



Supplement of

Drivers of diffusive $\rm CH_4$ emissions from shallow subarctic lakes on daily to multi-year timescales

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Supplement Table S1 – Different relations of k with the wind speed at 10 m (U_{10}) and lake surface area (SA). Validity ranges of U_{10} were based on the data range used to construct each model. For comparison, gas transfer velocities were computed from the multi-year ice-free mean wind speed on the Stordalen Mire and normalized to a Schmidt number of 600 (CO₂ at 20 °C).

Model	Method	Lake surface	U ₁₀	<i>k</i> 600 at	Reference
		area (km²)	validity	U ₁₀ = 4.3	
			range	m s ^{−1}	
			(m s ⁻¹)	(cm h ⁻¹)	
$k_{600} = 0.77 \times U_{10}^{1.02} + 0.62$	FC	0.01–0.17	1–9	4.0	This work
$k_{600} = 0.45 \times U_{10}^{1.6}$	Tracers	0.13–500	1–8	4.6	MacIntyre et al., 1995
$k_{600} = 0.215 \times U_{10}^{1.7} + 2.07$	SF ₆	0.15	0–9	4.6	Cole and Caraco, 1998
$k_{600} = 4.33 \times U_{10} - 13.3$	SF ₆	0.13	1–5.5	5.3	Crusius and Wanninkhof, 2003
$k_{600} = 0.228 \times U_{10}^{2.2} + 0.168$	SF ₆	0.13	1–5.5	5.8	Crusius and Wanninkhof, 2003
$k_{600} = 0.78 \times U_{10} + 1.31$	FC	0.06	0–5	4.7	Soumis et al., 2008
$k_{600} = 1.48 \times U_{10} + 1.48 \times U_{10}$	FC	0.01-0.15	1–6.5	5.5–7.5	Vachon and Prairie, 2013
× log10(SA) + 2.51					



Supplement Figure S1 – Based on Figure 3 (main text), but for individual lakes: Villasjön (**a**), Inre Harrsjön (**b**) and Mellersta Harrsjön (**c**). Comparison between gas transfer velocities from floating chambers (Eq. 2, main text) and the surface renewal model (Eq. 4, main text, with $\alpha' = 1$ and Sc = 600, half-hourly values averaged over each chamber deployment period). Mean ratios, and therefore α' , are represented by the slopes of the dotted lines. Error estimates represent the 95% confidence intervals of the mean ratios.



Supplement Figure S2 – Based on Figure 7a and 7c (main text), but for individual lakes: Villasjön (a,b), Inre Harrsjön (c,d) and Mellersta Harrsjön (e,f). Temporal variation of the 24-hour chamber fluxes (a,c,e), air-water concentration difference (b,d,f), air and water temperature (g) and modelled gas transfer velocity and measured wind speed (h). In panels a-f, large squares and triangles represent binned means with 95% confidence interval error bars, horizontal bars represent binned medians and small symbols show individual measurements. Variables were binned in 10-day bins.



Supplement Figure S3 – Based on Figure 7b and 7d (main text), but for individual lakes: Villasjön (a,b), Inre Harrsjön (c,d) and Mellersta Harrsjön (e,f). Temporal variation of the 1-hour chamber fluxes (a,c,e), air-water concentration difference (b,d,f), air and water temperature (g) and modelled gas transfer velocity and measured wind speed (h). In panels a-f, large squares and triangles represent binned means with 95% confidence interval error bars, horizontal bars represent binned medians and small symbols show individual measurements. Variables were binned in 1-hour bins.



Supplement Figure S4 – Based on Figure 8a (main text), but for the ice-free seasons of individual measurement years. Normalized spectral densities of wind speed (a), air temperature (c), surface water temperature (e) and surface sediment temperature in Villasjön (b), Inre Harrsjön (d) and Mellersta Harrsjön (f).

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