	134	2006	2020	11.44	5.71	176.1	0	91.78%	0.3	3.04	39.5	0	14.71%	22.31	3.88	77.1	0	25.86%
	28-RED_Harbour	22.31	109	2016	2017	9.19	6.06	109.9	0	89.71%	1.21	3.89	75.3	0	31.88%	18.92	2.85	18.6	1E-04	16.97%
	28-RED_Reef	22.29	129	2016	2017	6.99	4.94	69.1	0	82.09%	0.38	2.17	11.8	0.001	6.50%	2.37	0.96	1.4	0.214	1.23%
Tropical	08-CAR	10.5	124	1996	2017	4.61	6.75	17.7	0	55.49%	0.39	5.33	134.2	0	37.89%	10.45	3.39	19.5	1E-04	14.03%
	37-NAU	-18.81	2186	2007	2021	7.58	7.78	944.6	0	77.64%	1.88	6.96	660	0	9.36%	29.58	7.27	240.7	0	4.66%
	38-SEA_north	23.27	112	2018	2020	13.65	4.22	178	0	93.16%	7.58	7.64	9.1	0	41.70%	108.72	7.78	8.8	0	41.19%
	38-SEA_south	1.62	262	2017	2020	2.52	6.8	15.1	0	33.20%	8.37	7.31	5.2	0	14.91%	84.86	6.05	3.3	1E-04	10.51%

Table S6. Estimation of dissolved organic carbon (DOC) concentrations as a function of temperature and salinity for the data (depth < 10 m) included in the statistical analysis. Number of samples (N) and sampling period for each region are shown. Degrees of freedom (edf) and Chi-squared significance test (Chi.sp, p-value) for temperature (T)), salinity (s(sal)) and interaction between them (te(T,sal)) on DOC concentrations D. expl: percentage of deviance explained by the GAM fit.

MARCAT Segment	MARCAT region	System name	N	Period		GAM tits					
				Start	End	Effect variable	edf	Chi.sq	p-value	Dev. expl.	R.sq
EBC	2-CAL	CaliforniaCurrent	231	2008	2009	s(T)	4.94	638.14	0	0.7049	0.7776
						s(sal)	4.92	356.66	0		
	19-IBE-NW	IberianUpwelling-North West	####	2002	2011	s(T)	5.59	285.04	0	0.288	0.2953
						s(sal)	1.02	56.73	0		
						te(T,sal)	8.75	54.58	0		
	19-IBE-SW	IberianUpwelling - South West	238	2010	2017	s(T)	0.8	9.01	#######	0.7056	0.8654
						s(sal)	6.55	340.94	0		
						te(T,sal)	9.37	489	0		
	22-MOR	Moroccan Upwelling	57	2016	2021	s(T)	0.67	1.65	0.0003	0.7883	0.4684
						s(sal)	7.71	393.73	0		
						te(T,sal)	7.82	154.54	0		
WBC	6-BRA	BrazilianCurrent	186	2013	2014	s(T)	0.83	2.97	0.0141	0.4437	0.5076
						s(sal)	1.03	19.38	0		
						te(T,sal)	8.37	56.92	0		
	10-FLO-SAB	FloridaUpwelling-South-Atlantic Bay	286	2005	2018	s(T)	0.87	5.89	0.0084	0.3325	0.3581
						s(sal)	6.2	220.99	0		
	10-FLO-MAB	FloridaUpwelling- Mid-Atlantic Bay	807	2005	2017	s(T)	8.19	147.22	0	0.5565	0.6491
						s(sal)	6.35	698.54	0		
						te(T,sal)	5.26	87.76	0		
	10-FLO-Bermuda	FloridaUpwelling - Bermuda	896	2007	2012	s(T)	1.05	26.45	0	0.2276	0.2679
						s(sal)	7.04	43.06	0		
						te(T,sal)	8.17	100.78	0		
	39-CSK-China	ChinaSeaandKuroshio - Chinese Sea	939	2008	2021	s(T)	4.54	19.33	#######	0.2953	0.1388
						s(sal)	5.68	104.71	0		
						te(T,sal)	11.45	186.88	0		
	39-CSK-Japan	ChinaSeaandKuroshio - Japan coastal waters	1530	2008	2021	s(T)	8.24	185.49	0	0.5478	0.6534
						s(sal)	1.12	257.55	0		
						te(T,sal)	13.26	506.92	0		
Subpolar	17-NEA-DK	North-easternAtlantic-Danish Waters	171	2001	2005	s(T)	3.99	50.05	0	0.658	0.6819
						s(sal)	1.19	74.82	0		
						te(T,sal)	6.73	28.02	#######		
	17-NEA-NE	North-easternAtlantic-Netherlands	9556	1991	2005	s(T)	8.76	485.18	0	0.528	0.7043
						s(sal)	8.79	1310.24	0		
						te(T,sal)	12.86	609.46	0		
	17-NEA-UK South	North-easternAtlantic-United Kingdom south	225	2002	2003	s(T)	7.12	198.08	0	0.3824	0.4619
						s(sal)	2.35	32.69	0		

						te(T,sal)	1.6	22.41	#######		
	17-NEA-UK West	North-easternAtlantic-United Kingdom west	46	1998	1999	s(T)	3.88	50.57	0	0.6789	0.6968
						s(sal)	1.24	88.99	0		
						te(T,sal)	6.9	28.31	#######		
Polar	16-NOR	NorwegianBasin	82	2017	2018	s(T)	0.46	0.84	0.1719	0.2854	0.2721
						s(sal)	1.02	23.67	#######		
						te(T,sal)	0	0	0.3943		
	44-BKS	BarentsandKaraSeas	42	2017	2018	s(T)	0	0	0.3732	0.7599	0.7531
						s(sal)	1.14	125.05	0		
	45-ANT	AntarcticShelves	688	2002	2018	s(T)	1.21	91.1	0	0.0813	0.0975
						s(sal)	0.69	2.21	0.073		
						te(T,sal)	0	0	0.4531		
Marginal	9-MEX	GulfofMexico	476	2000	2018	s(T)	8.01	102.78	0	0.6298	0.7608
						s(sal)	8.07	251.98	0		
						te(T,sal)	14.37	683.73	0		
	18-BAL-DE	BalticSea	541	2010	2020	s(T)	1.43	140.12	0	0.605	0.6561
						s(sal)	3.97	1912.26	0		
	18-BAL-DS	BalticSea	3235	2000	2021	s(T)	0.83	4.29	#######	0.2856	0.3681
						s(sal)	8.56	443.71	0		
						te(T,sal)	11.65	374.74	0		
	20-MED	MediterraneanSea	1377	2000	2021	s(T)	1.08	15.86	#######	0.2108	0.2296
						s(sal)	6.42	237.52	0		
						te(T,sal)	8.34	81.12	0		
	28-RED	RedSea	238	2016	2017	s(T)	0	0	0.7867	0.2637	0.2804
						s(sal)	0	0	0.7447		
						te(T,sal)	9.06	140.82	0		
Tropical	8-CAR	CaribbeanSea	124	1996	2017	s(T)	1.04	22.4	#######	0.1479	0.1476
						s(sal)	0	0	0.3387		
	37-NAU	NorthernAustralia	2069	2007	2021	s(T)	0	0	0.8682	0.2314	0.3964
						s(sal)	6.95	4560.72	0		
						te(T,sal)	13.37	526.97	0		
	38-SEA South	SouthEastAsia - South	607	2000	2021	s(T)	0.89	5.44	0.0015	0.5115	0.7573
						s(sal)	8.09	820.23	0		
						te(T,sal)	10.64	121.63	0		
	38-SEA North	SouthEastAsia - North	134	2006	2020	s(T)	1.08	20.63	0	0.249	0.2129

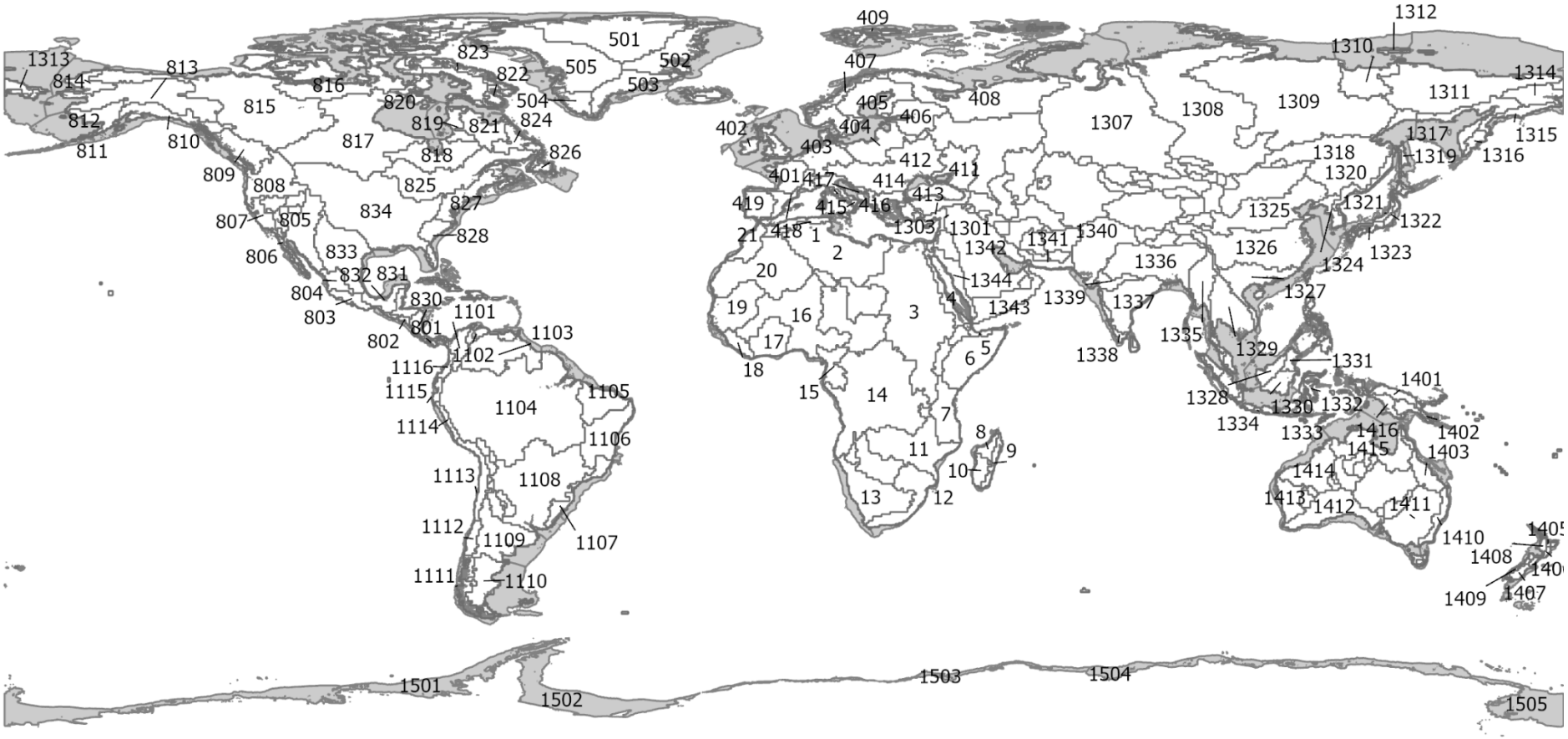

Figure S1. Distribution of the 145 COastal Segmentation and related CATchment (COSCATS) segments (see Table s1 for further detail.

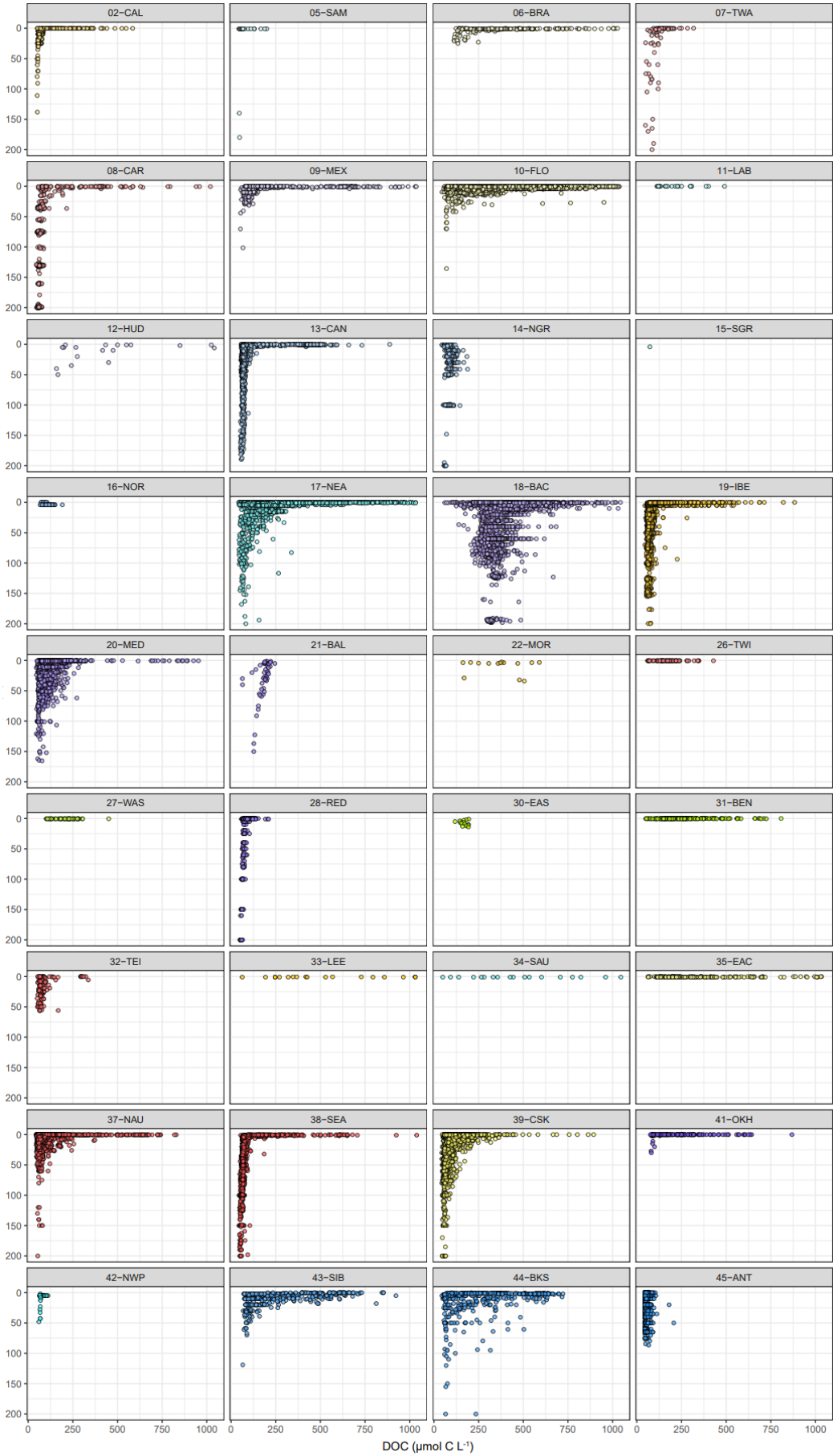

Figure S2. Depth distribution of dissolved organic carbon (DOC) samples for the MARgin and CATchment segmentation units (MARCATS) and which were used in the DOC stock calculations. Please see Table S1 for a description of the different MARCATS and region names.

Description of the areas included in statistical analysis

Reassignment of COSCAT - It should be noted that to assign our data into the MARCATS segments, we reassigned some of the original COSCAT subsets (see Table 1 in [*Laruelle et al.*, 2013]) as these were incorrectly assigned. This entailed 2 cases: 1) COSCAT 1103 was originally incorrectly assigned to MARCATS 21-BLA and was therefore moved to 7-TWA; and 2) according to [*Laruelle et al.*, 2013], the Iberian Upwelling Section (19-IBE) comprises the coastal area between the Strait of Gibraltar and the English Channel; in our study, however, data collected along the Cantabrian coast (Spanish and French coasts in the Bay of Biscay) were assigned to the subpolar Northeast Atlantic (17-NEA) region.

Once data had been classified into coastal shelfs and segments, we selected those regions with enough data to conduct a statistical analysis following the criteria detailed in Section 2.4. Below we provide a detailed description of the spatial and temporal data coverage in each region under study.

Eastern Boundary Currents (Figure S3) - More than the 90% of the data in the Eastern Boundary Systems (EBC) were collected in the Iberian Upwelling Current (19-IBE), but we also had enough data to conduct the regression analysis in California (02-CAL) and Morocco (22-MOR), the temporal sparseness in the latter does not allow for a seasonal analysis. Seasonal and regression analysis in the California current was conducted with data collected in Santa Barbara Channel at 1-10 m from January 2008 to April 2009, data collected in other areas and regions reported higher DOC values and larger variability, but the spatial and temporal sparseness does not allow proper seasonal and regression analysis of these data. In the Iberian Upwelling System, the majority of DOC data were collected in the South-western and North-western Iberian coasts, but we only have complete annual cycles in the Galician rias (NW) from 2001 to 2012. Both interannual variability and differences between rias in the seasonal patterns were found. However, as this is a global-scale analysis, this local variability is outside of the scope of this work, and we provide the distribution and seasonal patterns of the region, i.e. we characterise the mean annual cycles of the decade under study. Relationships between salinity, temperature and DOC have been fitted in the two regions.

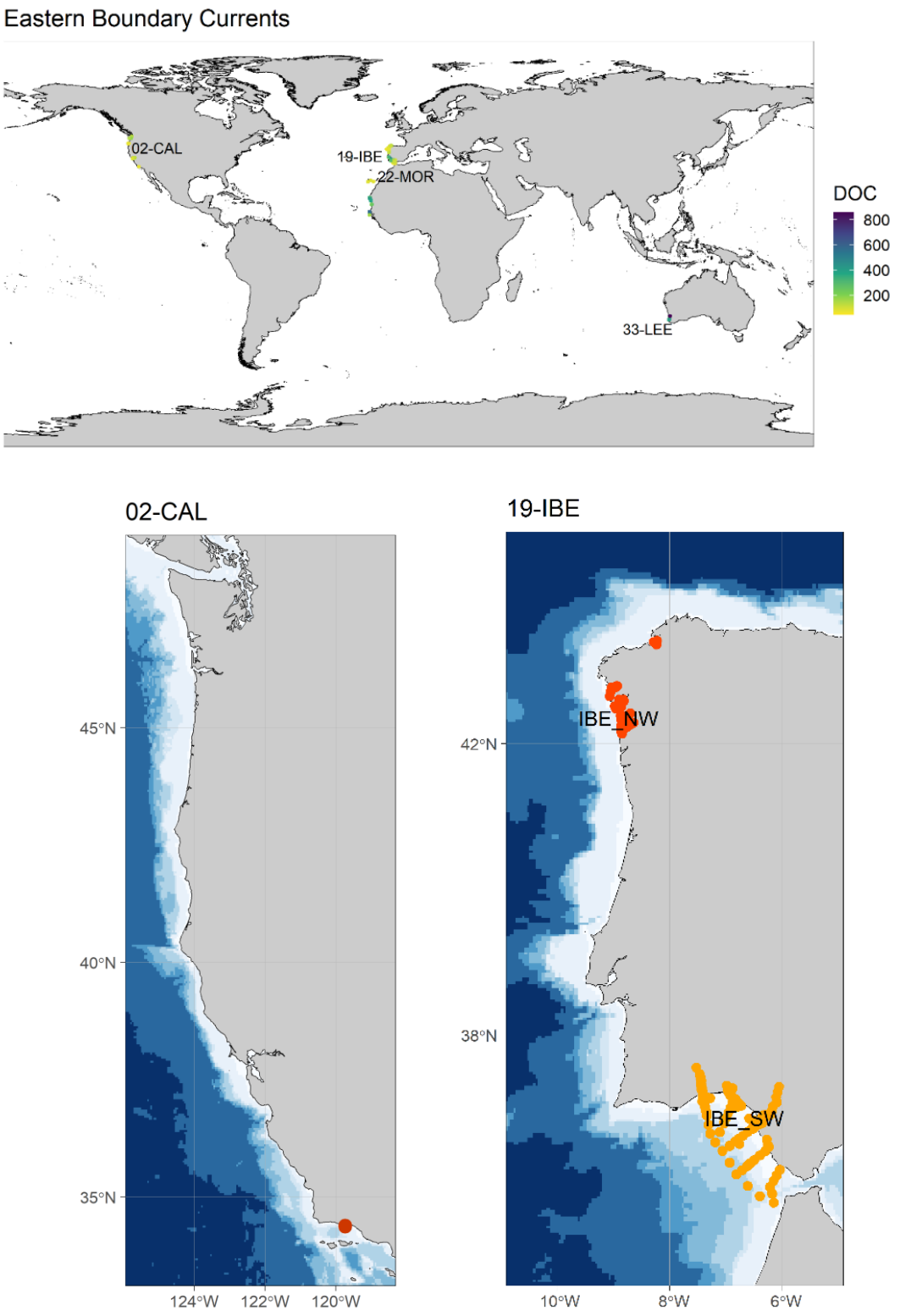

Figure S3. Top: location of locations in the Eastern Boundary Currents and median DOC concentrations in each sampling point. Bottom: sampling locations used in the seasonal and/or regression analysis of the California (02-CAL) and Iberian (19-IBE) Upwelling Systems (Colors match those used to identify the areas in the regression models).

Western Boundary Currents (Figure S4) - The majority of data in the Western Boundary Current systems were collected in the Florida Upwelling (10-FLO) and the China Sea (39-CSK), whereas the Brazilian Current (6-BRA) and the Eastern Australian Current (35-EAC) are underrepresented. Even though the number of data in the Brazilian Current is limited, we have a complete annual cycle collected in the Guanabara Bay (2013-2014). For a proper understanding of DOC distribution in the Florida Upwelling, we have defined three main subregions, the Mid-Atlantic Bight (MAB, longitude >34 ºN, data from 2005 to 2018), South-Atlantic Bight (SAB, longitude < 34 ºN, data from 1996 to 2018) and Bermuda Island (Bermuda, data from 2007 to 2018). Although some samplings have been conducted in this area since 1992, data with enough temporal resolution to estimate the seasonal cycle are available for the period 2008-2021. Data has been collected in the coastal areas of China, Japan and the Republic of Korea, but data collected in the Republic of Korea do not allow a proper estimation of the annual cycle and therefore, we focus on China and Japan.

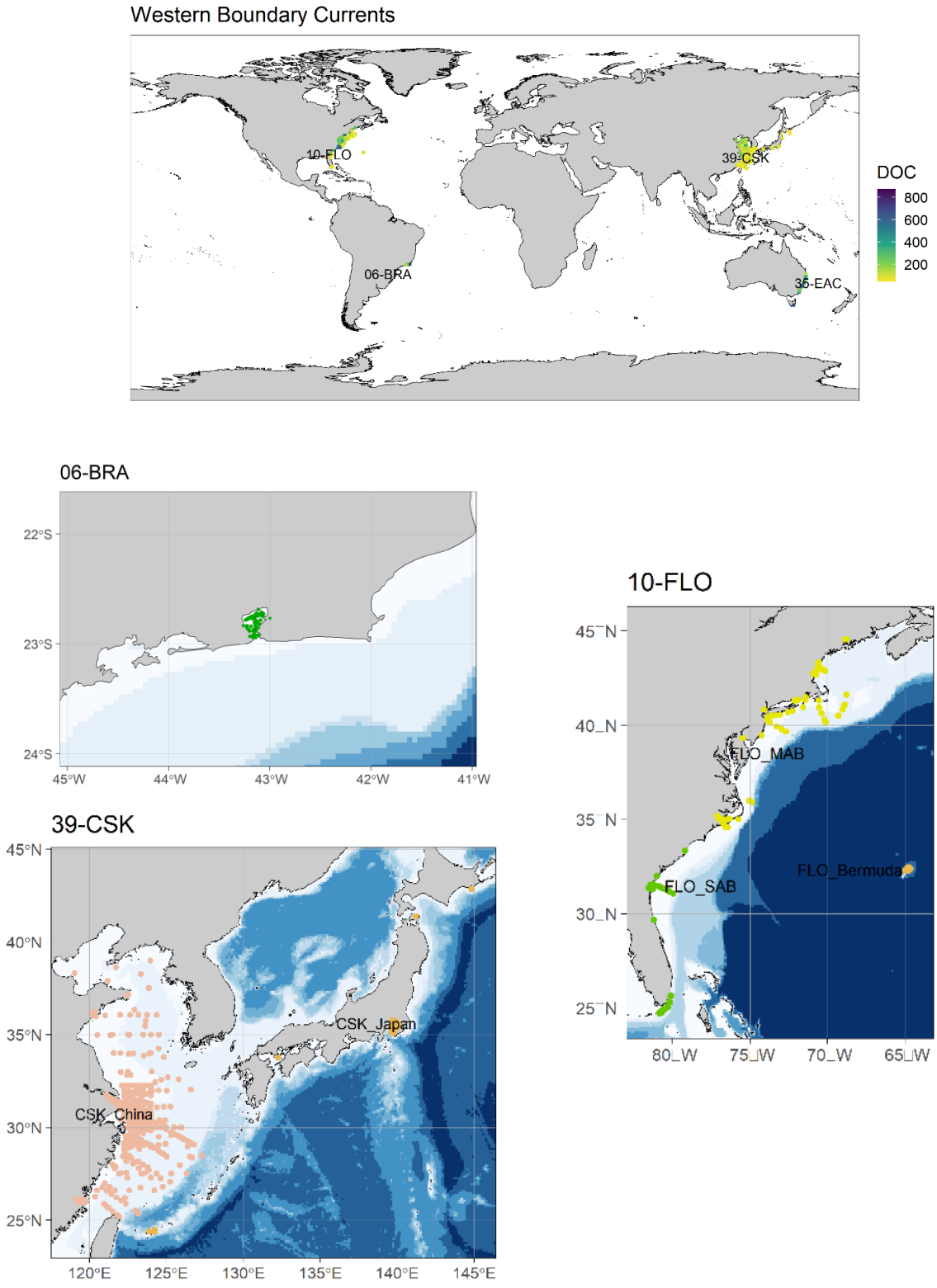

Figure S4. Top: location of locations in the Western Boundary Currents and median DOC concentrations in each sampling point. Bottom: sampling locations used in the seasonal and regression analysis of the Brazilian Current (06-BRA), Florida Upwelling (10-FLO), and East China Sea and Kuroshio (39-CSK).

Subpolar margins (Figure S5) - The majority of data in Subpolar Margins (99.18%) have been collected in the North Eastern Atlantic (17-NEA) while the other sections are underrepresented, and do not have enough temporal resolution to determine seasonal variability and relationships between physical properties and DOC in any of them. Data in the North Eastern Atlantic has been collected during the period 1991-2021. However, the sampling effort was higher in the first half of the period (1991-2005) than in the second one (2006-2021). After a deeper exploratory analysis of the second period (2006-2021) we found that despite having a large number of data and apparently complete annual cycles, the spatio-temporal resolution does not allow a proper estimation of annual cycles, as data were collected in different years and areas. Therefore, we focus on the first period. Data in 1991-2005 were collected in the coastal areas of several countries, but we only have enough temporal resolution to estimate annual cycles in the Baltic coast of Denmark (DK), The Netherlands (NE), and the United Kingdom (UK). Data in Denmark were collected in the Baltic Sea between 2001 and 2005. Data in the Netherlands, which accumulate 92.5% of the NEA data, were collected in the North and Wadden Sea coastal areas between 2001 and 2005. Data in the United Kingdom were collected in different locations, but we only have enough temporal resolution to estimate the annual cycles in the Menai Strait (UK_West, 1998-1999), and in the Plym and Yealm estuaries (UK_South, 2002 2003), once tested for differences between locations in the annual cycles (GAM F-test, $p < 1e\text{-}5$), we analyse the two areas separately.

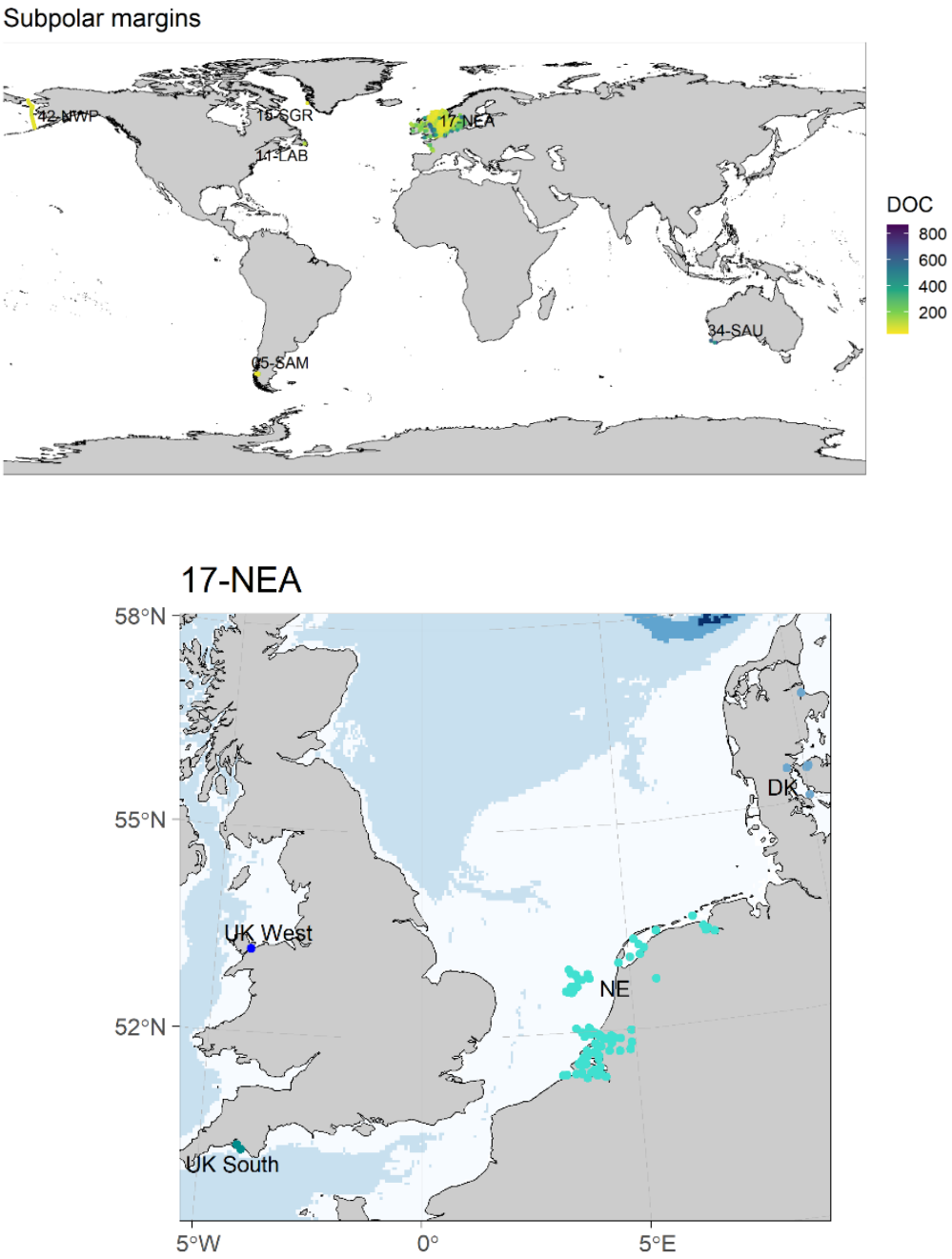

Figure S5. Top: location of locations in Subpolar margins and median DOC concentrations in each sampling point. Bottom: sampling locations used in the seasonal and regression analysis of the North-eastern Atlantic (17-NEA).

Polar margins (Figure S6) - Data in Polar margins were collected in 1991, and from 1999 onward, we here discard 1991 from the analysis. Although a relatively large amount of data is available in some regions (e.g. Canadian Archipelagos (13-CAN) and Antarctic Ocean (45-ANT)), data were collected only during warmer months. Thus, a seasonal analysis is not applicable in these cases, and we focus on the Norwegian Basin (16-NOR, 2017-2018) and the Norwegian coast of the Barents and Kara Seas (44-BKS, 2017-2018) but also estimate the relationship between physical characteristics and DOC in the Antarctic Ocean.

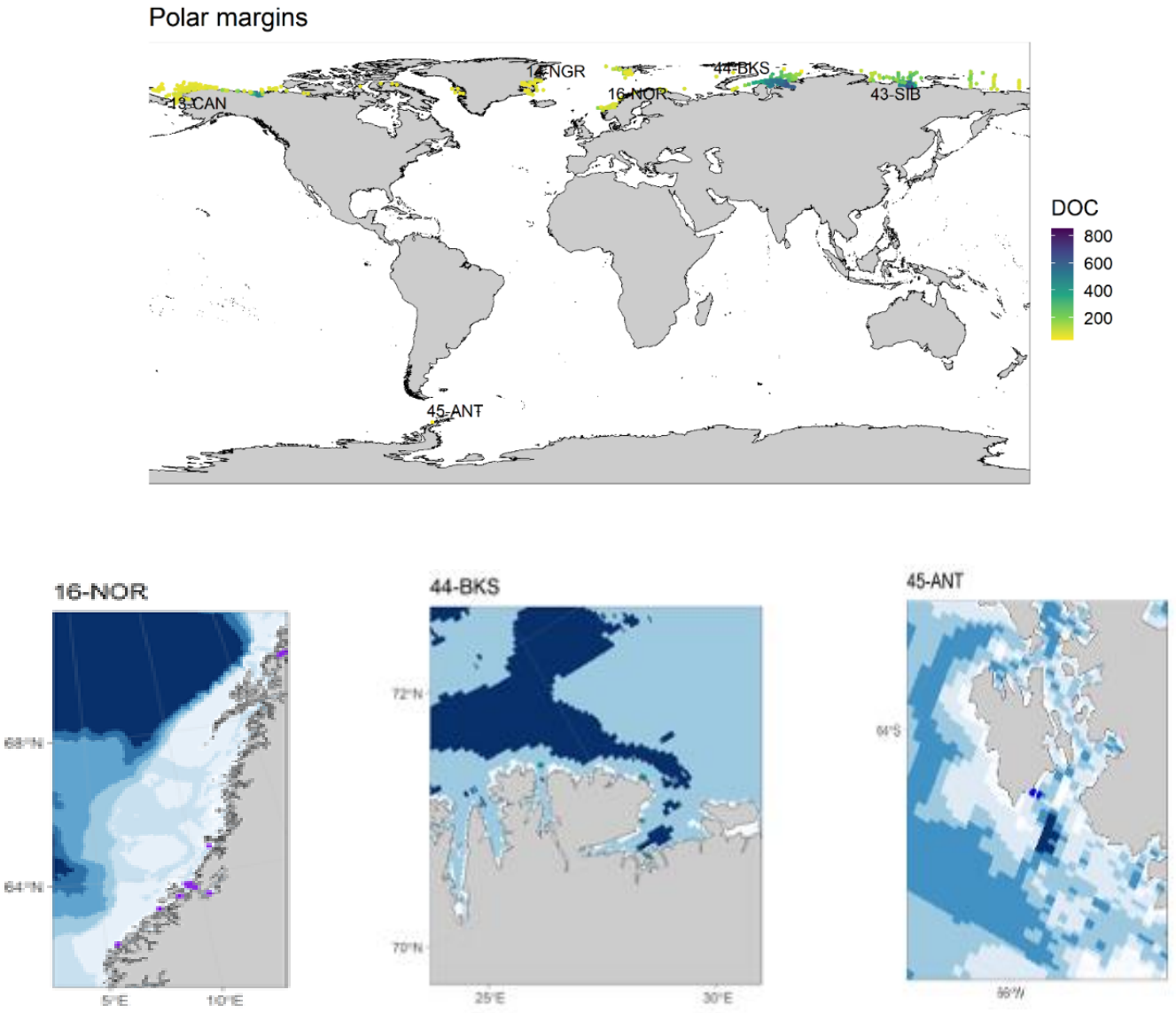

Figure S6. Top: location of locations in Polar margins and median DOC concentrations in each sampling point. Bottom: sampling locations used in the seasonal and regression analysis of the Norwegian basin (16-NOR), the Barents and Kara Seas (44-BKS), and the Antarctic Ocean (45-ANT).

Marginal seas (Figure S7) - The majority of data in the Marginal seas segments were collected in the Baltic (19-BAL) and Mediterranean (20-MED) seas. We also have data in the Gulf of Mexico (09-MEX) and Red Sea (28-RED), but the sampling effort of the former does not allow for a seasonal analysis. Therefore, we focus on the Baltic Sea, the Mediterranean Sea, and the Red Sea for seasonal analysis, but also estimate the relationship between physical conditions and DOC in the Gulf of Mexico. Data in the Baltic Sea were collected in different areas, in particular we have data in the coastal areas of six countries, but only enough temporal resolution of the north coast of Germany (BAL_DE, 2010-2020) and North-eastern coast of Sweden (BAL_SE, 2000-2021). These areas have different salinity and DOC values (Wlicoxon test, $p < 0.001$) with lower salinity in the German and higher DOC in the Sweden coast, and different seasonal cycles (GAM, f-test, $p < 2e-16$) and, consequently we analyse them separately. DOC data have been collected in different areas of the Mediterranean Sea, but we only have enough temporal resolution to estimate annual cycles in the Northern Adriatic coast (MED_Adriatic, 2000-2021) and Blanes Bay (Med_Blanes, 2008-2020). We have found differences between areas in DOC (Wilcoxon test, $p < 0.001$), with lower values in Blanes Bay than in the North Adriatic. We have also found a significant effect of area in the annual cycles of the three variables (GAM, f-test, $p < 2e-16$). Thus, we estimate the annual cycle for each area separately. The regression analysis was conducted at location level accounting for spatiotemporal variability and dependence. Data in the coastal areas of the Red Sea were collected from 2004 to 2019, but we only have enough temporal resolution in 2016-2017 in two areas, the KAUST Harbour (RED_harbour) and Al Fahal reef (RED_reef), where the three target variables have different seasonal patterns (GAM, f-test, $p < 2e-16$) and, consequently, should be analysed separately. The regression analysis was conducted at location level accounting for spatio-temporal variability and dependence.

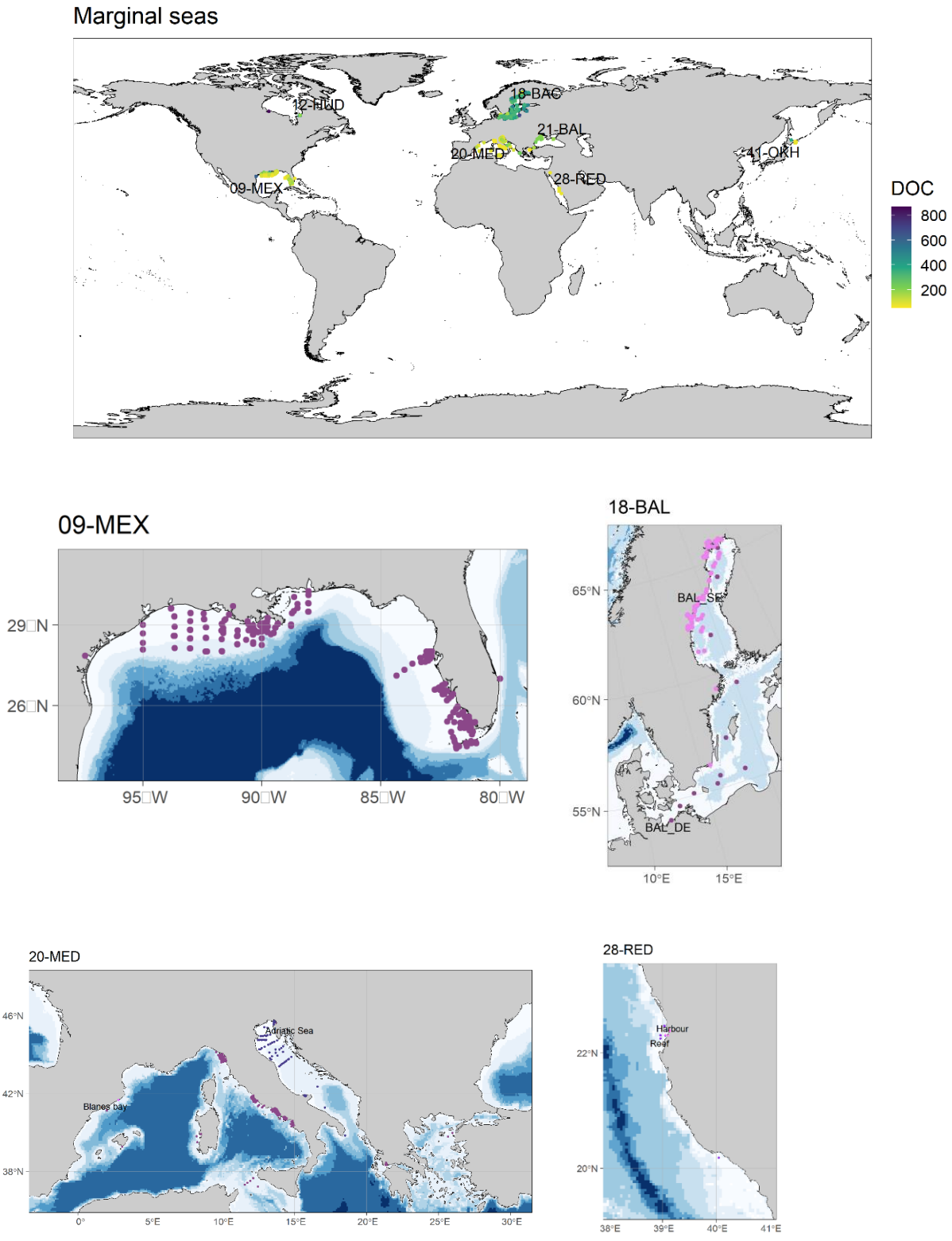

Figure S7. Top: location of locations in Marginal seas and median DOC concentrations in each sampling point. Bottom: sampling locations used in the seasonal and regression analysis of the Gulf of Mexico (09_MEX), Baltic (18-BAL), Mediterranean (20-MED), and Red (28-RED) seas.

Tropical margins (Figure S8) - We only have enough data to conduct a seasonal analysis in the Caribbean Sea (08-CAB), Northern Australia (37-NAU) and SouthEast Asia (38-SEA). DOC data in the Caribbean Sea were collected in the Cariaco basin (1996-2017) and in Belize river, but we only have enough temporal resolution for the former. The majority of data in the Northern Australian coast was collected on the Great Barrier Reef in the period 2007-2021, so our analysis focuses on this area. Data in South-east Asia were collected since 1998, but we only have enough temporal resolution in the period 2017-2020. We have divided the catchment into two major areas: the Northern (latitude > 10, SEA_north, which coincide with the South China Sea) and Southern (latitude < 10, SEA_south) coastal margins.

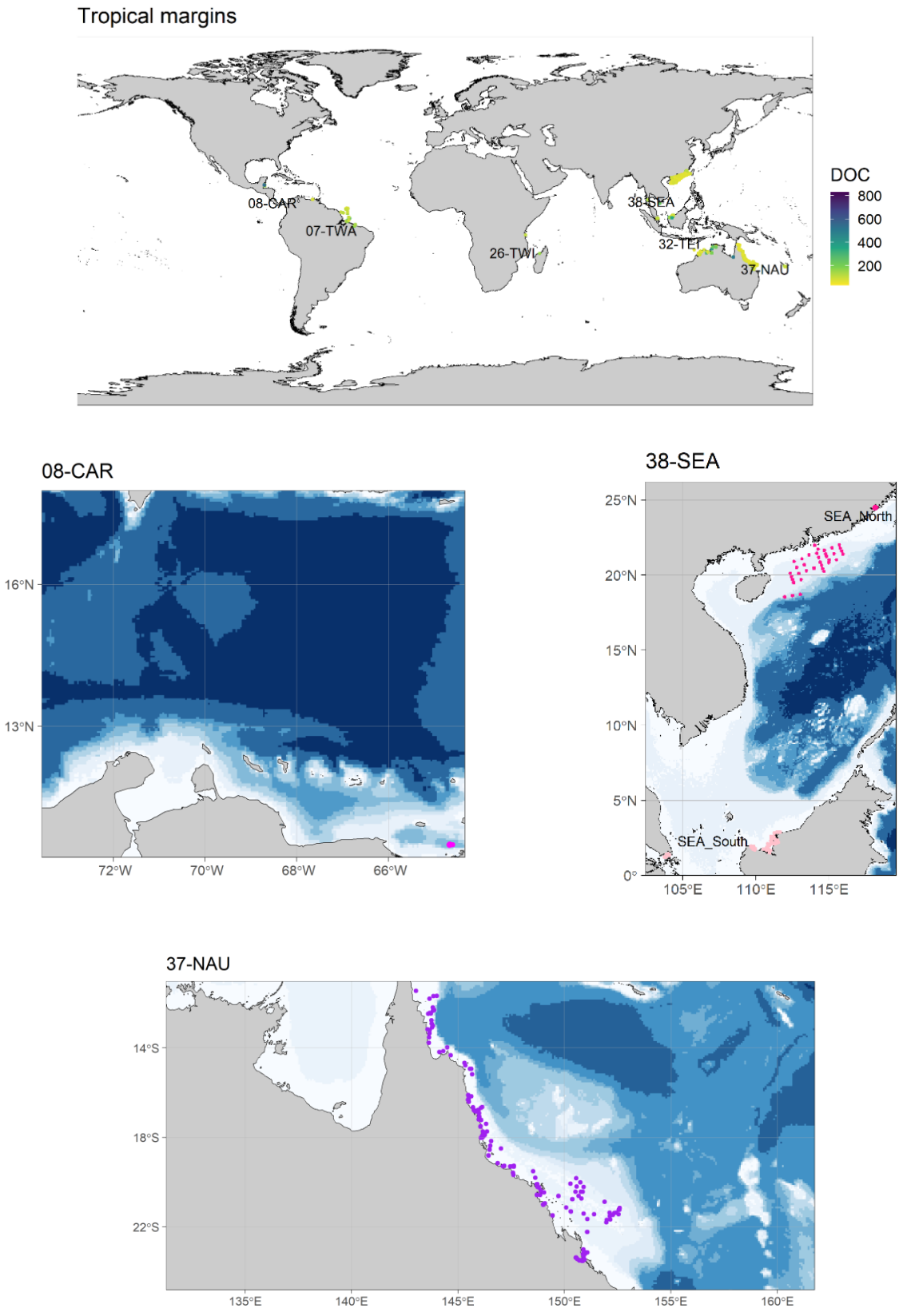

Figure S8. Top: location of locations in Tropical margins and median DOC concentrations in each sampling point. Bottom: sampling locations used in the seasonal and regression analysis of the Caribbean Sea (08-CAR), Northern Australia (37-NAU), and Southeast Asia (39-SEA).