



Supplement of

Technical note: Preventing CO₂ overestimation from mercuric or copper(II) chloride preservation of dissolved greenhouse gases in freshwater samples

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Table S1. Water chemistry analyses of Lake Svartkulp sample.

Determinants	Standard (NIVA method)	Result	Units	MU	LOQ
Alkalinity	NS-EN ISO 9963-1:1996 (C1-4)	127	$\mu\text{mol L}^{-1}$	20%	30
Ammonium	NS-EN ISO 10304-1:2009 (anion) NS-EN ISO 14911:1999 (cation) (C4-4)	3	$\mu\text{g N L}^{-1}$	20%	2
Nitrate	NS-EN ISO 10304-1:2009 (anion) NS-EN ISO 14911:1999 (cation) (C4-4)	5	$\mu\text{g N L}^{-1}$	20%	2
Colour	NS-EN ISO 7887:2011 (A5-2)	59	mg L^{-1} Pt	20%	2
Phosphate	Mod. NS 4724:1984 (D1-3)	1	$\mu\text{g P L}^{-1}$	30%	1
pH	NS-EN ISO 10523:2012 (A1-5)	6.73	pH units	± 0.2	3.5
pH temperature	NS-EN ISO 10523:2012 (A1-5)	23.9	$^{\circ}\text{C}$		
TOC	Mod. NS-EN 1484:1997 (G4-2)	8.9	mg C L^{-1}	20%	0.1
Total nitrogen		230	$\mu\text{g N L}^{-1}$	20%	10
Total phosphorus	Mod. NS 4725:1984 (D2-1)	9	$\mu\text{g P L}^{-1}$	20%	1
Aluminum*	Mod. NS-EN ISO 17294-1:2007 (E8-4)	66.6	$\mu\text{g L}^{-1}$	20%	0.1
Calcium*	Mod. NS-EN ISO 17294-1:2007 (E8-4)	2.34	mg L^{-1}	20%	0.005
Chloride*	NS-EN ISO 10304-1:2009 (C4-4)	1.91	mg L^{-1}	20%	0.005
Copper*	Mod. NS-EN ISO 17294-1:2007 (E8-4)	1.23	$\mu\text{g L}^{-1}$	25%	0.04
Iron*	Mod. NS-EN ISO 17294-1:2007 (E8-4)	51.6	$\mu\text{g L}^{-1}$	20%	0.3
Magnesium*	NS-EN ISO 14911:1999 (C4-4)	0.43	mg L^{-1}	20%	0.002
Manganese*	Mod. NS-EN ISO 17294-1:2007 (E8-4)	53.5	$\mu\text{g L}^{-1}$	15%	0.03
Nickel*	Mod. NS-EN ISO 17294-1:2007 (E8-4)	0.22	$\mu\text{g L}^{-1}$	15%	0.04
Potassium*	NS-EN ISO 14911:1999 (C4-4)	0.19	mg L^{-1}	20%	0.003
Sulfate*	NS-EN ISO 10304-1:2009 (C4-4)	1.63	mg L^{-1}	20%	0.005
Zinc*	Mod. NS-EN ISO 17294-1:2007 (E8-4)	6.5	$\mu\text{g L}^{-1}$	25%	0.15

*determined in water from nearby lake Store Åklungen (60.000; 10.722; 3 km North of Lake Svartkulp, within the same watershed) in August 2020. TOC = total organic carbon, MU = measurement uncertainties, LOQ = limit of quantification

Table S2. Effect of time and treatment on dissolved gases (two way anova, with *F* test and *P* value). Bonferroni correction for multiple testing $\alpha=0.05/5=0.01$.

	Treatment		Time		Treatment × Time	
	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>
O₂	204	$<2 \times 10^{-16}$	199	$<2 \times 10^{-16}$	61	$<2 \times 10^{-16}$
CO₂	215	$<2 \times 10^{-16}$	165	$<2 \times 10^{-16}$	61	$<2 \times 10^{-16}$
CH₄	121	$<2 \times 10^{-16}$	3.4	0.039	0.74	0.62
N₂O	8.9	6×10^{-5}	84	$<2 \times 10^{-16}$	6.3	4×10^{-5}
N₂	1.5	0.22	0.5	0.61	0.9	0.53

Table S3. CO₂ diffusion fluxes (F_{CO_2} , mol m⁻² d⁻¹) from Lake Lundebyvannet estimated from HgCl₂-fixed and unfixed samples following Cole and Caraco (1998; CC98), Vachon and Prairie (2013; VP13) and Crusius and Wanningkhof (2003; CW03).

Preservatives		Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Ice-free season
CC98	None	0.10	0.07	0.01	0.15	0.11	0.23	0.37	0.48	0.17
	HgCl ₂	0.20	0.21	0.16	0.34	0.29	0.47	0.57	0.77	0.35
	Diff (%)	97 %	188 %	2163 %	130 %	162 %	99 %	55 %	62 %	108 %
VP13	None	0.15	0.11	0.01	0.22	0.16	0.35	0.52	0.71	0.24
	HgCl ₂	0.30	0.32	0.24	0.50	0.42	0.69	0.80	1.14	0.51
	Diff (%)	97 %	186 %	2101 %	130 %	164 %	99 %	56 %	62 %	109 %
CW03	None	0.02	0.01	0.00	0.02	0.01	0.04	0.02	0.09	0.02
	HgCl ₂	0.03	0.03	0.02	0.04	0.02	0.07	0.04	0.15	0.04
	Diff (%)	88 %	178 %	1783 %	136 %	163 %	103 %	59 %	63 %	112 %

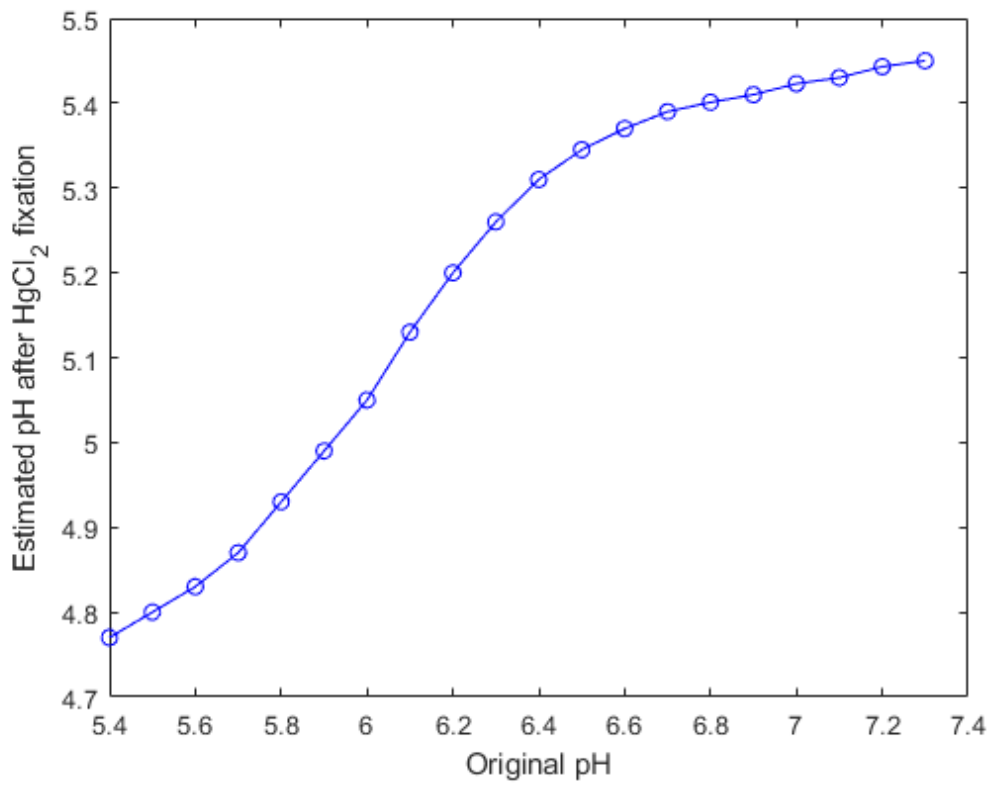


Fig S1. Comparison of in-situ and PHREEQC-estimated pH after HgCl₂ fixation in Lake Lundebyvannet samples.

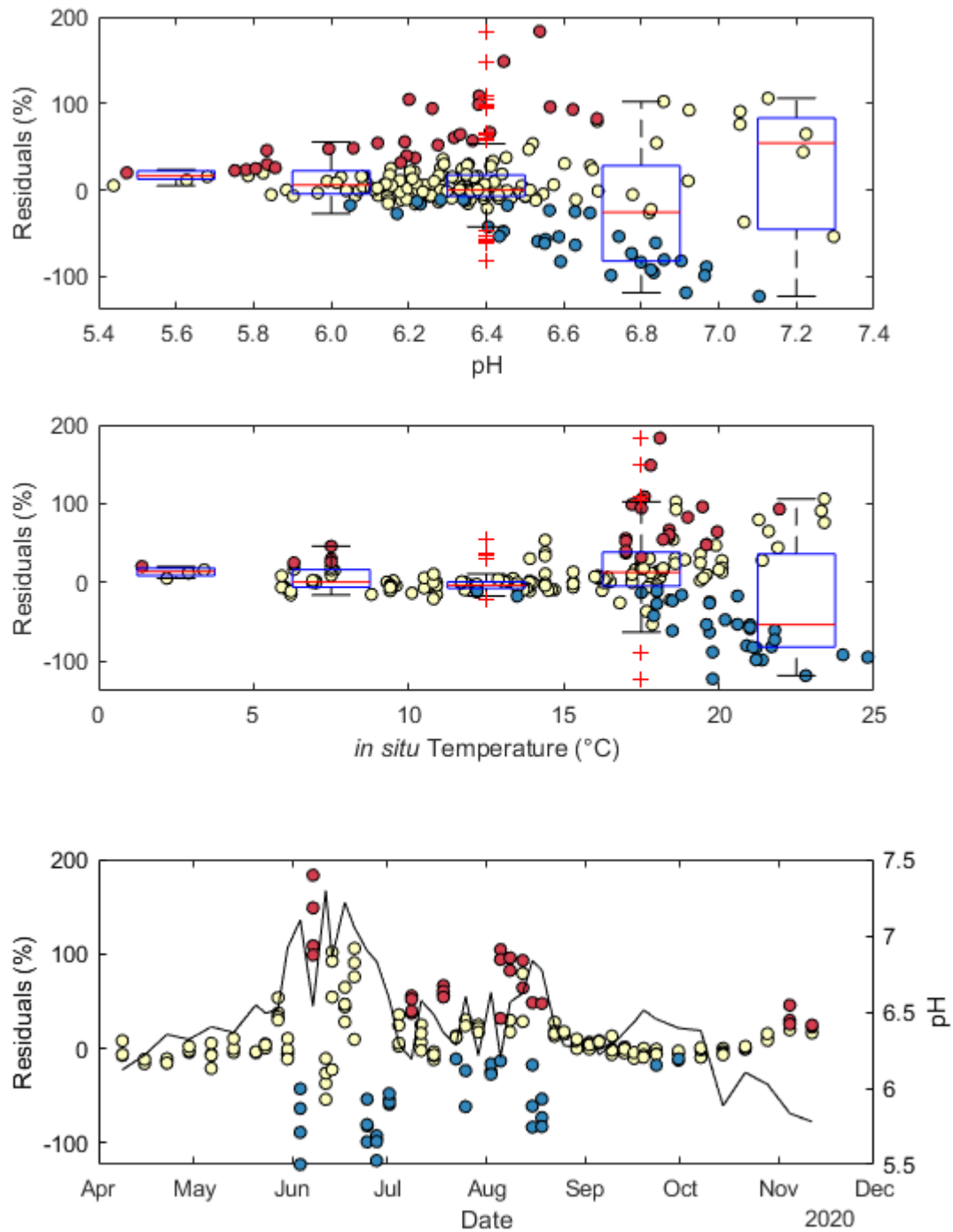


Fig S2. *E* model residuals as a function of pH (top), *in situ* water temperature (middle) and date (bottom) in Lake Lundebyvannet. Residuals are determined by the difference between *E* predicted with Eq. 11 and empirically determined *E* with Eq. 7. Timeseries of pH is also shown in the bottom panel. For each 0.4 pH unit bin and 5°C temperature bin, a box plot was drawn. Blue and red symbols are samples for which values of $[HCO_3^-]_i - [CO_2]_{ex}$ were larger than (or equal to) 20 μM and smaller than (or equal to) -20 μM , respectively.

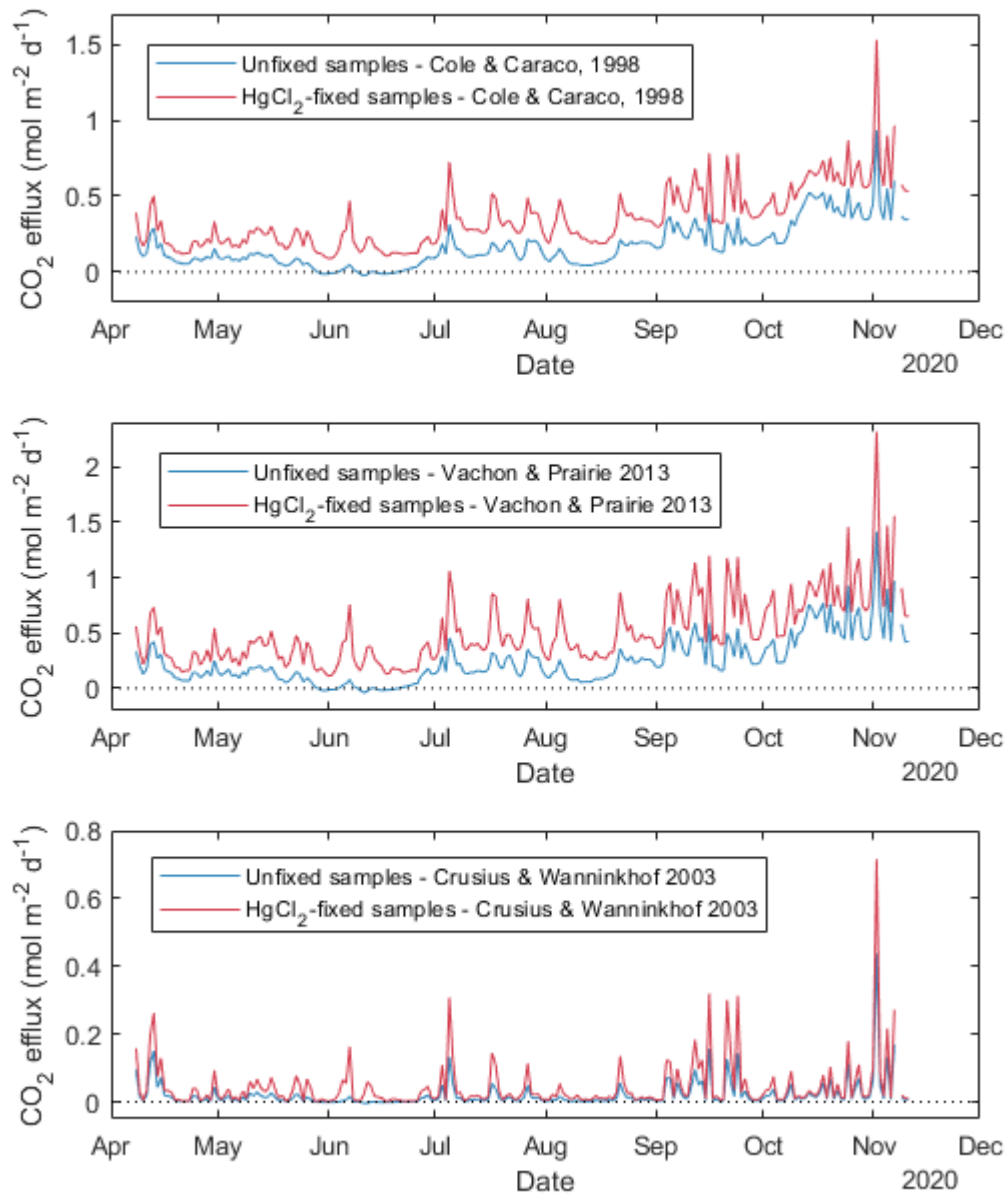


Fig S3. Daily diffusion fluxes at the water-atmosphere interface from Lake Lundebyvannet. Diffusion fluxes were calculated following Cole & Caraco (1998; top panel), Vachon and Prairie (2013; middle panel) and Crusius and Wanninkhof (2003; bottom panel).