Supplement of Atmos. Chem. Phys., 18, 4229–4250, 2018
https://doi.org/10.5194/acp-18-4229-2018-supplement

Supplement of

Potential of European $^{14}CO_2$ observation network to estimate the fossil fuel CO_2 emissions via atmospheric inversions

Yilong Wang et al.

Correspondence to: Yilong Wang (yilong.wang@lsce.ipsl.fr)

Supplementary Information: Wang et al., 2017, Potential of European $^{14}CO_2$ observation network to estimate the fossil fuel CO_2 emissions via atmospheric inversions

Table S1 Global configuration of the 56 regions

No.	Region	No.	Region	No.	Region
1	Ireland	20	US 3	39	China 4
2	northern UK	21	US 4	40	China 5
3	southern UK	22	US 5	41	China 6
4	Benelux	23	US 6	42	China 7
5	Switzerland/Swiss	24	US 7	43	China 8
6	northern Italy	25	US 8	44	China 9
7	southern Italy	26	US 9	45	China 10
8	Balkan	27	US 10	46	India
9	western Germany	28	US 11	47	Indochina
10	eastern Germany	29	south-eastern Canada	48	Malay Archipelago
11	Denmark	30	south-western Canada	49	South America
12	western France	31	Alaska	50	Africa
13	eastern France	32	northern Canada	51	Middle East
14	Iberia	33	Mexico	52	Australia
15	northern Europe	34	Cuba	53	Greenland
16	eastern Europe	35	Japan/Korea	54	Russia
17	south-eastern Europe	36	China 1	55	Ocean
18	US 1	37	China 2		
19	US 2	38	China 3		

Table S2 Plausible locations of observation sites within ICOS network to measure the $FFCO_2$ gradients to the JFJ reference site. The sites with a star are the existing stations measuring $^{14}CO_2$ and those used in the experiments N-17W and E-17W. All the 43 sites are used in experiments N-43W and E-43W.

Station ID	**latitude (°N)**	**longitude (°E)**
Jungfraujoch (JFJ)*	46.55	7.99
Cabauw (CBW)*	51.97	4.93
Gartow (GRT)*	53.07	11.44
Heidelberg (HEI)*	49.42	8.67
Hohenpeißenberg (HPB)*	47.80	11.01
Hyltemossa (HYL)*	56.10	13.42
Hyytiälä (HYT)*	61.85	24.29
Křešín u Pacova (KUP)*	49.58	15.08
Lindenberg (LIN)*	52.21	14.12
Mace Head (MHD)*	53.33	-9.90
Norunda (NRD)*	60.08	17.47
Observatoire Pérenne de l'Environnement (OPE)*	48.48	5.36
Ochsenkopf (OXK)*	50.02	11.80
Pallas (PAL)*	67.97	24.12
Schauinsland (SIL)*	47.92	7.92
Svartberget (SVB)*	64.17	19.77
Trainou (TRN)*	47.96	2.11
Angus (TTA)	55.95	-3.22
Begur (BEG)	41.58	3.13
Bialystok (BIA)	53.23	23.03
Biscarrosse (BIS)	44.38	-1.23
Carnsore Point (CRP)	52.18	-6.37
Doñana (DON)	37.02	-6.32
Ersa (ERS)	42.97	9.38
Gif-sur-Yvette (GIF)	48.71	2.15
Hengelo (HGT)	46.57	16.38
Ile Grande (IGR)	48.48	-3.35
Isny(ISN)	47.69	10.04
Kasprowy Wierch (KAS)	49.23	19.98
La muela (LMU)	41.95	1.10
Lutjewad (LUT)	53.40	6.35
Malin Head (MLH)	55.36	-7.33
Observatoire de Haute Provence (OHP)	43.92	5.70
Orléans (ORL)	47.92	1.90
Pic du Midi (PDM)	42.56	0.08
Puijo (PUJ)	62.90	27.56
Puy de Dome (PUY)	45.77	2.97
Ridge Hill (RGL)	52.00	-2.53
Tacolneston (TAC)	52.52	1.14
Tver (TVR)	56.47	32.93
Utö (UTO)	59.78	21.37
Vermunt(VER)	47.01	9.57
Zugspitze (ZUG)	47.42	10.98

Table S3 Standard deviations of the different types of observation errors (in ppm) for the 2-week/daily mean afternoon $FFCO_2$ gradients, derived by Wang et al. (2017).

	Spring		Summer		Autumn		Winter	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
$\boldsymbol{\varepsilon}_i$	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2-week mean afternoon $FFCO_2$ gradients								
$\boldsymbol{\varepsilon}_r$	0.99	0.52	0.92	0.52	1.50	0.71	1.89	0.93
$\boldsymbol{\varepsilon}_a$	0.17	0.17	0.17	0.17	0.21	0.21	0.21	0.21
$\boldsymbol{\varepsilon}_t$	0.52–1.11, site dependent							
daily mean afternoon $FFCO_2$ gradients								
$\boldsymbol{\varepsilon}_r$	1.48	0.92	1.45	0.91	2.25	1.25	2.56	1.42
$\boldsymbol{\varepsilon}_a$	0.24	0.24	0.24	0.24	0.30	0.30	0.30	0.30
$\boldsymbol{\varepsilon}_t$	1.94–4.15, site dependent							

Table S4 The parameters of the temporal autocorrelations in the representation and aggregation errors for 2-week/daily mean afternoon $FFCO_2$ gradients, derived by Wang et al. (2017). The temporal correlations have a form of e-folding functions $r(\mathit{\Delta t})=a\times e^{-\mathit{\Delta t}/b}+(1-a)\times e^{-\mathit{\Delta t}/c}$.

	a	*b*	*c*
2-week mean afternoon $FFCO_2$ gradients			
urban ε_r	0.29	18.9	365
rural ε_r	0.36	11.6	365
ε_a	0.16	11.2	365
daily mean afternoon $FFCO_2$ gradients			
urban ε_r	0.66	0.90	365
rural ε_r	0.78	0.78	365
ε_a	0.54	1.1	365