



Supplement of

Temporary stratification promotes large greenhouse gas emissions in a shallow eutrophic lake

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Supplementary materials. Table S1.

Daily ebullitive flux estimates from the automatic flushing chamber (AFC) are given along with differences between daily estimates and the mean value of the 7 day period. This shows how poorly a single day's 'perfect' measurement reflects the mean 7-day ebullitive flux. The AFC are flushed every four hours and estimate ebullitive flux and diffusive flux at a 4-hour resolution. The total flux is calculated based on the concentration just prior to flushing after 4 hours accumulation. Diffusive flux is calculated by randomly repeat resampling 120 three-minute periods over the four hours to calculate diffusive flux, periods where bubbles interfere with the determination of diffusive flux are identified based on a low r^2 and discarded. Then median beta of the regression equations on the retained 3-minute periods is used to calculate diffusive flux. Thus, we can calculate the expected concentration of CH₄ in the chamber from diffusive flux after 4 hours and by taking this away from the final measured concentration ebullitive and diffusive flux can be calculated.

Date	AFC ebullitive flux mg CH ₄ C m ⁻² day ⁻¹	Difference from mean	% error
03/07/2023	11.72	21.6	64.8
04/07/2023	34.79	-1.5	4.4
05/07/2023	50.99	-17.7	53
06/07/2023	49.32	-16	48
07/07/2023	20.68	12.6	37.9
08/07/2023	16.8	16.5	49.6
09/07/2023	30.37	2.9	8.8
10/07/2023	51.88	-18.6	55.7
Mean value period 1	33.32	Median % error	48.8
11/07/2023	192.87	-101.7	111.5
12/07/2023	87.42	3.8	4.2
13/07/2023	37.29	53.9	59.1
14/07/2023	33.72	57.5	63
15/07/2023	178.29	-87.1	95.5
16/07/2023	67.34	23.9	26.2
17/07/2023	79.1	12.1	13.3
18/07/2023	53.62	37.6	41.2
Mean period 2	91.21	Median % error	50.2
min error			4.2
max error			111.5

Table S2

Summary of comparison of automatic flushing chamber (AFC) and static chambers ebullitive flux estimates for the two periods sampled. This shows a % underestimation of ebullitive emissions by the static chamber, which are 16% and 34%. This is lower than the median error involved in using daily estimates by a 'perfect' method which gives a median error of 49 and 50% .

	period 1	period 2
	3-10/07/2023	11-18/07/2023
AFC mean of ebullitive flux mg CH ₄ C m ⁻² day ⁻¹	33.3	91.21
static chamber ebullitive flux mg CH ₄ C m ⁻² day ⁻¹	27.9	59.9
difference	5.42	31.3
% error of static chamber relative to AFC	16	34
median % error for single day ebullitive flux estimate compared with mean emission	49	50

Figure S1.

Daily average methane ebullitive and diffusive flux over 21 days sampled in June/July 2023. Ebullition and diffusion of CH₄ were calculated as described above. The plot shows the extreme daily variation in emissions, in particular ebullition, the peaks of which correlate with sharp drops in atmospheric pressure (black line).

