Table 1. Seasonal and annual sea-to-air fluxes of CO_2 in world's estuaries.

Type	Lon.(°)	Lat.(°)	Spring flux[c] (mmol C m^{-2} d^{-1})	Summer flux (mmol C m^{-2} d^{-1})	Autumn flux (mmol C m^{-2} d^{-1})	Winter flux (mmol C m^{-2} d^{-1})	Annual flux (mol C m^{-2} yr^{-1})	References[f]
1-1 (fjord) (US)[b]	-152.5	57.7	-1.8		1.8		0.001	Takahashi et al. (2012) (LDEO database)
11-1 (fjord) (CA)	-55.8	52.3		-2.1			-0.8	Takahashi et al. (2012) (LDEO database)
14-1 (fjord) (IC)	-23.2	66.2	-0.7	-7.0	-12.9	-4.8	-2.3	Takahashi et al. (2012) (LDEO database)
14-2 (fjord) (IC)	-23.6	66.1		-7.7			-2.8	Takahashi et al. (2012) (LDEO database)
14-3 (fjord) (IC)	-23.7	65.7			5.4		2.0	Takahashi et al. (2012) (LDEO database)
14-4 (fjord) (IC)	-24.1	65.6	-0.3				-0.1	Takahashi et al. (2012) (LDEO database)
14-5 (fjord) (IC)	-18.6	66.0	-48.2	-7.8	-11.2	-9.0	-7.0	Takahashi et al. (2012) (LDEO database)
Aby lagoon (CI)	-3.3	5.4	-10.1	1.2	-11.3	-4.1	-2.7	Kone et al. (2009)
Altamaha Sound (US)	-81.3	31.3	57.8	127.0	79.7	28.5	26.8	Jiang et al. (2008a)
Ambalayaar (IN)	79.3	10.0		-0.02			-0.007	Sarma et al. (2012)
Amur River (RU)	141.1	52.9		0.1	1.5		0.3	Johnson et al. (2009)(WOD09 database)
Ason (ES)	-3.5	43.3		-3.0			-1.1	Ortega et al. (2005)
Aveiro lagoon (PT)	-8.7	40.7					12.4	Borges and Frankignoulle (unpublished)
Baitarani (IN)	86.9	20.5		20.7			7.6	Sarma et al. (2012)
Bancal (PH)	115.0	5.0	2.2				0.8	Chen (unpublished)
Bebar River (MY)	103.4	3.1			17.7		6.5	Chen (unpublished)
Bellamy (US)	-70.9	43.1	-11.0	43.0	6.0		4.6	Hunt et al. (2011)
Betsiboka (MG)	46.3	-15.7					3.3	Ralison et al. (2008)
Bharatakulza (IN)	76.0	11.2		11.7			4.3	Sarma et al. (2012)
Bothnian Bay (FI)	21.0	63.0					3.5	Algesten et al. (2004)
Brazos River (US)	-95.4	28.9					0.033	Zeng et al. (2011)
Brunei River (BN)	96.4	16.5		53.7			19.6	Chen (unpublished)
Cauvery (IN)	79.89	11.26		2.23			0.8	Sarma et al. (2012)
Chalakudi (IN)	76.18	10.69		12.86			4.70	Sarma et al. (2012)
Changjiang (Yantze) (CN)	120.5	31.5	23.5	65.5	33.7	37.8	14.6	Zhai et al. (2007)
Chi Shui River (TW)	120.11	23.29		176		68.5	44.6	Chen (unpublished)
Chilka (lagoon) (IN)	85.5	19.1	9.8	141.0			27.5	Gupta et al. (2008)
Cho Shui River (TW)	120.3	23.9	651.0	13.4			121.0	Chen (unpublished)
Chung Kang River (TW)	120.8	24.7	45.8	53.4	28.8	144.0	24.8	Chen (unpublished)
Churchill River (CA)	-94.2	58.8		1.2	-3.6		-0.4	Stainton (2009)
Citanduy-Manganit (ID)	108.8	-7.7	25.7[d]				9.4	Chen (unpublished)
Ciujung-Kragilan (ID)	106.4	-6.0	36.9[d]				13.5	Chen (unpublished)
Cocheco (US)	-70.8	43.1	2.0	26.0	2.0		3.7	Hunt et al. (2011)
Cochin (IN)	76.0	9.5			267.0	65.0	60.6	Gupta et al. (2008)
Cross Sound (fjord) (US)	-134.1	56.6		-0.2	45.1		8.2	Takahashi et al. (2012) (LDEO database)
Doboy Sound (US)	-81.3	31.4	15.2	47.4	51.0	16.0	11.9	Jiang et al. (2008a)
Douro (PT)	-8.7	41.1			240.0		87.6	Frankignoulle et al. (1998)
Duplin River (US)	-81.3	31.5	53.4	83.0	73.2	23.4	21.3	Wang and Cai (2004)

Type	Lon.(°)	Lat.(°)	Spring flux[c] ($mmol\ C\ m^{-2}\ d^{-1}$)	Summer flux ($mmol\ C\ m^{-2}\ d^{-1}$)	Autumn flux ($mmol\ C\ m^{-2}\ d^{-1}$)	Winter flux ($mmol\ C\ m^{-2}\ d^{-1}$)	Annual flux ($mol\ C\ m^{-2}\ yr^{-1}$)	References[f]
Ebrié lagoon (CI)	-4.3	5.5	56.4	109.0	61.9	47.9	26.6	Kone et al. (2009)
Elbe (DE)	8.8	53.9	180.0				65.7	Frankignoulle et al. (1998)
Ems (DE)	6.9	53.4		110.0			40.2	Frankignoulle et al. (1998)
Endau River (MY)	103.6	2.7			1.0		0.4	Chen (unpublished)
Erh Jen River (TW)	120.2	22.9	68.5	11.1		26.5	12.9	Chen (unpublished)
Florida Bay (US)	-80.8	25.0					1.7	Millero et al. (2001)
Fong Kang River (TW)	120.7	22.2	6.7	-17.9		18.0	0.8	Chen (unpublished)
Gaderu creek (IN)	82.3	16.8		56.0			20.4	Borges et al. (2003)
Gironde (FR)	-1.1	45.6	110.0	110.0	65.0	50.0	30.6	Frankignoulle et al. (1998)
Godavari (IN)	82.3	16.7					8.0	Bouillon et al. (2003), Sarma et al. (2012)
Godthåbsfjord (GL)[e]	-51.9	64.1					-7.25	Rysgaard et al. (2012)
Golfo Almirante Montt (fjord) (CL)	-72.0	-52.1			-17.7[d]		-6.5	Takahashi et al. (2012)(LDEO database)
Great Bay (US)	-70.9	43.1					3.6	Hunt et al. (2011)
Guadalquivir (ES)	-6.0	37.4		104.0			37.9	de la Paz et al. (2007)
Haldia (IN)	88.2	21.9		12.3			4.5	Sarma et al. (2012)
Hanjiang (CN)	116.8	23.4				0.9	0.3	Chen (unpublished)
Ho Ping River (TW)	121.8	24.3	5.3	22.0		68.5	11.7	Chen (unpublished)
Hooghly (IN)	88.0	22.0	31.8	-1.1	16.7	2.5	4.9	Mukhopadhyay et al. (2002)
Hou Lung River (TW)	120.8	24.6	72.9	9.3	7.6	21.0	10.1	Chen (unpublished)
Hsiu Ku Luan River (TW)	121.5	23.5	26.5	41.9		19.2	10.7	Chen (unpublished)
Hua Lien River (TW)	121.6	23.9	93.4	75.3		4.8	21.1	Chen (unpublished)
Hudson River Estuary (US)	-74.0	40.7					5.9	Raymond et al. (1997)
Isla Gordon (fjord) (CL)	-68.9	-55.2			-1.2[d]		-0.4	Takahashi et al. (2012)(LDEO database)
Itacuraca creek Sepetiba (Bay)(BR)	-44.0	-23.0					41.4	Ovalle et al. (1990), Borges et al. (2003)
Jiulong Jiang (Xiamen Bay) (CN)	118.1	24.5					0.5	Dai et al. (2009)
Jiulongjiang (CN)	118.0	24.5				4.3	1.6	Chen (unpublished)
Johor River (MY)	104.0	1.5			2.3		0.8	Chen (unpublished)
Kakinada Bay (IN)	82.3	16.7					3.0	Bouillon et al. (2003)
Kali (IN)	74.2	14.8		3.2			1.2	Sarma et al. (2012)
Kaneohe Bay and stream (US)	-157.8	21.5					1.5	Fagan and Mackenzie (2007)
Kao Ping River (TW)	120.4	22.5	98.1	51.8	30.5	12.4	17.6	Chen (unpublished)
Kapuas River (ID)	109.1	0.1				148.3	54.1	Chen (unpublished)
Kennebec River (US)	-69.8	43.8	22.5	22.0	-0.2	-49.6	-0.5	Takahashi et al. (2012)(LDEO database)
Khura River estuary(TH)	98.3	9.2					35.7	Miyajima et al. (2009)
Kidogoweni creek (Gazi Bay) (KE)	39.5	-4.4				154.4[d]	21.8	Bouillon et al. (2007b)
Kien Vang creeks(VN)	105.1	8.7	32.2		154.7		34.2	Kone and Borges (2008)

Type	Lon.(°)	Lat.(°)	Spring flux[c] (mmol C m^{-2} d^{-1})	Summer flux (mmol C m^{-2} d^{-1})	Autumn flux (mmol C m^{-2} d^{-1})	Winter flux (mmol C m^{-2} d^{-1})	Annual flux (mol C m^{-2} yr^{-1})	References[f]
Klang River (MY)	101.4	3.0			7.7		2.8	Chen (unpublished)
Kobbe fjord (GL)	-51.5	64.2	-2.7		-136.6	-2.6	-17.3	Ruiz-Halpern et al. (2010)
Kochi back waters (IN)	76.4	10.0		8.1			2.9	Sarma et al. (2012)
Kola Bay (RU)	33.4	69.1	-2.5	-0.2	-3.5	-3.9	-0.9	Johnson et al. (2009)(WOD09 database)
Krishna (IN)	81.1	15.8		6.8			2.5	Sarma et al. (2012)
Lan Yang River (TW)	121.8	24.7	65.5	66.0		23.2	18.8	Chen (unpublished)
Liminganlahti Bay (FI)	25.4	64.9		-0.9			-0.9	Silvennoinen et al. (2008)
Lin Pien River (TW)	120.5	22.4	44.4	54.5		49.0	18.0	Chen (unpublished)
Little Bay (US)	-70.9	43.1	-5.1	33.9	3.9		4.0	Hunt et al. (2011)
Loire (FR)	-2.2	47.2			155.0		64.4	Abril et al. (2003)
Luohe (CN)	115.6	22.9				0.1	0.022	Chen (unpublished)
Mahanadi (IN)	86.6	20.0		3.1			1.1	Sarma et al. (2012)
Mahisagar (IN)	72.6	22.1		10.2			3.7	Sarma et al. (2012)
Mandovi (IN)	73.8	15.7		18.1			6.6	Sarma et al. (2012)
Mandovi-Zuari (IN)	73.5	15.3					14.2	Sarma et al. (2001)
Matolo creek (KE)	40.1	-2.1					21.2	Bouillon et al. (2007a)
Mekong (VN)	106.5	10.0					30.8	Borges (unpublished)
Mempawah River (ID)	89.0	22.0		23.2			8.5	Chen (unpublished)
Mtoni (TZ)	39.3	-6.9					2.4	Kristensen et al. (2008)
Nagada creek (Papua New Guinea) (ID)	145.8	-5.2				43.6[d]	15.9	Borges et al. (2003)
Nagavali (IN)	84.0	18.2		0.2			0.1	Sarma et al. (2012)
Nalonghe (CN)	112.0	21.8				10.1	3.7	Chen (unpublished)
Narmada (IN)	73.0	20.2		8.8			3.2	Sarma et al. (2012)
Netravathi (IN)	75.0	12.7		70.7			25.8	Sarma et al. (2012)
Norman's Pond (BS)	-76.1	23.8				13.8	5.0	Borges et al. (2003)
Orinoco River (VE)	-62.3	8.6	31.8				11.6	Takahashi et al. (2012)(LDEO database)
Oyster (US)	-70.9	43.1	-17.2	51.5	2.5		4.5	Hunt et al. (2011)
Pa Chang River (TW)	120.1	23.3	29.9	94.2		34.8	19.3	Chen (unpublished)
Pahang River (MY)	103.5	3.5			3.5		1.3	Chen (unpublished)
Palau lagoon (PW)	134.5	7.5	0.03		-1.0		-0.2	Watanabe et al. (2006)
Parker River estuary (US)	-70.8	42.8		3.2	2.9		1.1	Raymond and Hopkinson (2003)
Pei Kang River (TW)	120.2	23.5	27.3	80.0	35.1	28.8	15.6	Chen (unpublished)
Pei Nan River (TW)	121.2	22.8	155.0	96.2		147.0	48.4	Chen (unpublished)
Penna (IN)	80.2	14.4		5.2			1.9	Sarma et al. (2012)
Piauí River estuary (BR)	-37.5	-11.5					15.0	Souza et al. (2009)
Po Tzu River (TW)	120.1	23.4		85.5		89.9	32.0	Chen (unpublished)
Ponnayaar (IN)	80.3	12.4		96.3			35.2	Chen (unpublished)
Potou lagoon (CI)	-3.8	5.6	40.3	186.0	45.5	82.7	36.8	Kone et al. (2009)
Qiantang River (CN)	122.0	30.1					0.1	Chen (unpublished)

Type	Lon.(°)	Lat.(°)	Spring flux[c] (mmol C m^{-2} d^{-1})	Summer flux (mmol C m^{-2} d^{-1})	Autumn flux (mmol C m^{-2} d^{-1})	Winter flux (mmol C m^{-2} d^{-1})	Annual flux (mol C m^{-2} yr^{-1})	References[f]
Qinjiang (CN)	108.6	21.7				6.3	2.3	Chen (unpublished)
Rajang River (MY)	115.5	2.1			7.1		2.6	Chen (unpublished)
Randers Fjord (DK)	10.3	56.6	-5.0	52.9			8.7	Gazeau et al. (2005)
Ras Dege creek (TZ)	39.3	-6.9					12.0	Kristensen et al. (2008), Bouillon et al. (2007c)
Rhine (NL)	4.1	52.0		160.0	75.1		21.9	Frankignoulle et al. (1998)
Rı´a de Vigo (FR)	8.6	42.1	-0.1	-0.5	0.5	-0.6	-0.1	Á lvarez-Salgado et al. (1999)
Rio San Pedro (ES)	-6.1	36.4					39.4	Ferron et al. (2007)
Rompin River (MY)	103.5	2.8			1.5		0.6	Chen (unpublished)
Rongjiang (CN)	116.7	23.3				14.0	5.1	Chen (unpublished)
Rushikulya (IN)	85.2	19.3		-0.02			-0.01	Sarma et al. (2012)
S. Muar (MY)	102.6	2.0			3.2		1.2	Chen (unpublished)
Sabarmathi (IN)	72.8	21.6		13.8			5.1	Sarma et al. (2012)
Sado (PT)	-8.9	38.5			396.0		145.0	Frankignoulle et al. (1998)
Saja-Besaya (ES)	-4.0	43.4		446.0			163.0	Ortega et al. (2005)
São Francisco Estuary (US)	-122.3	37.7		1.8		0.5	0.4	Peterson (1979)
Sapelo Sound (US)	-81.3	31.6	19.1	41.1	47.1	16.8	10.5	Jiang et al. (2008a)
Saptamukhi creek (IN)	89.0	22.0					20.7	Ghosh et al. (1987), Borges et al. (2003)
Satilla River (US)	-81.5	31.0			116.0		42.5	Cai and Wang (1998)
Scheldt (BE/NL)	3.5	51.4	175.0	233.0	326.0	240.0	94.1	Frankignoulle et al. (1998)
Sedili Besar (MY)	104.1	1.9			12.6		4.6	Chen (unpublished)
Sentosa River (MY)	104.1	1.9			17.2		6.3	Chen (unpublished)
Sharavathi (IN)	74.5	14.4		10.2			3.7	Sarma et al. (2012)
Shark River (US)	-81.1	25.2					16.0	Kone and Borges (2008)
Skeena River (US)	-130.1	53.9			65.6		23.9	Takahashi et al. (2012)(LDEO database)
Subarnalekha (IN)	87.6	21.5		0.03			0.01	Sarma et al. (2012)
Szu Chung River (TW)	120.7	22.1	12.9	50.4		-0.8	7.6	Chen (unpublished)
Ta An River (TW)	120.6	24.4	-0.4	3.4	27.3	17.0	4.3	Chen (unpublished)
Ta Chia River (TW)	120.6	24.3	-6.3	25.3	-29.2		-1.2	Chen (unpublished)
Tagba lagoon (CI)	-5.0	5.4	18.1	114.0	28.5	13.2	18.5	Kone et al. (2009)
Tam Giang creeks (VN)	105.2	8.8	141.5		128.5		49.3	Kone and Borges (2008)
Tamar (UK)	-4.2	50.4	90.1	120.0			38.3	Frankignoulle et al. (1998)
Tan Shui River (TW)	121.5	25.1	168.0	160.0	214.0	3.3	49.8	Chen (unpublished)
Tana (KE)	40.1	-2.1					21.2	Bouillon et al. (2007a)
Tapti (IN)	72.7	21.1		362.5			132.4	Sarma et al. (2012)
Tendo laggon (CI)	-3.2	5.3	-17.7	75.6	-4.9	-3.0	7.0	Kone et al. (2009)
Thames (UK)	0.9	51.5			250.0		91.3	Frankignoulle et al. (1998)
Tou Chien River (TW)	120.9	24.8	55.9	10.5	7.2	46.6	11.0	Chen (unpublished)
Trang River estuary (TH)	99.4	7.2					30.9	Miyajima et al. (2009)
Tseng Wen River (TW)	120.1	23.1	93.2	-1.8	12.4		34.6	Chen (unpublished)

Type	Lon.(°)	Lat.(°)	Spring flux[c] (mmol C m^{-2} d^{-1})	Summer flux (mmol C m^{-2} d^{-1})	Autumn flux (mmol C m^{-2} d^{-1})	Winter flux (mmol C m^{-2} d^{-1})	Annual flux (mol C m^{-2} yr^{-1})	References[f]
Tung Kang River (TW)	120.4	22.5	114.0	160.0	48.9	121.0	40.5	Chen (unpublished)
Urdaibai (ES)	-2.7	43.4		22.8			8.3	Ortega et al. (2005)
Vaigai (IN)	78.9	9.3		0.2			0.1	Sarma et al. (2012)
Vamsadhara (IN)	84.7	18.9		0.4			0.1	Sarma et al. (2012)
Vellar (IN)	79.9	11.7		17.0			6.2	Sarma et al. (2012)
Wadden Sea estuary (NL)	4.8	53.0	-160.0				-58.4	Zemmelink et al. (2009)
Wailoa river-estuary (US)[e]	-159.5	22.2	1032		422	607	251	Paquay et al. (2007)
Wailuku River (US)	-155.08	19.72	5.73				5.73	Paquay et al. (2007)
Wu River (TW)	120.5	24.2	44.4	92.1			24.9	Chen (unpublished)
Yangon (MM)	121.8	31.3				5.4	2.0	Chen (unpublished)
Yen Shui River (TW)	120.2	23.0	50.1	125.0		14.4	23.1	Chen (unpublished)
Yenisey (RU)	82.7	71.8	29.7	16.7	3.5	27.5	7.1	Johnson et al. (2009)(WOD09 database)
York River (US)	-76.4	37.2	10.0	29.0	16.7	6.5	5.6	Raymond et al. (2000)
Zhujiang (Pearl River) (CN)	113.5	22.5	60.2	70.7	47.0	22.2	6.9	Guo et al. (2009)
Zuari (IN)	74.0	15.3		6.4			2.3	Sarma et al. (2012)

[a] Positive fluxes indicate an emission of CO_2 from water to the atmosphere.

[b] BE: Belgium; BN: Brunei; BR: Brazil; BS: Bahamas; CI: Côte d'Ivoire, CL: Chile; CN: China; DE: Germany; DK: Denmark; ES: Spain; FI: Finland; FR: France; GL: Greenland; IC: Iceland; ID: Indonesia; IN: India; KE: Kenya; MG: Repoblikan'i Madagasikara; MM: Myanmar; MY: Malaysia; NL: Netherlands; PH: Philippines; PT: Portugal; PW: Palau; RU: Russia; TH: Thailand; TW: Taiwan; TZ: Tunisia; UK: United Kingdom; US: United States; VE: Venezuela; VN: Viet Nam

[c] spring: March–May; summer: June–August; autumn: September–November; winter: December–February

[d] Austral seasons

[e] not used in the calculation

[f] LDEO: Lamont-Doherty Earth Observatory; WOD09: World Ocean Database 2009

Table 2 The pCO_2 and flux method, the gas exchange coefficient and the wind speed in world's estuaries.

Type[a]	pCO_2 method	Flux method[b]	Gas exchange coefficient	Wind speed	References[c]
1-1(fjord) (US)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
11-1(fjord) (CA)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
14-1(fjord) (IC)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
14-2(fjord) (IC)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
14-3(fjord) (IC)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
14-4(fjord) (IC)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
14-5(fjord) (IC)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
Aby lagoon (CI)	calculated from TA & pH	TBL	Raymond and Cole (2001)	on situ	Koné et al. (2009)
Altamaha Sound (US)	equilibrator	TBL	Wannikhof(1992)	QuikSCAT	Jiang et al. (2008a)
Ambalayaar (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Amur River (RU)	calculated from TA & pH	TBL	Wannikhof(1992)	NCEP/NCAR Reanalysis	NODC database
Ason (ES)	calculated from TA & pH	TBL	Raymond and Cole (2001)	weather station	Ortega et al. (2005)
Aveiro lagoon (PT)	-	-	-	-	Borges and Frankignoulle [unpublished]
Baitarani (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Bancal (PH)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Bebar River (MY)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Bellamy (US)	equilibrator	TBL	Raymond and Cole (2001)	on situ & weather station	Hunt et al. (2011)
Betsiboka (MG)	calculated from TA & pH	TBL	Raymond and Cole (2001)	on situ	Ralison et al. (2008)
Bharatakulza (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Bothnian Bay (FI)	headspace	TBL	Wannikhof(1992)	on situ	Algesten et al. (2004)
Brazos River (US)	headspace	TBL	Raymond et al.(1997); Richey et al.(2002); Zeng andMasiello(2010)	NOAA, National Weather Service	Zeng et al. (2011)
Brunei River (BN)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Cauvery (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Chalakudi (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Changjiang (Yantze) (CN)	equilibrator	TBL	Wanninkhof (1992); Raymond and Cole (2001); Borges et al. (2004)	on situ	Zhai et al. (2007)
Chi Shui River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Chilka (lagoon) (IN)	calculated from DIC & pH	TBL	Borges et al.(2004)	weather station	Gupta et al. (2008)
Cho Shui River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Chung Kang River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Churchill River (CA)	equilibrator	TBL	Wannikhof(1992)	on situ	Stainton (2009)

Type[a]	pCO_2 method	Flux method[b]	Gas exchange coefficient	Wind speed	References[c]
Citanduy-Manganit (ID)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Ciujung-Kragilan (ID)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Cocheco (US)	equilibrator	TBL	Raymond and Cole (2001)	on situ & weather station	Hunt et al. (2011)
Cochin (IN)	calculated from DIC & pH	TBL	Borges et al.(2004)	on situ	Gupta et al. (2009)
Cross Sound (fjord) (US)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
Doboy Sound (US)	equilibrator	TBL	Wannikhof(1992)	QuikSCAT	Jiang et al. (2008a)
Douro (PT)	calculated from TA & pH/equilibrator	TBL/ FCM	constant (8 cm h^{-1})/-	on situ	Frankignoulle et al. (1998)
Duplin River(US)	equilibrator	TBL	Raymond et al. (2000)	on situ	Wang and Cai (2004)
Ebrié lagoon (CI)	calculated from TA & pH	TBL	Raymond and Cole (2001)	on situ	Koné et al. (2009)
Elbe (DE)	calculated from TA & pH/equilibrator	TBL/ FCM	constant (8 cm h^{-1})/-	on situ	Frankignoulle et al. (1998)
Ems (DE)	calculated from TA & pH/equilibrator	TBL/ FCM	constant (8 cm h^{-1})/-	on situ	Frankignoulle et al. (1998)
Endau River (MY)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Erh Jen River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Florida Bay (US)	equilibrator	TBL	constant (4 cm h^{-1})	-	Millero et al. (2001)
Fong Kang River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Gaderu creek(IN)	equilibrator	FCM	-	on situ	Borges et al. (2003)
Gironde (FR)	calculated from TA & pH/equilibrator	TBL/ FCM	constant (8 cm h^{-1})/-	on situ	Frankignoulle et al. (1998)
Godavari (IN)	equilibrator/ calculated from DIC & pH	TBL	Raymond and Cole (2001); Wannikhof(1992)	on situ; weather station	Bouillon et al. (2003); Sarma et al. (2012)
Golfo Almirante Montt (fjord) (CL)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
Great Bay (US)	equilibrator	TBL	Raymond and Cole (2001)	on situ & weather station	Hunt et al. (2011)
Guadalquivir (ES)	equilibrator	TBL	O'Connor and Dobbins(1958); Borges et al.(2004); Carini et al.(1996); Clark et al.(1995); Wannikhof(1992)	on situ	de La Paz et al. (2007)
Haldia (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Hanjiang (CN)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Ho Ping River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Hooghly (IN)	headspace	TBL	Wannikhof(1992)	on situ	Mukhopadhyay et al. (2002)
Hou Lung River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Hsiu Ku Luan River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Hua Lien River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Hudson River Estuary (US)	headspace	TBL	Clark et al.(1994)	weather	Raymond et al. (1997)

Type[a]	pCO_2 method	Flux method[b]	Gas exchange coefficient	Wind speed	References[c]
				station	
Isla Gordon (fjord) (CL)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
Itacuraca creek Sepetiba Bay)(BR)	equilibrator	FCM	-	on situ	Ovalle et al. (1990), Borges et al. (2003)
Jiulong Jiang (Xiamen Bay) (CN)	equilibrator	TBL	Wannikhof(1992)	on situ	Dai et al. (2009)
Jiulongjiang (CN)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Johor River (MY)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Kakinada Bay (IN)	calculated from TA & pH	TBL	Raymond and Cole (2001)	on situ	Bouillon et al. (2003)
Kali (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Kaneohe Bay and stream (US)	calculated from DIC & TA	TBL	Wannikhof(1992)	on situ	Fagan et al. (2007)
Kao Ping River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Kapuas River (ID)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Kennebec River (US)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
Khura River estuary(TH)	-	-	-	-	Miyajima et al. (2009); T. Miyajima [pers. comm.]
Kidogoweni creek (Gazi Bay) (KE)	calculated from TA & pH	TBL	Carini et al.(1996); Raymond and Cole(2001)	on situ	Bouillon et al. (2007a)
Kien Vang creeks(VN)	calculated from TA & pH	TBL	Carini et al.(1996)	on situ	Koné and Borges (2008)
Klang River (MY)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Kobbe fjord (GL)	equilibrator	TBL	Wannikhof(1992); Nightingale et al.(2000)	weather station	Ruiz-Halpern et al. (2010)
Kochi back waters (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Kola Bay (RU)	calculated from TA & pH	TBL	Wannikhof(1992)	NCEP/NCAR Reanalysis	NODC database
Krishna (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Lan Yang River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Liminganlahti Bay (Temmesjoki River) (FI)	equilibrator	TBL/ FCM	Borges et al.(2004)	weather station	Silvennoinen et al. (2008)
Lin Pien River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Little Bay (US)	equilibrator	TBL	Raymond and Cole (2001)	on situ & weather station	Hunt et al. (2011)
Loire (FR)	calculated from TA & pH	TBL	constant (13 cm h^{-1})	-	Abril et al. (2003)
Luohe (CN)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Mahanadi (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Mahisagar (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Mandovi (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Mandovi-Zuari (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	-	Sarma et al. (2001)
Matolo creek (KE)	calculated from TA & pH	TBL	constant (4 cm h^{-1})	-	Bouillon et al (2007b)
Mekong (VN)	-	-	-	-	Borges (unpublished)
Mempawah River (ID)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)

Type[a]	pCO_2 method	Flux method[b]	Gas exchange coefficient	Wind speed	References[c]
Mtoni (TZ)	equilibrator	TBL	Raymond and Cole (2001)	on situ	Kristensen et al. (2008)
Nagada creek (Papua New Guinea) (ID)	equilibrator	FCM	-	on situ	Borges et al. (2003)
Nagavali (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Nalonghe (CN)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Narmada (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Netravathi (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Norman's Pond (BS)	equilibrator	FCM	-	on situ	Borges et al. (2003)
Orinoco River (VE)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
Oyster (US)	equilibrator	TBL	Raymond and Cole (2001)	on situ & weather station	Hunt et al. (2011)
Pa Chang River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Pahang River (MY)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Palau lagoon (PW)	calculated from DIC & TA	TBL	McGillis et al.(2001)	NOAA station	Watanabe et al. (2006)
Parker River estuary (US)	equilibrator	TBL	constant (4 cm h^{-1})	-	Raymond and Hopkinson (2003)
Pei Kang River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Pei Nan River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Penna (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Piauí River estuary (BR)	calculated from DIC & pH	TBL	range (1-3 cm h^{-1})	on situ	Souza et al. (2009)
Po Tzu River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Ponnayaar (IN)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Potou lagoon (CI)	calculated from TA & pH	TBL	Raymond and Cole (2001)	on situ	Koné et al. (2009)
Qiantang River (CN)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Qinjiang (CN)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Rajang River (MY)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Randers Fjord (DK)	equilibrator	TBL	Borges et al.(2004)	on situ	Gazeau et al. (2005)
Ras Dege creek (TZ)	equilibrator/ calculated from TA & pH	TBL	Raymond and Cole (2001)	on situ	Kristensen et al. (2008); Bouillon et al (2007c)
Rhine (NL)	calculated from TA & pH/equilibrator	TBL/FCM	constant (8 cm h^{-1})/-	on situ	Frankignoulle et al. (1998)
Rı´a de Vigo (FR)	calculated from TA & pH	TBL	Liss and Mervilat(1986); Woolf and Thorpe(1991)	estimated	Alvarez-Salgado et al. (1999)
Rio San Pedro (ES)	headspace	TBL	Clark et al.(1995); Carini et al.(1996); Kremer et al.(2003); Borges et al.(2004)	weather station	Ferrón et al. (2007)
Rompin River (MY)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Rongjiang (CN)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Rushikulya (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
S. Muar (MY)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)

Type[a]	pCO_2 method	Flux method[b]	Gas exchange coefficient	Wind speed	References[c]
Sabarmathi (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Sado (PT)	calculated from TA & pH/equilibrator	TBL/FCM	constant ($8\ cm\ h^{-1}$)/-	on situ	Frankignoulle et al. (1998)
Saja-Besaya (ES)	calculated from TA & pH	TBL	Raymond and Cole (2001)	weather station	Ortega et al. (2005)
São Francisco Estuary (US)	calculated from TA & pH	TBL	range (4-8 cm h^{-1})	-	Peterson (1979)
Sapelo Sound (US)	equilibrator	TBL	Jiang et al. (2008a)	QuikSCAT	Jiang et al. (2008a)
Saptamukhi creek (IN)	calculated from TA & pH/ equilibrator	FCM	-	on situ	Ghosh et al. (1987); Borges et al. (2003)
Satilla River (US)	equilibrator	TBL	range (8-17 cm h^{-1})	-	Cai and Wang (1998)
Scheldt (BE/NL)	calculated from TA & pH/equilibrator	TBL/FCM	constant ($8\ cm\ h^{-1}$)/-	on situ	Frankignoulle et al. (1998)
Sedili Besar (MY)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Sentosa River (MY)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Sharavathi (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Shark River (US)	calculated from TA & pH	TBL	Carini et al.(1996)	on situ	Koné and Borges (2008)
Skeena River (US)	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
Subarnalekha (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Szu Chung River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Ta An River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Ta Chia River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Tagba lagoon (CI)	calculated from TA & pH	TBL	Raymond and Cole (2001)	on situ	Koné et al. (2009)
Tam Giang creeks (VN)	calculated from TA & pH	TBL	Carini et al.(1996)	on situ	Koné and Borges (2008)
Tamar (UK)	calculated from TA & pH/equilibrator	TBL/FCM	constant ($8\ cm\ h^{-1}$)/-	on situ	Frankignoulle et al. (1998)
Tan Shui River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Tana (KE)	calculated from TA & pH	TBL	constant (4 cm h^{-1})	-	Bouillon et al (2007b)
Tapti (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Tendo laggon (CI)	calculated from TA & pH	TBL	Raymond and Cole (2001)	on situ	Koné et al. (2009)
Thames (UK)	calculated from TA & pH/equilibrator	TBL/FCM	constant ($8\ cm\ h^{-1}$)/-	on situ	Frankignoulle et al. (1998)
Tou Chien River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Trang River estuary (TH)	-	-	-	-	Miyajima et al. (2009); T. Miyajima [pers. comm.]
Tseng Wen River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Tung Kang River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Urdaibai (ES)	calculated from TA & pH	TBL	Raymond and Cole (2001)	weather station	Ortega et al. (2005)
Vaigai (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)

Type[a]	pCO_2 method	Flux method[b]	Gas exchange coefficient	Wind speed	References[c]
Vamsadhara (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Vellar (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)
Wadden Sea estuary (NL)	calculated from DIC & TA	TBL	Wannikhof(1992)	-	Zemmelink et al. (2009)
Wu River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Yangon (MM)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Yen Shui River (TW)	equilibrator	TBL	Wannikhof(1992)	on situ	Chen (unpublished)
Yenisey (RU)	calculated from TA & pH	TBL	Wannikhof(1992)	NCEP/NCAR Reanalysis	NODC database
York River (US)	equilibrator	TBL	Clark et al. (1994); Carini et al. (1996)	-	Raymond et al. (2000)
Zhujiang (Pearl River) (CN)	equilibrator	TBL	Wannikhof(1992); Borges et al.(2004)	-	Guo et al. (2009)
Zuari (IN)	calculated from DIC & pH	TBL	Wannikhof(1992)	weather station	Sarma et al. (2012)

[a] BE: Belgium; BN: Brunei; BR: Brazil; BS: Bahamas; CI: Côte d'Ivoire, CL: Chile; CN: China; DE: Germany; DK: Denmark; ES: Spain; FI: Finland; FR: France; GL: Greenland; IC: Iceland; ID: Indonesia; IN: India; KE: Kenya; MG: Repoblikan'i Madagasikara; MM: Myanmar; MY: Malaysia; NL: Netherlands; PH: Philippines; PT: Portugal; PW: Palau; RU: Russia; TH: Thailand; TW: Taiwan; TZ: Tunisia; UK: United Kingdom; US: United States; VE: Venezuela; VN: Viet Nam

[b] TBL: thin boundary layer method; FCM: floating chamber method

[c] LDEO: Lamont-Doherty Earth Observatory; WOD09: World Ocean Database 2009

Table 3. Areas and air-sea fluxes of CO_2 in estuaries and continental shelves by biogeochemical provinces (Laruelle et al., 2013).

MARCATS Segments Number	continent	ocean	System Name	Class	Estuarine Surface (10^3 km^2)	Average CO_2 flux (mol C m^{-2} yr^{-1})	CO_2 flux (TgC yr^{-1})	Shelf Surface (10^3 km^2)	Average CO_2 flux (mol C m^{-2} yr^{-1})	CO_2 flux (TgC yr^{-1})
1	NA	PA	North Eastern Pacific	Subpolar	33.9	10.71 (n=3)	4.36	461	-3.51 (n=3)	-19.40
2	NA/OC	PA	Californian Current	EBC	8.9	0.93 (n=3)	0.10	214	-2.22 (n=3)	-5.69
3	NA	PA	Tropical Eastern Pacific	Tropical	6.2	14.47	1.08	198	-0.05 (n=2)	-0.13
4	SA	PA	Peruvian Upwelling Current	EBC	4.2	34.71	1.75	143	-0.62 (n=4)	-1.07
5	SA	AT	Southern America	Subpolar	22	-3.46 (n=2)	-0.91	1230	-3.25 (n=3)	-47.98
6	SA	AT	Brazilian Current	WBC	26.3	28.20 (n=2)	8.90	521	3.97 (n=1)	24.81
7	SA	AT	Tropical Western Atlantic	Tropical	13.4	11.60 (n=1)	1.87	517	-12.78 (n=1)	-79.26
8	NA	AT	Caribbean Sea	Tropical	26.2	5.04 (n=1)	1.58	344	0.66 (n=1)	2.74
9	NA	AT	Gulf of Mexico	Marginal Sea	31.9	8.02 (n=2)	3.07	544	-0.19 (n=2)	-1.26
10	NA	AT	Florida Upwelling	WBC	34	9.81 (n=15)	4.00	858	-1.10 (n=4)	-11.27
11	NA	AT	Sea of Labrador	Subpolar	36.1	-0.76 (n=1)	-0.33	395	-2.11 (n=1)	-10.02
12	NA	AT	Hudson Bay	Marginal Sea	39	-0.44 (n=1)	-0.20	1064	0.84 (n=1)	10.73
13	NA	AR	Canadian Archipelagos	Polar	163.7	-1.08	-2.11	1177	-4.06 (n=2)	-57.34
14	NA	AR	Northern Greenland	Polar	24.1	-2.05 (n=5)	-0.59	614	6.14 (n=1)	45.20
15	NA	AR	Southern Greenland	Polar	8.8	-1.08	-0.11	270	-5.95 (n=1)	-19.29
16	EU	AR	Norwegian Basin	Polar	17	-17.30 (n=1)	-3.53	171	-3.63 (n=1)	-7.45
17	EU	AT	North Eastern Atlantic	Marginal Sea	37.6	37.73 (n=8)	17.02	1112	-1.04 (n=2)	-13.88
18	EU	AT	Baltic Sea	Marginal Sea	26.3	1.28 (n=2)	0.40	383	-1.95 (n=1)	-8.96
19	EU	AT	Iberian Upwelling	EBC	12.7	58.75 (n=10)	8.95	283	-1.33 (n=5)	-4.51
20	EU	AT	Mediterranean Sea	Marginal Sea	15.1	-0.06 (n=1)	-0.01	580	1.47 (n=3)	10.21
21	EU	AT	Black Sea	Marginal Sea	10.3	10.00	1.24	172	-0.79	-1.63
22	AF	AT	Moroccan Upwelling	EBC	5.6	34.71	2.33	225	3.02 (n=1)	8.15
23	AF	AT	Tropical Eastern Atlantic	Tropical	26.6	17.25 (n=5)	5.51	284	0.29 (n=1)	0.99
24	AF	AT	Southern Western Africa	EBC	1.7	34.71	0.71	308	-2.41 (n=1)	-8.91
25	AF	IN	Agulhas Current	WBC	28.4	14.52	4.95	254	-4.03 (n=1)	-12.28
26	AF	IN	Tropical Western Indian	Tropical	5.8	15.73 (n=5)	1.09	72	1.03 (n=1)	0.89
27	AF	IN	Western Arabian Sea	Indian Margins	2	3.32 (n=1)	0.08	102	-0.32 (n=2)	-0.40
28	AF	IN	Red Sea	Marginal Sea	0.04	10.00	0.005	190	0.12 (n=2)	0.28
29	AS	IN	Persian Gulf	Marginal Sea	2.3	10.00	0.28	233	-0.79	-2.20
30	AS	IN	Eastern Arabian Sea	Indian Margins	14.5	9.02 (n=25)	1.57	342	0.01 (n=1)	0.06
31	AS	IN	Bay of Bengal	Indian Margins	10.1	19.82 (n=10)	2.40	230	-0.22 (n=1)	-0.60
32	AS	IN	Tropical Eastern Indian	Indian Margins	16.2	13.73 (n=6)	2.67	809	-0.28 (n=4)	-2.74
33	OC	IN	Leeuwin Current	EBC	0.6	34.71	0.25	118	-0.58 (n=1)	-0.82
34	OC	PA	Southern Australia	Subpolar	13.1	2.82	0.44	452	-0.94 (n=1)	-5.12
35	OC	PA	Eastern Australian Current	WBC	7.9	14.52	1.38	139	-0.19 (n=3)	-0.31
36	OC	PA	New Zealand	Subpolar	7.3	2.82	0.25	283	-0.17 (n=1)	-0.58
37	AS	PA	Northern Australia	Tropical	40.5	15.90 (n=1)	7.73	2463	0.11 (n=3)	3.35

MARCATS Segments Number	continent	ocean	System Name	Class	Estuarine Surface (10^3 km^2)	Average CO_2 flux (mol C m^{-2} yr^{-1})	CO_2 flux (TgC yr^{-1})	Shelf Surface (10^3 km^2)	Average CO_2 flux (mol C m^{-2} yr^{-1})	CO_2 flux (TgC yr^{-1})
38	AS	PA	South East Asia	Tropical	45.6	17.70 (n=49)	9.68	2318	0.86 (n=1)	23.92
39	AS	PA	East China Sea and Kuroshio	WBC	27.8	7.33 (n=2)	2.44	1299	1.04 (n=8)	16.26
40	AS	PA	Sea of Japan	Marginal Sea	6.7	10.00	0.80	277	-3.89 (n=2)	-12.93
41	AS	PA	Sea of Okhotsk	Marginal Sea	19.7	0.30 (n=1)	0.07	992	-1.67 (n=1)	-19.82
42	AS	PA	North Western Pacific	Subpolar	22.3	2.82	0.76	1082	-2.12 (n=2)	-27.56
43	AS	AR	Siberian Shelves	Polar	37.8	-1.08	-0.49	1918	0.01 (n=1)	0.25
44	AS	AR	Barent and Kara Seas	Polar	72.2	3.07 (n=2)	2.66	1727	0.01 (n=1)	0.23
45	AN	AN	Antarctic Shelves	Polar	–			2952	-1.98 (n=2)	-69.96
Total					1012.44	7.74	94.08	30320	-1.09	-395.71

*Shaded area is regions without data and data from a similar region is given.

Table 4. Summary of reported total air-to-sea fluxes of CO_2 in world's estuaries.

	Unit area flux (mol C m^{-2} yr^{-1})	Area (10^6 km^2)	Total flux (PgC yr^{-1})	References
Estuaries (n=19)	35.71	1.40	0.60	Abril and Borges (2005)
Estuaries (n=16)	38.12	0.94	0.43	Borges (2005)
Non-estuarine salt marshes (n=1)	23.45	0.14	0.04	
Mangroves	13.66	0.20	0.04	
Ave/Total	33.20	1.28	0.51	
Estuaries (n=16)	28.62	0.94	0.32	Borges et al. (2005)
Non-estuarine salt marshes	21.40	0.14	0.036	
Mangroves	18.66	0.15	0.033	
Ave/Total	26.42	1.23	0.39	
Estuaries (n=32)	32.10	0.943	0.36	Chen and Borges (2009)
Non-estuarine salt marshes	30.40	0.384	0.09	
Mangroves	27.10	0.147	0.05	
Ave/Total	28.27	1.474	0.50	
Small deltas and estuaries	25.7±15.8	0.084	0.026±0.016	Laruelle et al. (2010)
Tidal systems and embayments	28.5±24.9	0.276	0.094±0.082	
Lagoons	17.3±16.6	0.252	0.052±0.050	
Fjords and fjards	17.5±14.0	0.456	0.096±0.077	
Ave/Total (n=60)	21.0±17.6	1.067	0.268±0.225	
Estuaries (including both river-dominated and nonriverine coastal lagoons)	20.83	1.05	0.25	Cai (2011)
Estuaries (n=106)	23.9±33.1	1.07	0.26	Chen et al. (2012)
Estuaries (n=165)	7.74	1.01	0.094	This study

Table 5. Seasonal and annual air-sea fluxes of CO_2 in world's continental shelves.

Type	Lon.(°)	Lat.(°)	Spring fluxes[b] (mmol C m^{-2} d^{-1})	Summer fluxes (mmol C m^{-2} d^{-1})	Autumn fluxes (mmol C m^{-2} d^{-1})	Winter fluxes (mmol C m^{-2} d^{-1})	Annual flux (mol C m^{-2} yr^{-1})	References
1 NEP	-155.9	56.4	-9.31	-12.22	-10.30		-3.87	Pfeil et al. (2012)(SOCAT database)
10T	-1.7	4.5	-0.80				0.29	Takahashi et al. (2012)(LDEO database)
11EBC	20.1	-35.7		-5.79[c]	-7.42[c]		-2.41	Takahashi et al. (2012)(LDEO database)
11LAB	-53.4	47.0	-9.77	0.46	-5.91	-7.95	-2.11	Pfeil et al. (2012)(SOCAT database)
14 NGR	-14.0	69.2	-14.98	-18.64			-6.14	Pfeil et al. (2012)(SOCAT database)
14WBC	26.2	-34.1		-11.04[c]			-4.03	Takahashi et al. (2012)(LDEO database)
15 SGR	-28.5	63.8	-16.61	-40.20	-6.07	-2.37	-5.95	Pfeil et al. (2012)(SOCAT database)
16 NOR	14.1	66.9	-11.65	-6.41	-12.77	-8.93	-3.63	Pfeil et al. (2012)(SOCAT database)
17EBC	114.8	-29.9	-3.23[c]		-3.94[c]		-1.31	Pfeil et al. (2012)(SOCAT database)
20 MED	3.1	39.5	-0.31	0.06	0.33	-2.28	-0.20	Pfeil et al. (2012)(SOCAT database)
22 MOR	-16.7	18.8	20.22	4.00	0.59		3.02	Pfeil et al. (2012)(SOCAT database)
26 TWI	46.4	-12.4			2.83[c]		1.03	Pfeil et al. (2012)(SOCAT database)
27WAS	57.1	25.3	0.71	0.66			0.25	Pfeil et al. (2012)(SOCAT database)
28 RED	32.7	29.2		0.23	1.06		0.23	Pfeil et al. (2012)(SOCAT database)
3 TEP	-82.5	8.8	1.99	-1.29	-1.28	-0.39	-0.09	Pfeil et al. (2012)(SOCAT database)
31 BEN	92.4	19.7				-0.59	-0.22	Pfeil et al. (2012)(SOCAT database)
33 LEE	113.5	-27.4	-4.27[c]	-0.39[c]	-0.10[c]		-0.58	Pfeil et al. (2012)(SOCAT database)
34 SAU	146.8	-42.1	-4.21[c]	-1.39[c]	-1.42[c]	-3.34[c]	-0.94	Pfeil et al. (2012)(SOCAT database)
39 CSK	150.2	45.6				20.05	7.32	Pfeil et al. (2012)(SOCAT database)
4 HUM-1	-77.8	-11.6			-0.14[c]		-0.05	Takahashi et al. (2012)(LDEO database)
4 HUM-2	-80.0	-26.3		-0.91[c]			-0.33	Takahashi et al. (2012)(LDEO database)
4 HUM-3	-73.1	-36.1		-11.82[c]			-4.32	Takahashi et al. (2012)(LDEO database)
42 NWP	-169.1	60.4	-33.81	-13.73	-3.41	6.61	-4.05	Pfeil et al. (2012)(SOCAT database)
4HUM-4	-72.7	-36.7	-2.14[c]	9.74[c]	10.53[c]		2.20	Pfeil et al. (2012)(SOCAT database)
5 SAM	-71.8	-50.5		-18.15[c]			-6.62	Pfeil et al. (2012)(SOCAT database)
6WBC-1	-56.5	-37.8		-4.56[c]	-5.19[c]		-1.78	Takahashi et al. (2012)(LDEO database)
6WBC-2	-47.4	-25.7		10.87[c]			3.97	Takahashi et al. (2012)(LDEO database)
8 CAR	-68.0	17.3	0.86	3.76	2.58	0.07	0.66	Pfeil et al. (2012)(SOCAT database)
Amazon River Plume	-52.5	6					-12.78	Ternon et al. (2000), Kortzinger (2003)
Arafura Sea	136.3	-9.9	-0.02[c]				-0.01	Hydes et al. (2012)
Atlantic Bight (Middle)	-74.5	38.5					-1.8	DeGrandpre et al. (2002)
Atlantic Bight (Southern)	-80.6	31	-0.44	-0.22	-0.24	-0.26	-0.48	Jiang et al. (2008b)
Baltic Sea	20; 13.9	57; 54.9	-92.9	-66.5	-3.6	-34.4	-1.95	Thomas and Schneider (1999), Kuss et al. (2006)
Bass Strait	148.0	-38.8		-0.11[c]	-0.73[c]		-0.15	Hydes et al. (2012)
Bay of Biscay (Northern)	-7.9	49					-0.8	Borges et al. (2006)
Bay of Biscay (Southern)	-3.5	46.5					-2.65	de la Paz et al. (2010)

Type	Lon.(°)	Lat.(°)	Spring fluxes[b] (mmol C m^{-2} d^{-1})	Summer fluxes (mmol C m^{-2} d^{-1})	Autumn fluxes (mmol C m^{-2} d^{-1})	Winter fluxes (mmol C m^{-2} d^{-1})	Annual flux (mol C m^{-2} yr^{-1})	References
Beaufort Shelves	-155	72		-2.81			-2.79	Murata and Takizawa (2003), Cai et al. (2006)
Bering Sea Shelf	-165	57	-1.2	-0.66			-6.15	Nedashkovsky et al. (1995), Codispoti et al. (1986), Walsh and Dieterle (1994)
Bering Sea Shelf	-165.4	56.7					-8	Codispoti et al. (1986)
Bristol Bay	-164	58					-0.2	Borges et al. (2005), Kelley and Hood (1971), Codispoti et al. (1986), Chen (1993), Murata and Takizawa (2003)
Canterbury Bight	170.7	-45.8	-0.64[c]	-0.43[c]	-0.41[c]	-0.37[c]	-0.17	Guilderson et al. (2005)
Chukchi Sea	-165	72.5	-0.05	-2.3	-2.47	-0.04	-5.33	Bates (2006)
Coastal Calif. (Monterey Bay)	-121.9	36.9					0.05	Friederich et al. (2002)
East China Sea (Middle)	124	31	-8.8	-4.9	2.9	-10.4	-1.9	Zhai and Dai (2009)
East China Sea(Northern)	126	33	-5.04	-2.52	1.9		-0.79	Shim et al. (2007)
East China Sea(Southern Eastern)	125	30	-4.87	-3.32	-5.14	-8.57	-1.45	Wang et al. (2000)
English Channel	-1.2	50.2					-0.15	Borges and Frankignoulle (2003), Thomas et al. (2007)
Funka Bay	140.6	42.3					-7	Nakayama et al. (2000)
Gray's Reef	-80.9	31.4	0.28	-0.35	-0.01	-1.72	-0.16	Sabine et al. (2012)
Great Barrier Reef	145.5	-15					0.33	Kawahata et al. (1999)
Gulf of Biscay	-6.5	49	-6.98	-15.08	-1.43	0.94	-2.88	Frankignoulle and Borges (2001)
Gulf of Cadiz	-6.5	36.75	-0.85	1.45	-0.4	-1.75	-0.16	Ribas-Ribas et al. (2011), Huertas et al. (2006[e])
Gulf of Lion	4	43					7.1	de Madron et al. (2010)
Gulf of Mexico Shelf (Northwest)	-88.6	30.0	-1.35	-0.16	-0.31		-0.22	Sabine et al. (2012)
Gulf of Nicoya	-84.9	9.6			-0.05		-0.02	Pfeil et al. (2012)(SOCAT database)
Gulf of Trieste	13.6	45.7					-2.5	Turk et al. (2010)
Hudson Bay	-85	59		5.43	0.77		0.84	Else et al. (2008)
Ishigaki Island[e]	124.3	24.4	-27		55	25	6.45	Kayanne et al. (2005)
Java Sea	112.9	-5.6	0.26[c]	-0.01[c]	0.07[c]	0.23[c]	0.05	Hydes et al. (2012)
Jiaozhou Bay	120.3	36.15	4.14	19.47	17.07	-0.15	3.7	Li et al. (2007)
Kaneohe Bay	-157.8	21.5					1.45	Fagan and Mackenzie (2007)
Kara Sea	74.0	74.0					0.01	Fransson et al. (2001)
La Push	-125.0	48.0		-1.62	0.14		-0.27	Sabine et al. (2011)
Laptev Sea	130.0	74.0					0.01	Fransson et al. (2001)
Malacca Strait	101.6	2.4	-0.10		0.63		0.10	Hydes et al. (2012)
Moorea[e]	-149.9	-17.5		1.5[c]		-1.2[c]	0.05	Frankignoulle et al. (1996), Gattuso et al. (1993)
New Jersey Coast	-74.2	39.4					-0.68	Boehme et al. (1998)
North Coastal of California	-123.8	39.0		2.52			0.92	Pfeil et al. (2012)(SOCAT database)
North Sea (Northern and Middle)	2.6	56.7					-1.38	Thomas et al. (2004)
North Sea (Southern)	2.5	52.0	-12.47	6.8	4.35	-0.35	-0.7	Schiettecatte et al. (2007), Hoppema (1991[e])

Type	Lon.(°)	Lat.(°)	Spring fluxes[b] (mmol C m^{-2} d^{-1})	Summer fluxes (mmol C m^{-2} d^{-1})	Autumn fluxes (mmol C m^{-2} d^{-1})	Winter fluxes (mmol C m^{-2} d^{-1})	Annual flux (mol C m^{-2} yr^{-1})	References
Northeast Coastal of Australia	151.5	-23.5	-0.16[c]	0.28[c]	0.04[c]		0.02	Takahashi et al. (2012)(LDEO database)
NorthEast Sunda Shelf	105.7	0.7	-0.04		0.28	0.01	0.03	Hydes et al. (2012), Chen unpublished
Okhotsk Sea	143.5	44.5		-4.1			-1.67	Chen et al. (2003), Otsuki et al. (2003), Wakita et al. (2003)
Omani coast	59.0	20.0	0.75	-7.13	-0.95	-1.17	-0.9	Goyet et al. (1998)
Oregon Coast	-124.5	44.5		-20			-7.3	Hales et al. (2005)
Otaru Bay	141.0	43.3	-8.8	-8.9	7.4	-6.9	-0.78	Sakamoto et al. (2008)
Palau Islands[e]	134.4	7.4		33	49		15.0	Kayanne et al. (2005)
Patagonian shelf	-65.0	-45.0	-7[c]	-3.8[c]	-2.9[c]	-1[c]	-1.35	Bianchi and Allison (2009)
Prydz Bay	78.9	-68.6				-75[c]	-2.45	Gibson and Trull (1999), Borges et al., (2005), Wang et al. (1998)
Red Sea	42.8	13.4			0.04		0.01	Hydes et al. (2012)
Ross Sea	180.0	-75.0				-13[c]	-1.5	Sweeney (2003), Wang et al. (1998), Bates et al. (1998)
Scotian shelf	-63.0	44.0	1.6	-3.1	-5.9	-8.3	-1.42	Shadwick et al. (2011)
Sortheast Coastal of Australia	152.4	-32.8	-0.74[c]	-0.57[c]			-0.24	Takahashi et al. (2012)(LDEO database)
South China Sea (Northern)	116.0	22.0	2.7	7.5	1.4		0.86	Zhai et al. (2005), Zhai et al. (2007)
Sydney Coast (Port Hacking time series station)	151.2	-34.1					-0.17	McNeil (2010)
Taiwan St.[e]	120.3	25.0	-17.6				-6.4	Ma et al. (1999)
Vancouver Is. Coast	-126.0	49.0					-0.5	Ianson and Allen (2002)
West Coastal of India	74.0	14.1	0.06		0.03	0.03	0.01	Hydes et al. (2012)
Yellow Sea	122.0	35.5	-4.4	1.8	-4.4	-13	-2.2	Oh et al. (2000), Wang et al. (2001)
Yellow Sea (Northern)	122.5	38.5	1.88	3.38	1.39	0.24	1.68	Xue et al. (2012)
Yellow Sea (Southern)	122.0	34.5	4.47	1.56	4.85		1.99	Xue et al. (2011)

[a] Positive fluxes indicate an emission of CO_2 from water to the atmosphere.
[b] Spring: March–May; Summer: June–August; Autumn: September–November; Winter: December–February
[c] Austral seasons
[d] not used in the calculation
e LDEO: Lamont-Doherty Earth Observatory; SOCAT: Surface Ocean CO_2 Atlas

Table 6 The pCO_2 and flux method, the gas exchange coefficient and the wind speed in world's continental shelves.

Type	pCO_2 method	Flux method[a]	Gas exchange coefficient	Wind speed	References[b]
1 NEP	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
10T	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
11EBC	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
11LAB	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
14 NGR	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
14WBC	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
15 SGR	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
16 NOR	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
17EBC	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
20 MED	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
22 MOR	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
26 TWI	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
27WAS	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
28 RED	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
3 TEP	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
31 BEN	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
33 LEE	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
34 SAU	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
39 CSK	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
4 HUM-1	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
4 HUM-2	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
4 HUM-3	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
42 NWP	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
4HUM-4	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
5 SAM	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
6WBC-1	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
6WBC-2	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
8 CAR	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)

Type	pCO_2 method	Flux method[a]	Gas exchange coefficient	Wind speed	References[b]
Amazon River Plume	equilibrator/ calculated from DIC & pH	TBL	Liss and Merlivat (1986); Wanninkhof (1992)	on situ/ COADS wind speed climatology	Ternon et al. (2000), Kortzinger (2003)
Arafura Sea	calculated from DIC & TA	TBL	Wanninkhof (1992)	WindSat	Hydes et al., 2012
Atlantic Bight (Middle)	equilibrator	TBL	Liss and Merlivat (1986); Wanninkhof (1992)	NOAA NDBC buoys	DeGrandpre et al. (2002)
Atlantic Bight (Southern)	equilibrator	TBL	Wannikhof(1992); Wanninkhof and McGillis(1999); Nightingale et al.(2000); McGillis et al.(2001); McGillis et al.(2004); Ho et al.(2006)	QuikSCAT	Jiang et al. (2008)
Baltic Sea	equilibrator	TBL	Wanninkhof (1992); Kuss et al. (2004)	weather station/ MARNET data set	1. Thomas and Schneider (1999); 2. Kuss et al. (2006)
Bass Strait	calculated from DIC & TA	TBL	Wanninkhof (1992)	WindSat	Hydes et al., 2012
Bay of Biscay (Northern)	equilibrator/ calculated from TA & pH	TBL	Liss and Merlivat (1986); Tans et al. (1990); Wanninkhof (1992)	on situ	Borges et al. (2006)
Bay of Biscay (Southern)	equilibrator	TBL	Wanninkhof (1992)	NCEP/NCAR Reanalysis	de la Paz et al. (2010)
Beaufort Shelves	equilibrator	TBL	Liss and Merlivat (1986); Wanninkhof (1992); Wannkhof and McGillis (1999); Nightingale et al. (2000)	on situ	1. Murata and Takizawa (2003); 2. Cai et al. (2006)
Bering Sea Shelf	equilibrator	TBL	Broecker et al. (1980); Broecker and Peng (1982)	-	1.Nedashkovsky et al. (1995); 2.Codispoti et al. (1986); 3. Walsh and Dieterle (1994)
Bering Sea Shelf	equilibrator	TBL	Broecker et al. (1980)	-	Codispoti et al. (1986)
Bristol Bay	equilibrator/ calculated from TA & pH	TBL	Broecker et al. (1980); Liss and Merlivat (1986); Wanninkhof (1992); Wannkhof and McGillis (1999); Nightingale et al. (2000)	on situ	Borges et al. (2005) based on Kelly & Hood (1971), Codispoti et al. (1986), Chen (1993), Murata & Takiwaza (2003)
Canterbury Bight	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
Chukchi Sea	calculated from DIC & TA	TBL	Wannikhof(1992)	NCEP/NCAR Reanalysis	Bates (2006)

Type	pCO_2 method	Flux method[a]	Gas exchange coefficient	Wind speed	References[b]
Coastal Calif. (M-1; Monterey Bay)	equilibrator	TBL	Wanninkhof and McGillis (1999)	on situ	Friederich et al. (2002)
EAST China Sea (Middle)	equilibrator	TBL	Wannikhof(1992)	on situ	Zhai & Dai (2009)
East China Sea(Northern)	equilibrator	TBL	Liss and Merlivat (1986); Wanninkhof (1992)	on situ/ QuikSCAT	Shim et al. (2007)
East China Sea(Southern Eastern)	equilibrator	TBL	Liss and Merlivat (1986); Tans et al. (1990); Wanninkhof (1992)	on situ	Wang et al. (2000)
English Channel	equilibrator	TBL	Nightingale et al. (2000)	PFEL/ FNMOC	1. Borges and Frankignoulle, 2003; 2. Thomas et al. (2008)
Funka Bay	calculated from DIC & pH	-	estimated from the $\delta^{13}C$ budget	-	Nakayama et al. (2000)
Gray's Reef	equilibrator	TBL	Wannikhof(1992)	WindSat	Sabine et al. (2012)
Great Barrier Reef	equilibrator	TBL	Liss and Merlivat (1986); Wanninkhof (1992)	on situ	Kawahata et al. (2000)
Gulf of Biscay	equilibrator	TBL	Liss and Merlivat (1986); Tans et al. (1990); Wanninkhof (1992)	on situ	Frankignoulle and Borges (2001)
Gulf of Cadiz	equilibrator	TBL	Wannikhof(1992)	buoy	Ribas-Ribas et al (2010)
Gulf of Lion	-	-	-	-	de Madron et al. (2008)
Gulf of Maine	equilibrator	TBL	Wannikhof(1992)	NDBC station	Salisbury et al. (2009)
Gulf of Mexico Shelf (Northwest)	equilibrator	TBL	Wannikhof(1992)	WindSat	Sabine et al. (2012)
Gulf of Nicoya	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
Gulf of Trieste	equilibrator	TBL	Wannikhof(1992)	buoy	Turk et al. (2010)
Hudson Bay	equilibrator	TBL	Wannikhof(1992)	Nightingale et al. (2000); NCEP/NCAR Reanalysis	Else et al. (2008)
Java Sea	calculated from DIC & TA	TBL	Wanninkhof (1992)	WindSat	Hydes et al., 2012
Jiaozhou Bay	calculated from DIC & pH	TBL	Wanninkhof (1992)	weather station	Li et al. (2007)
Kaneohe Bay	equilibrator/ calculated from DIC & TA	TBL	Liss and Merlivat (1986); Wanninkhof (1992); Wannkhof and McGillis (1999); Nightingale et al. (2000)	weather station	Fagan & Mackenzie (2007)
Kara Sea	-	Redfield ratio	-	-	Fransson et al. (2001)
La Push	equilibrator	TBL	Wannikhof(1992)	WindSat	Sabine et al. (2011)
Laptev Sea	-	Redfield ratio	-	-	Fransson et al. (2001)
Malacca Strait	calculated from DIC & TA	TBL	Wanninkhof (1992)	WindSat	Hydes et al., 2012

Type	pCO_2 method	Flux method[a]	Gas exchange coefficient	Wind speed	References[b]
New Jersey Coast	equilibrator	TBL	Liss and Merlivat (1986); Tans et al. (1990); Wanninkhof (1992)	buoy	Boehme et al. (1998)
North Coastal of Califorina	equilibrator	TBL	Wannikhof(1992)	WindSat	Pfeil et al., 2012 (SOCAT database)
North Sea (Northern and Middle)	equilibrator	TBL	Wannkhof and McGillis (1999)	The European Centre for Medium-Range Weather Forecasts	Thomas et al. (2004)
North Sea (Southern)	equilibrator	TBL	Wannikhof(1992); Wanninkhof and McGillis(1999); Nightingale et al.(2000)	weather station	Schiettecatte et al. (2007)
Northeast Coastal of Australia	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
NorthEast Sunda Shelf	calculated from DIC & TA	TBL	Wanninkhof (1992)	WindSat	1. Hydes et al., 2012; 2. Chen unpublished
Okhotsk Sea	calculated from DIC & TA	TBL	Wanninkhof (1992)	-	1. Chen et al. (2003); 2. Otsuki et al. (2003); 3. Wakita et al. (2003)
Omani coast	equilibrator	TBL	Wannikhof(1992)	FNMOC	Goyet et al. (1998)
Oregon Coast	equilibrator	TBL	McGillis et al. (2001)	buoy	Hales et al. (2005)
Otaru Bay	calculated from DIC & TA	TBL	Wanninkhof et al. (1999)	weather station	Sakamoto et al. (2008)
Patagonian shelf	equilibrator	TBL	Ho et al. (2006)	QuikSCAT	Bianchi et al. (2009)
Prydz Bay	calculated from DIC & pH/ equilibrator	TBL	Wannikhof(1992)	weather station	Gibson & Trull (1999) 2. Borges et al. (2005); 3. Wang et al. (1998)
Red Sea	calculated from DIC & TA	TBL	Wanninkhof (1992)	WindSat	Hydes et al., 2012
Ross Sea	equilibrator	TBL	Wannikhof(1992)	NCEP/NCAR Reanalysis	Sweeney (2003); 2. Wang et al. (1998); 3. Bates et al. (1998)
Scotian shelf	equilibrator	TBL	Wannikhof(1992)	weather station	Shadwick et al. (2011)
Sortheast Coastal of Australia	equilibrator	TBL	Wannikhof(1992)	WindSat	Takahashi et al., 2012 (LDEO database)
South China Sea (Northern)	equilibrator	TBL	Wannikhof(1992); Raymond and Cole (2001); Borges et al. (2004)	on situ	Zhai et al. (2005, 2007)
Sydney Coast (Port Hacking time series station)	calculated from DIC & TA	TBL	-	weather station	McNeil, 2010
Taiwan St.	-	-	-	-	Ma et al. (1999)
Vancouver Is. Coast	calculated from DIC & TA	TBL	Wannikhof(1992)	Faucher et al. (1999)	Ianson and Allen (2002)
West Coastal of India	calculated from DIC & TA	TBL	Wanninkhof (1992)	WindSat	Hydes et al., 2012
Yellow Sea	equilibrator	TBL	Wannikhof(1992)	Na et al. (1992)	1.Oh et al. (2000); 2. Wang et al. (2001)
Yellow Sea (Northern)	equilibrator	TBL	Wannikhof(1992)	QuikSCAT	Xue et al. (2012)
Yellow Sea (Southern)	equilibrator	TBL	Wannikhof(1992)	QuikSCAT	Xue et al. (2011)

Type	pCO_2 method	Flux method[a]	Gas exchange coefficient	Wind speed	References[b]

[a] TBL: thin boundary layer method; FCM: floating chamber method
[b] LDEO: Lamont-Doherty Earth Observatory; SOCAT: Surface Ocean CO_2 Atlas

Table 7. Summary of reported annual global air-sea CO_2 fluxes in world's continental shelves.

CO_2 sink in the coastal ocean (PgC yr^{-1})	References
-1.00	Tsunogai et al. (1999)
-0.10	Liu et al. (2000)
0.50	Fasham et al. (2001)
-0.60	Yool and Fasham (2001)
-0.24	Rabouille et al. (2001)
-0.30	Chen et al. (2003)
-0.36	Chen (2004)
-0.40	Thomas et al. (2004)
-0.90	Ducklow and McCallister (2004)
-0.37	Borges (2005)
-0.45	Borges et al. (2005)
-0.22	Cai et al. (2006)
-0.33 to -0.36	Chen and Borges (2009)
-0.21	Laruelle et al. (2010)
-0.25	Cai (2011)
-0.40	This study