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Changing sources and processes sustaining surface CO_2 and CH_4 fluxes along a tropical river to reservoir system

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Supplementary information content

- **Table S1**: non-parametric Kendall correlation (cor) and their p-value between reservoir surface CO_2 and CH_4 concentrations with physical and chemical variables.

- **Figure S1**: Linear regressions of the natural logarithm of surface CO_2 and CH_4 concentrations with water temperature (a, p-value < 0.001, R^2_{adj} = 0.22) and TN (b, p-value < 0.001, R^2_{adj} = 0.14) respectively in the reservoir (branches and main basin).

- **Figure S2**: Linear regressions of the natural logarithm of surface concentrations of CO_2 versus CH_4 in the reservoir inflows (brown, p-value = 0.006 and R^2_{adj} = 0.54), branches (green, p-value = 0.005 and R^2_{adj} = .0.17), and main basin (blue, p-value = 0.11 and R^2_{adj} = 0.01).

- **Table S2**: Estimated averages (± SE) of rates of CO_2 inputs to the epilimnion from horizontal flow (H), sediments (S), vertical transport (V), and internal metabolism (M_inc and M_mod when derived from incubations and inverse O_2 modeling respectively), their sum (T, considering an average of M_inc and M_mdod) and surface flux to the atmosphere (F) in the branches and main basin for each sampling campaign and their mean. Units are mmol m^{-2} d^{-1} of water surface area. *Represents missing value, assumed to be equal to the mean of other campaigns.

- **Table S3**: Estimated averages (± SE) of rates of CH_4 inputs to the epilimnion from horizontal flow (H), sediments (S), vertical transport (V), and internal metabolism (M_inc), their sum (T) and surface flux to the atmosphere (F) in the branches and main basin for each sampling campaign and their mean. Units are mmol m^{-2} d^{-1} of water surface area. *Represents missing value, assumed to be equal to the mean of other campaigns.

- **Figure S3**: boxplots of the buoyancy frequency N^2 (a), dissipation rate ϵ (b), and CH_4 and CO_2 concentration gradients at the epilimnion-metalimnion interface (c, d) in the reservoir branches and main basin. Boxes bounds, whiskers, solid lines, and open circles represent the 25th and 75th percentiles, the 10th and 90th percentiles, the median, and single data points respectively.

- **Figure S4**: Example of a vertical profile (main reservoir, Aug 2018) of CO_2 (light gray points) and CH_4 (dark gray points) concentrations, as well as $\delta^{13}CH_4$ (dark grey triangles) as a function of depth. The dotted line represents the top of the metalimnion.

- **Figure S5**: Boxplot of sediment CO_2 (a) and CH_4 (b) flux rates (per sediment area) across sampled sites in the reservoir branches and main basin. Boxes bounds, whiskers, solid lines, and open circles represent the 25th and 75th percentiles, the 10th and 90th percentiles, the median, and single data points respectively.

Table S1: non-parametric Kendall correlation (cor) and their p-value between reservoir surface CO_2 and CH_4 concentrations with physical and chemical variables.

	[CO_2]		[CH_4]		
Variables	cor	p-value	cor	p-value	n
Water temperature	-0.36	< 0.001	0.07	0.223	131
% O2	-0.01	0.933	0.15	0.013	130
Chla	0.12	0.056	0.18	0.005	110
DOC	0.01	0.939	0.17	0.008	113
TP	0.14	0.031	0.13	0.049	112
TN	0.1	0.112	0.27	< 0.001	113

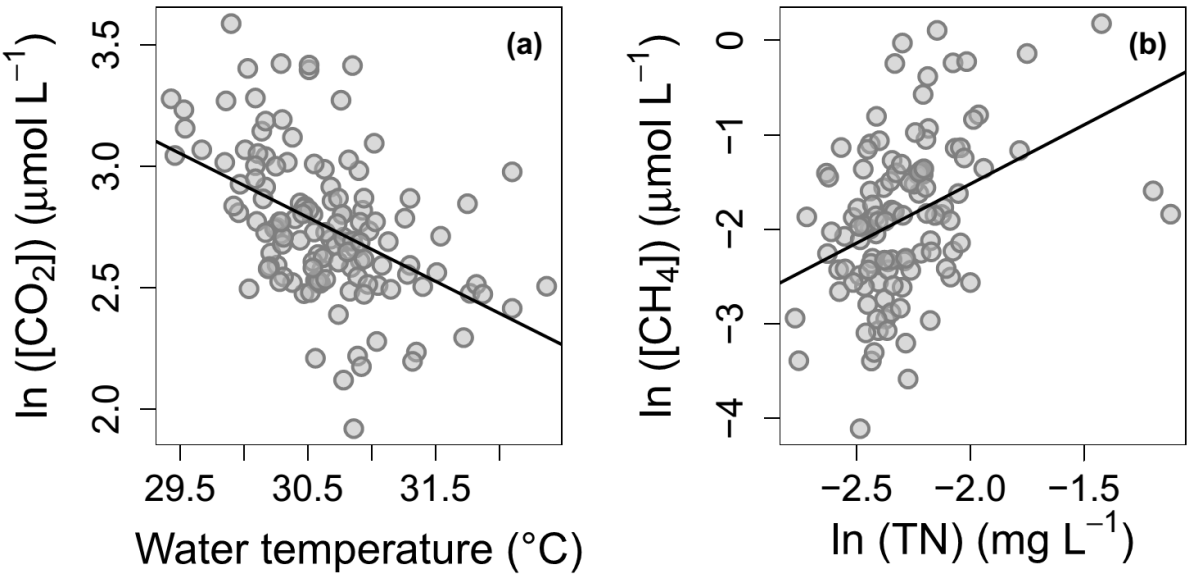

Figure S1: Linear regressions of the natural logarithm of surface CO_2 and CH_4 concentrations with water temperature (a, p-value < 0.001, R^2_{adj} = 0.22) and TN (b, p-value < 0.001, R^2_{adj} = 0.14) respectively in the reservoir (branches and main basin).

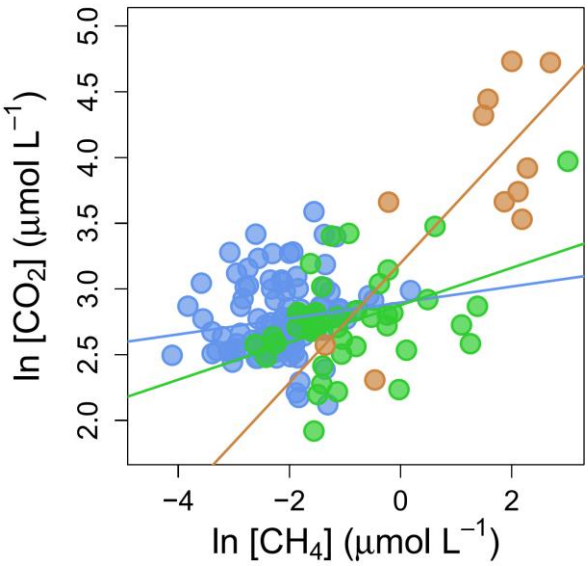

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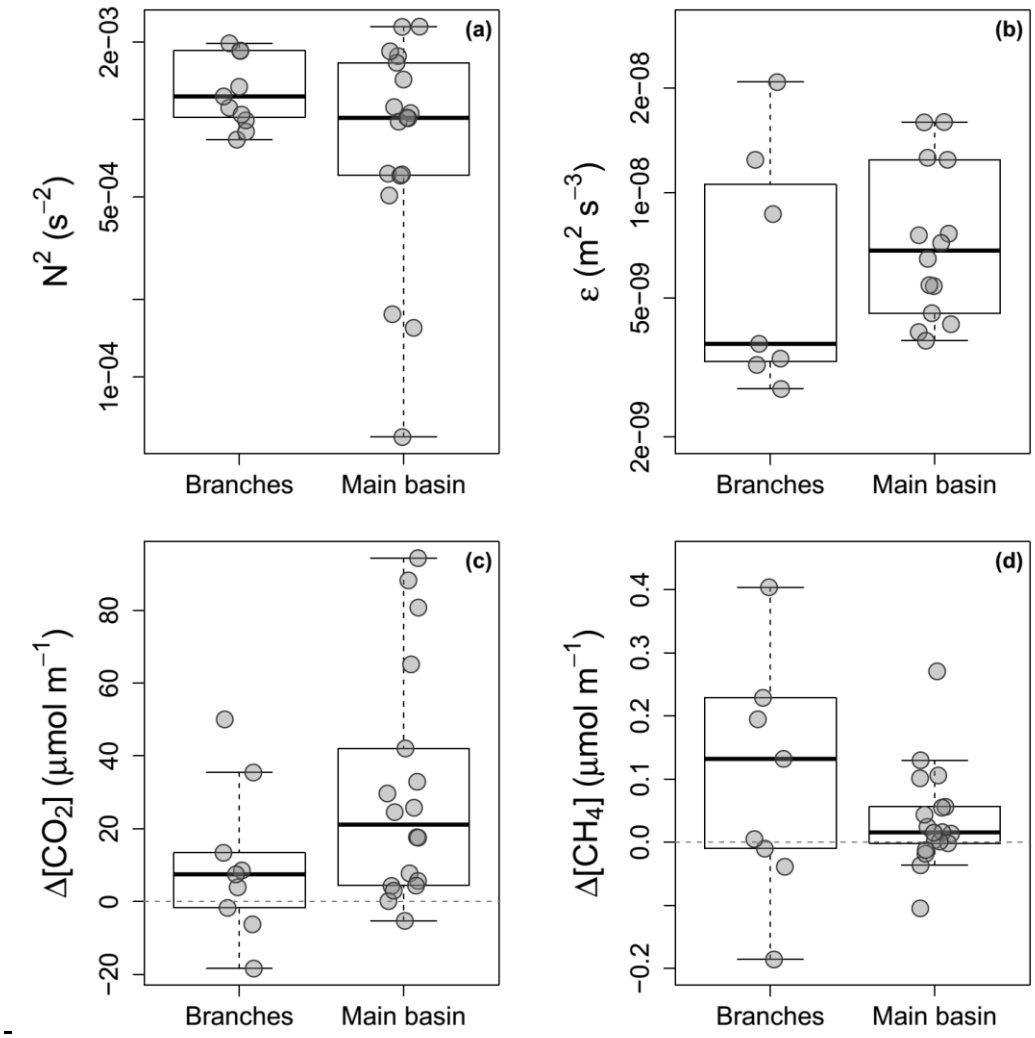
Table S2: Estimated averages (± SE) of rates of CO_2 inputs to the epilimnion from horizontal flow (H), sediments (S), vertical transport (V), and internal metabolism (M_inc and M_mod when derived from incubations and inverse O_2 modeling respectively), their sum (T, considering an average of M_inc and M_mdod) and surface flux to the atmosphere (F) in the branches and main basin for each sampling campaign and their mean. Units are mmol m^{-2} d^{-1} of water surface area. *Represents missing value, assumed to be equal to the mean of other campaigns.

		H	S	V	M_inc	M_mod	T	F
Branches	Nov-Dec 2016	5.7 (± 2.6)	*0.6 (± 0)**	-1.8 (± NA)	1.4 (± 1.9)	-63.2 (± NA)	-26.5 (± 36.1)	2.8
	Apr-May 2017	2.7 (± 0.2)	*0.6 (± 0)**	3.6 (± 2.3)	*1.4 (± 1.9)**	-32.4 (± 20)	-8.6 (± 19.4)	15.2
	Feb-Mar 2018	3.2 (± 1.1)	*0.6 (± 0)**	0.9 (± 0.5)	*1.4 (± 1.9)**	*-47.8 (± 20)**	-18.6 (± 26.2)	4.1
	Aug 2018	5.5 (± 3.3)	*0.6 (± 0)**	0.1 (± 0.5)	*1.4 (± 1.9)**	*-47.8 (± 20)**	-17.1 (± 28.4)	-3.4
	Mean	4.3 (± 0.8)	0.6 (± 0)	0.7 (± 1.1)	1.4 (± 1.9)	-47.8 (± 15.4)	-17.7 (± 26.5)	4.7 (± 3.9)
Main basin	Nov-Dec 2016	0.2 (± NA)	*0.5 (± 0.1)**	6 (± 2.2)	-2.6 (± 6.2)	-21.4 (± 5.6)	-5.3 (± 11.7)	11.3
	Apr-May 2017	0.4 (± NA)	*0.5 (± 0.1)**	3.1 (± 1.3)	7.2 (± NA)	-49 (± 37.3)	-16.9 (± 29.5)	15.1
	Feb-Mar 2018	0.5 (± NA)	*0.5 (± 0.1)**	4.7 (± 1)	*2.3 (± 6.2)**	-17 (± 4.5)	-1.6 (± 10.8)	3.3
	Aug 2018	0.1 (± NA)	*0.5 (± 0.1)**	4.3 (± 3.3)	*2.3 (± 6.2)**	-16.2 (± 20.9)	-2 (± 12.6)	0.3
	Mean	0.3 (± 0.1)	0.5 (± 0.1)	4.5 (± 0.6)	2.3 (± 4.9)	-25.9 (± 7.8)	-6.5 (± 14.9)	7.5 (± 3.4)

Table S3: Estimated averages (± SE) of rates of CH_4 inputs to the epilimnion from horizontal flow (H), sediments (S), vertical transport (V), and internal metabolism (M_inc), their sum (T) and surface flux to the atmosphere (F) in the branches and main basin for each sampling campaign and their mean. Units are mmol m^{-2} d^{-1} of water surface area. *Represents missing value, assumed to be equal to the mean of other campaigns.

		H	S	V	M_inc	T	F
Branches	Nov-Dec 2016	0.94 (± 0.67)	*0.04 (± 0.02)**	-0.001 (± NA)	0.04 (± 0.05)	1.03 (± 0.74)	1.28
	Apr-May 2017	0.58 (± 0.08)	*0.04 (± 0.02)**	0.001 (± 0.008)	*0.04 (± 0.05)**	0.67 (± 0.16)	0.71
	Feb-Mar 2018	0.16 (± 0.08)	*0.04 (± 0.02)**	0.025 (± 0.016)	*0.04 (± 0.05)**	0.27 (± 0.17)	0.84
	Aug 2018	1.97 (± 1.39)	*0.04 (± 0.02)**	0.034 (± 0.029)	*0.04 (± 0.05)**	2.09 (± 1.49)	1.13
	Mean	0.91 (± 0.39)	0.04 (± 0.02)	0.015 (± 0.009)	0.04 (± 0.05)	1.01 (± 0.46)	0.99 (± 0.13)
Main basin	Nov-Dec 2016	0.005 (± NA)	0.1 (± 0.06)*	0.001 (± 0.004)	-0.35 (± 0.32)	-0.24 (± 0.38)	0.36
	Apr-May 2017	0.003 (± NA)	0.1 (± 0.06)*	0.013 (± 0.008)	0.03 (± NA)	0.14 (± 0.39)	0.39
	Feb-Mar 2018	0.003 (± NA)	0.1 (± 0.06)*	0.001 (± 0.003)	*-0.16 (± 0.32)**	-0.06 (± 0.38)	0.45
	Aug 2018	0.003 (± NA)	0.1 (± 0.06)*	0.018 (± 0.008)	*-0.16 (± 0.32)**	-0.04 (± 0.39)	0.58
	Mean	0.004 (± 0.001)	0.1 (± 0.06)	0.008 (± 0.004)	-0.16 (± 0.19)	-0.05 (± 0.25)	0.44 (± 0.05)



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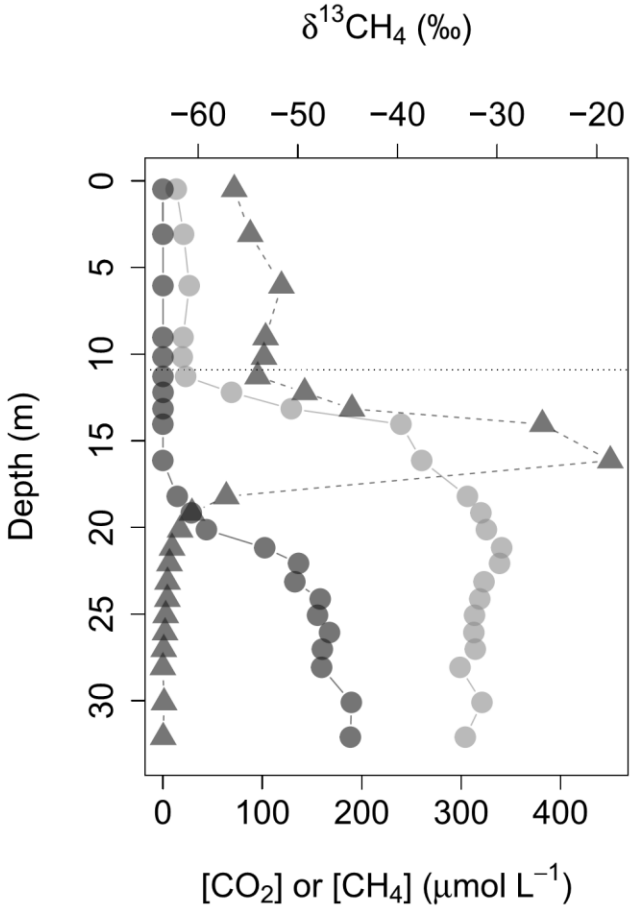

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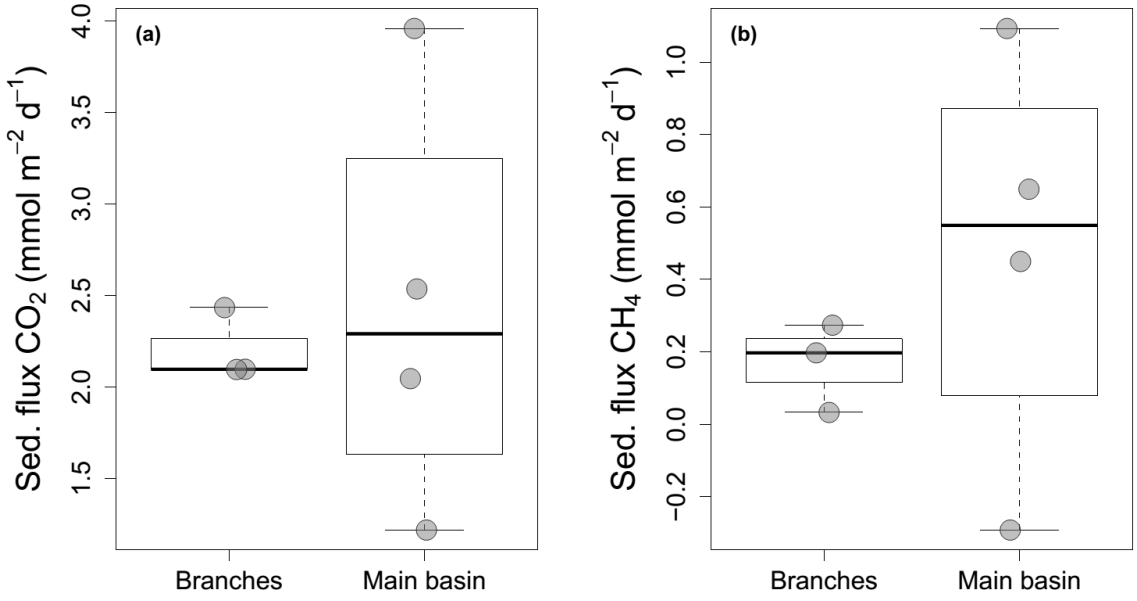

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