Supplementary Information

Andean headwater and piedmont streams are hot spots of carbon dioxide and methane emissions in the Amazon basin

Gonzalo Chiriboga^{1,2}, Alberto V. Borges^{1,*}

¹ Chemical Oceanography Unit, University of Liège, Liège, Belgium

² Universidad Central del Ecuador, Quito, Ecuador

* alberto.borges@uliege.be

Supplementary Fig. 1 Location of stations in main-stem (blue circles) and tributaries (green squares) and sampling dates. Stations in the main-stem are shown by blue circles and in the tributaries by green squares.



Supplementary Fig. 2 Strong elevation gradients of water temperature and gas transfer velocity in the Andean headwater and piedmont streams. Variations of measured water temperature (a) and the gas transfer velocity normalized to Schmidt number of 600 (k_{600}) modelled from freshwater discharge and stream gradient from RiverATLAS⁶⁸ (b) in the Napo streams as a function of elevation. Symbols show the median and error bars the interquartile range, stations in the main-stem are shown by blue circles and in the tributaries by green squares, and solid lines show fits to the data (Supplementary Table 4).



Supplementary Fig. 3 Strong elevation gradients of land cover in the catchment of Andean headwater and piedmont streams. Variations of grassland cover (**a**), forest cover (**b**) and inundation extent (**c**) in the Napo streams as a function of elevation, from Global Land Cover 2000¹¹⁵ and Global Inundation Extent from Multi-Satellites (GIEMS-D15)¹⁸ extracted from RiverATLAS⁶⁸. Grassland and forest cover are given over the total catchment upstream the sampled stream; inundation extent is given at the reach level. Stations in the main-stem are shown by blue circles and in the tributaries by green squares, and solid lines show fits to the data (Supplementary Table 4).



Supplementary Fig. 4 Grassland cover and inundation extent affect pCO₂, CH₄ and %N₂O in the Andean headwater and piedmont streams. Variations of the partial pressure of CO₂ (pCO₂), CH₄ dissolved concentration, N₂O saturation level (%N₂O), and oxygen saturation level (%O₂) in the Napo streams as a function of grassland cover (**a**,**c**,**e**,**g**) and inundation extent (**b**,**d**,**f**,**h**) in the Napo streams, from Global Land Cover 2000¹¹⁴ and Global Inundation Extent from Multi-Satellites (GIEMS-D15)¹⁸ extracted from RiverATLAS⁶⁸. Symbols show the median and error bars the interquartile range, stations in the main-stem are shown by blue circles and in the tributaries by green squares, and solid lines show fits to the data (Supplementary Table 4).



Supplementary Fig. 5 Elevation gradients of dissolved inorganic nitrogen in the Andean headwater and piedmont streams. Nitrate (NO₃⁻), ammonia (NH₄⁺) and dissolved inorganic nitrogen (DIN) concentration as a function of elevation in the Napo streams. Symbols show the median and error bars the interquartile range, stations in the main-stem are shown by blue circles and in the tributaries by green squares, and solid lines show fits to the data (Supplementary Table 4).



Supplementary Fig. 6 Aerial view of the Huirima stream showing meandering river course and presence of small lakes indicative of lateral inundation related to flat relief (low catchment slope). Landsat image was extracted from https://earthexplorer.usgs.gov/ and is in the U.S. Public Domain.



Supplementary Fig. 7 High N₂O levels are related to the presence of oil palm plantations in the Andean piedmont streams. Distribution of "natural" vegetation (merging forest and grassland) and agriculturally impacted land (pastures and oil palm plantations) in the Napo streams, for the whole catchment upstream of the most downstream station (**a**), and for individual catchments for N₂O saturation levels \leq 119% (**b**) and \geq 150% (**c**). Land covered by forest and grassland was merged into a single class (natural vegetation) by opposition to land cover strongly impacted by human activity (pastures and oil palm plantations). Stations in the main-stem are shown by blue circles and in the tributaries by green squares.



Supplementary Fig. 8 Low variations of pCO₂, CH₄ and %N₂O in the Andean headwater and piedmont streams as function of stream size. Variations of the partial pressure of CO₂ (pCO₂), CH₄ dissolved concentration, N₂O saturation level (%N₂O), and oxygen saturation level (%O₂) in the Napo streams as a function of Strahler order irrespective of elevation (a,b,c,d), for elevation > 500 m (e,f,g,h) and < 500 m (i,j,k,l). Due to low number of samples in low order streams, orders 2 and 3 were binned. Symbols show the median and error bars the interquartile range. nd = no data.



Supplementary Fig. 9 Strong elevation gradients of CO₂, CH₄ and N₂O emissions in the Andean headwater and piedmont streams. Air-water flux of CO₂ (*F*CO₂) (**a**,**b**,**c**,**d**), of CH₄ (*F*CH₄) (**e**,**f**,**g**,**h**) and of N₂O (*F*N₂O) (**i**,**j**,**k**,**I**) as a function of elevation (**a**,**e**,**i**), upstream terrain slope (**b**,**f**,**j**), gas transfer velocity normalized to Schmidt number of 600 (k_{600}) (**c**,**g**,**k**), and respective dissolved gas content: partial pressure of CO₂ (pCO₂) (**d**), CH₄ dissolved concentration (**h**), N₂O saturation level (%N₂O) (**I**). Symbols show the median and error bars the interquartile range, stations in the main-stem are shown by blue circles and in the tributaries by green squares, and solid lines show fits to the data (Supplementary Table 4). Asterisk indicates streams with high CO₂ and CH₄ concentrations and high k_{600} values (refer to Fig. S10).



Supplementary Fig. 10 Transport-limitation or supply-limitation of the gaseous exchange with the atmosphere in the Andean headwater and piedmont streams. Partial pressure of CO₂ (pCO₂) (a), CH₄ dissolved concentration (b), and N₂O saturation level (%N₂O) (c) as a function of the gas transfer velocity normalized to Schmidt number of 600 (k_{600}). Symbols show the median and error bars the interquartile range, stations in the main-stem are shown by blue circles and in the tributaries by green squares, and solid lines show fits to the data (Supplementary Table 4). Asterisk indicates streams with high CO₂ and CH₄ concentrations and high k_{600} values leading to comparatively higher emissions (refer to Fig. S9).



Supplementary Fig. 11 Strong elevation gradients of CO₂, CH₄ and N₂O in streams and rivers across the whole Amazon basin. Variations of CH₄ dissolved concentration (a) and N₂O saturation level ((N_2O) (b) as a function of the partial pressure of CO₂ (pCO₂). Data in the lowland rivers and streams was compiled al.³⁴ with extracted from plots Richey et Plot Digitizer of (http://plotdigitizer.sourceforge.net). Small symbols show individual measurements, large symbols indicate the median, the blue triangles show the data in the mountainous headwater streams, green triangles show the data in piedmont streams, and the grey circles show the data in the lowland streams and rivers.



Supplementary Table 1 Comparison of air-water fluxes of CO₂ (FCO_2) and CH₄ (FCH_4) in the Amazon rivers and streams from this study and reported in literature^{5,16,27,30,31}. Only the diffusive component of FCH_4 is reported.

		FCO ₂	FCH ₄
		mol m ⁻² yr ⁻¹	mmol m ⁻² yr ⁻¹
River channels < 150 m	This study	161±11	
	Reference ²⁷	156	
	Reference 5	157	
River channels ≥ 150 m	This study	91±6	
	Reference 27	71	
	Reference ⁵	135	
Solimões/Amazon mainstem	This study		66±29
	Reference 30		75
River channels ≥ 200 m	This study		199±55
	Reference 16		274±41
River channels (whole lowland basin)	This study		564±141
	Reference ³¹		370

Supplementary Table 2 Goodness of the linear regression of modelled partial pressure of CO_2 (p CO_2) based on three models versus observed p CO_2 from the Andean headwater and piedmont streams. The models were a linear regression (LR) as function of upstream slope, a multiple linear regression (MLR) as function of upstream slope and elevation, and a MLR as function of upstream slope and forest cover.

	Modelled pCO_2 versus initial pCO_2	r ²	Sy.x
Upstream slope LR	$y = 1.284 \pm (0.072) + 0.594(\pm 0.023)^{*}x$	0.59	0.202
Upstream slope + Elevation MLR	y = 1.199(±0.071) + 0.620(±0.022)*x	0.62	0.200
Upstream slope + Forest cover MLR	y = 1.221(±0.071) + 0.613(±0.022)*x	0.61	0.200

Supplementary Table 3 Comparison of stream surface area in the Amazon basin used in this study (extracted from RiverATLAS⁶⁸) and reported in literature^{5,16,27,30,31}. The surface area for large lowland rivers used by Sawakuchi *et al.* ¹⁶ is two to three times higher than the range of values reported by Melack ²⁷ for an equivalent river size class.

		Stream surface area km ²
River channels < 150 m	This study	16,304 (*)
	Reference 27	31,000 (**)
	Reference ⁵	27,120 (***)
River channels ≥ 150 m	This study	21,668 (*)
	Reference 27	29,500 (**) to 52,000 (****)
	Reference ⁵	25,500
Solimões/Amazon mainstem	This study	4,994 (*)
	Reference ³⁰	8,856
River channels ≥ 200 m	This study	19,828 (*)
	Reference ¹⁶	91,212 (*****)
River channels (whole lowland basin)	This study	40,375 (*)
	Reference ³¹	52,380 (*****)

* Reference 68

** Reference 115

*** Reference ¹⁰²

**** from Shuttle Radar Topography Mission

***** Reference 116

****** Unspecified data source

Supplementary Table 4 Equations and statistics at 0.05 level of curve fits of data shown in Figures.

3 b b C 7.26 4.27 C 2.26 C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C <th< th=""><th>Figure</th><th>Function</th><th>Equation</th><th>Average Residual</th><th>r^2</th><th>n</th><th>n</th></th<>	Figure	Function	Equation	Average Residual	r^2	n	n
5 pCD, versus (parsen terms stope $r = 7000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 0000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 0000 + 0000 + 0000 + 0000 + 0000 + 00000 + 0000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 00000 + 000000$	2 a		v = 7.730E+04*EXP(-1.768E-02*x)+6.623E+02	6 20E+02		μ	44
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	2 h		$v = 7.085E \pm 0.3^{\circ}EXP(-6.395E \pm 0.1^{\circ}x) \pm 8.108E \pm 0.2^{\circ}$	5 14E+02			12
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	20		$y = 2.773E_{-}02*EXP(1.229E_{-}01*x)+9.977E_{+}02$	5.56E±02			12
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	20		$y = 6.775E \cdot 00^{\circ} E \times P(1.061E \pm 00^{\circ} \times) \pm 3.882E \pm 02^{\circ}$	7.14E+02			42
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	2 u 2 o		$y = 1.605E \pm 0.02 EVP(5.725E + 0.02 E \pm 0.01)$	2.105+02			42
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	20		$y = 1.005 \pm 0.03 \pm 0.02 \pm 0.$	2.19E+02			44
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	21	CH4 versus Opstream terrain slope	y = 1.2022+03 EXP(-0.1302+02 X)-3.0342+02	1.71E+02			42
2 h CH, versus Water temperature $y = 3.0450 \times 21.07 \times 10.0244 \times 10.07 \times 10.0240 \times 10.0240 \times 10.0240 \times 10.0001 \times 10.00001 \times 10.0001 \times 10.00001 \times 10.0001 \times 10.00001 \times 10$	2 g	CH ₄ versus Forest cover	$y = 1.804E+01^{\circ}EXP(4.134E-02^{\circ}X)-2.591E+00$	1.83E+02			42
21 %MQ versus Elevation $y = -0.480^{+} + 10.23$ 0.47 -0.000 38' 21 %MQ versus forst cover $y = 0.161^{+} y + 91.4$ 0.20 0.000 38' 21 %MQ versus forst cover $y = 0.461^{+} y + 91.4$ 0.40 -0.0001 42 2n %Q versus log(Eention) $y = 15.653^{+} y + 15.0$ 0.40 -0.0001 42 2n %Q, versus log(Eention) $y = 15.653^{+} y + 15.0$ 0.40 -0.0001 42 2n %Q, versus log(Eention) $y = 1.563^{+} y + 15.0$ 0.40 -0.0001 42 2n %Q, versus log(Eention) $y = 1.563^{+} y + 15.0$ 0.41 -0.0001 44 3a pCO, versus %O, $y = -5.596^{+} (47.47, 70.66.02^{+} y + 13.556-102 -0.0001 44 3d MNQ versus loO, y = -0.387^{+} + 10.5 0.15 0.013 44 b(pCO, versus %O, y = -0.387^{+} + 10.5 0.15 0.013 44 b(pCO, versus loG(Devation trans hope (fc Elevation + 10 m) y = -0.393^{+} + 3.648 0.50 -0.0001 45 4 b(pCCQ, versus log(Elevation trans hope (fc Elevation + 10 m) $	2 h	CH ₄ versus Water temperature	$y = 3.404E-02^{-}EXP(3.844E-01^{-}X)+9.299E+01$	2.29E+02			42
2 %AUQ versus (bystream terrain stope $y = 0.816^{57} + 11.23$ 0.47 -0.0001 387 2 %AQ versus (bglEmation) $y = 0.816^{57} + 11.23$ 0.40 -0.0001 387 2 m %Q, versus (bglEmation) $y = 0.816^{57} + 10.3$ 0.40 -0.0001 44 2 n %Q, versus (bglEmation) $y = 0.3757^{77} + 89.4$ 0.40 -0.0001 44 2 n %Q, versus Water temperature $y = -0.3777^{77} + 89.4$ 0.40 -0.0001 44 3 a (pCQ, versus %Q) $y = 5.90E^{-1}$ (Cr/Cr/Cr/Cr/Cr/Cr/Cr/Cr/Cr/Cr/Cr/Cr/Cr/C	2 i	%N ₂ O versus Elevation	y = 7.940E+01*EXP(-9.046E-03*x)+9.615E+01	4.05E+00			40*
2 k % 0,0 versus force cover $y = 0.616^{-1}9^{-1}9^{-1}4$ 0.20 838 2 n % 0,0 versus logElevation $y = 16.863^{-1}8^{-1}6.50^{-1}1^{-1}0.800^{-1}8^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800^{-1}1^{-1}0.800$	2 j	%N ₂ O versus Upstream terrain slope	$y = -0.8165^*x + 112.3$		0.47	<0.0001	38*
1 % 0,0 versus Water Imperature $y = 0.86E,07TEN(0.55E-01*1):0.50E-01 3.82E+00 0.40 0.000 1.44 2 n % 0, versus lightewain ternin siope y = 1.3584* + 50.1 0.40 0.000 44 2 n % 0, versus lightewain ternin siope y = 0.3747* + 80.4 0.40 0.0001 44 2 n % 0, versus Water Imperature y = -1.5737* + 80.8 0.40 0.0001 44 3 n pCO, versus % 0, y = 5.30E+0.74FK/0.165.022* 1.4.2758+0.22 4.37E+0.2 44 3 n pCO, versus % 0, y = -0.3467* + 100.5 0.56 -0.0001 44 3 n pCO, versus % 0, y = -0.3467* + 100.5 0.56 -0.0001 43 3 n NAU versus % 0, y = -0.3467* + 100.5 0.56 0.001 40 4 n log(D(V) versus % 0,000* y = -0.3677* + 3.062 0.471 4.37E+0.0 4.37E+$	2 k	%N ₂ O versus Forest cover	$y = 0.1619^*x + 91.4$		0.20	0.006	38*
$2n$ $300_{-} versus log(Escalar) y = 13.937 + 15.0 0.40 0.000 4.000 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.0001 4.00001 4.00001 4.00001 4.00001 4.00001 4.00001 4.00001 4.00001 4.000001 4.000001$	21	%N ₂ O versus Water temperature	y = 9.648E-07*EXP(6.536E-01*x)+9.610E+01	3.62E+00			38*
2.n %:0, versus logitesmi train stope $y = 1.356^{4} x + 50.1$ 0.40 -0.001 42.0 2.o %:0, versus Wate tremperature $y = -0.373^{4} x + 90.4$ 0.40 -0.001 44.0 3.o DCO, versus %:0, $y = 5.306^{4} + (KT, 7016-02^{2}, N4.7551-02 4.375-02 4.375-02 4.375-02 3.o DCO, versus %:0, y = 6.3374^{4} x + 90.4 4.375-02 4.375-02 4.375-02 3.o OC, versus %:0, y = 6.3262^{4} x + 10.5.2 0.56 -0.0001 44 3.d M:NO, versus %:0, y = -0.375^{4} x + 3.843 0.66 -0.001 40 4.d log(CM, versus %:0, Signestation) y = -0.375^{4} x + 3.863 0.57 -0.001 403 4.d log(CM, versus %:0, Signestation) y = -0.375^{4} x + 3.662 0.42 -0.001 41 4.d log(CM, Q: versus %:0, Signestation) y = -0.375^{4} x + 3.662 0.44 308 4.d log(CM, Q: versus %:0, Signestation <180 m)$	2 m	%O ₂ versus log(Elevation)	$y = 18.953^*x + 15.0$		0.40	<0.0001	44
2 0 ψ_{C_1} wersus Format cover $y = 0.3747 \times 90.4$ 0.1 0.0002 42 2 0 ψ_{C_1} wersus ψ_{C_2} $y = 1.5737 \times 90.8$ 0.00 44 3 a pC_0 wersus ψ_{C_1} $y = 5.000144^+ XP(-106.62^+ x)+4.7585.42$ 4.97E+02 44 3 a CA_1 wersus ψ_{C_1} $y = 0.0227 \times 93$ 0.55 0.0001 44 3 a ψ_{N_0} versus ψ_{C_1} $y = 0.0357 \times 94.84$ 4.97E+02 44 3 a ψ_{N_0} versus ψ_{C_1} $y = 0.00537 \times 94.84$ 1.05 0.0001 40' 3 a ψ_{N_0} versus ψ_{C_1} wersus ψ_{C_1} wersus ψ_{C_1} $y = 0.0397 \times 94.85$ 0.05 0.0001 40' 4 a $\log(C_1)$ versus ψ_{C_1} wersus ψ_{C_1} $y = -0.0377 \times 74.3652$ 0.42 0.0001 40' 4 big(C_1) versus ψ_{C_1} wersus ψ_{C_1} $y = -0.0737 \times 74.3652$ 0.42 0.0001 40' 4 big(C_1) versus ψ_{C_1} wersus ψ_{C_1} $y = -0.0737 \times 74.3652$ 0.04 40' 40' 40' 40' 40' 40' 40' 40' 40' 40'	2 n	%O2 versus Upstream terrain slope	$y = 1.3564^*x + 50.1$		0.40	<0.0001	42
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	2 o	%O ₂ versus Forest cover	$y = -0.3749^*x + 90.4$		0.31	0.0002	42
3 a $pCO_{yensus} SO_{y}$ $y = 5000E+04^{+}EXP(-104E+02^{+})+4785E+02$ 4.97E+02 4 3 c $CH_{yensus} SO_{y}$ $y = 1.652\pm04^{+}EXP(-1485E+02^{+})+1.332E+02$ 4.97E+02 4.4 3 d ShA_{D} orsus by O_{2} $y = 0.0252^{+} 3.98$ 0.45 -0.0001 4.4 3 d ShA_{D} orsus by O_{2} $y = 0.0252^{+} 3.98$ 0.46 -0.0001 4.07 3 d ShA_{D} orsus by O_{2} $y = 0.0353^{+} + 94.8$ 0.46 -0.0001 4.07 4 b bg(CC_{0}) versus bg(Eventon) $y = -0.305^{+} + 3.843$ 0.05 -0.0001 4.07 4 bg(CC_{0}) versus bg(Eventon) $y = -0.075^{+} + 3.065^{+} + 1.722$ 0.40 -0.0001 4.0001 4.0001 4.00001 4.00001 $y = -0.075^{+} + 3.065^{+} + 1.7272$ 0.40 -0.0001 4.0001 4.00001 4.00001 $y = -0.075^{+} + 3.056^{+} + 1.7272$ 0.40 -0.0001 4.0001 4.00001 4.00001 4.00001 4.00001 4.00001 4.00001 4.00001 4.00001 4.00001 4.00001 4.00001 4.00001 4.00001 <	2 p	%O ₂ versus Water temperature	$y = -1.5737^*x + 98.8$		0.40	<0.0001	44
3b pCO, versus (CL, versus 10C) $y = 0.2222 \times + 39$ 4.5 6.5 6.0001 44 3c CH, versus 10C, versus (CO, Versus	За	pCO ₂ versus %O ₂	y = 5.909E+04*EXP(-7.016E-02*x)+4.755E+02	4.97E+02			44
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	3 b	pCO ₂ versus CH	$y = 0.2022^* x + 39$		0.55	<0.0001	44
add Mathematical operation Mathematical operation Mathematical operation 3d Mathematical operation $y = 0.035^{2}x + 94.8$ 0.06 4.000 4.0 3e Mathematical operation $y = 0.035^{2}x + 94.8$ 0.26 0.000 4.0 3e Mathematical operation $y = -0.3478^{2}x + 106.5$ 0.15 0.001 4.3 4a log(CD_1) versus log(Elevation) $y = -0.6519^{2}x + 3.566$ 0.57 -0.0001 4.33 4d log(CH_1) versus log(Elevation) $y = -0.179^{2}x^{1} + 0.364x^{2}x^{1} - 0.1689^{2}x + 1.2722 0.40 e0.0001 271 4d log(CH_1) versus log(Elevation) y = -0.0777x^{2} + 3.2674 0.21 e0.0001 271 4d log(CH_1, CO_2) versus log(Elevation) <180 m)$	30	CH. versus %O-	v = 1.863E+04*EXP(-7.885E-02*x)+1.335E+02	4 97E+02	0.00	10.0001	44
3 b Integer (a) (a) (b) (a) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b	3 d		$v = 0.0053^*x + 94.8$		0.46	~0.0001	40*
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	30		$y = -0.2846^{*}y + 120.2$		0.40	0.0001	40*
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	36		$y = 0.2370 \times 1.120.2$		0.20	0.0009	40
4 a (b) (b)(C).) versus (b)(b)(Eventon) $y = -0.539^{+x} + 3.636$ 0.50 4.0001 4.03 4 b (b)(C).) versus (b)(Eventon) $y = -0.519^{+x} + 3.636$ 0.517^{+x} + 3.636 0.50 4.0001 4.01 4 c (b)(C)(C). versus (b)(C) relevation < 180 m) $y = -0.7179^{+x} + 3.6362$ 0.42 -0.0001 4.71 4 d (b)(C)(-C). versus (b)(Eventon) < 180 m) $y = -0.2737^{+x} + 3.6262$ 0.42 -0.0001 27 4 d (b)(C)(-C). versus (b)(Eventon) < 180 m) $y = -0.242^{-x} + 0.9761^{-x} - 1.3326$ 0.22 -0.001 74 4 (b)(C)(-C). versus (b)(Eventon) < 180 m) $y = -0.0489^{+x} - 2.74$ 0.08 0.0239 64 52.a Wate temperature versus (b)(Eventon) $y = -0.0489^{+x} - 2.74$ 0.08 0.023 64 -0.001 75 53.a Grassland over versus Elevation (for Main-stem) $y = 0.0489^{+x} + 5.568$ 0.80 -0.001 75 -0.001 75 53.a Grassland over versus Elevation (for Main-stem) $y = -0.0136^{+x} + 6.563$ 0.85 -0.0001 75 53.a Grassland over versus Elevation (for Main-stem) $y = -0.0136^{+x} + 8.565$ 0.007 <td>31</td> <td>%N2O Versus DIN</td> <td>y = -0.3475 x + 100.5</td> <td></td> <td>0.15</td> <td>0.0126</td> <td>40</td>	31	%N2O Versus DIN	y = -0.3475 x + 100.5		0.15	0.0126	40
4 b log(CC), versus log(Lepstream terrain slope) $y = -0.015^{15} x^{+} . 0.066^{15} x^{+} 1.7272$ 0.67 -0.0001 4.03 4 c log(CH), versus Upstream terrain slope (for Elevation > 180 m) $y = -0.075^{7} x^{+} . 0.066^{15} x^{+} 1.7272$ 0.42 -0.0001 4.03 4 d log(CH, versus Upstream terrain slope (for Elevation < 180 m)	4 a	log(pCO ₂) versus log(Elevation)	y = -0.308 x + 3.8443		0.50	<0.0001	403
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	4 b	log(pCO ₂) versus log(Upstream terrain slope)	$y = -0.6519^{\circ}x + 3.656$		0.57	<0.0001	403
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	4 c	log(CH ₄) versus log(Elevation)	$y = -0.1799^*x^3 + 0.6348^*x^2 - 0.1668^*x + 1.7272$		0.40	<0.0001	471
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	4 d	log(CH ₄) versus Upstream terrain slope (for Elevation > 180 m)	$y = -0.0757^*x + 3.0622$		0.42	<0.0001	297
4 e log(CH; CO), versus log(Elevation) $y = -0.232^{-23} + 0.971^{-5} - 0.1345$ 0.44 389 41 log(CH; CO), versus lupitream terrain slope (or Elevation < 180 m) $y = -0.01084^+ x - 1.3328$ 0.22 0.001 305 52 a Water temperature versus log(Elevation) $y = -0.01084^+ x - 2.74$ 0.08 0.0239 64 52 b $k_{e_{00}}$ versus Elevation (for Main-stem) $y = -0.0031^{-22} x - 1.406$ 0.96 -0.0001 25 53 a Grassland cover versus Elevation (for Tributaries) $y = 0.01356^+ x - 8.528$ 0.80 -0.0001 25 53 b Forest cover versus Elevation (for Main-stem) $y = 0.0156^+ x - 8.526$ 0.80 -0.0001 25 53 c log(Induction extent + 1) versus log(Elevation) (for Main-stem) $y = -0.01371^+ x - 8.134$ 0.55 0.0025 17 54 a log(CPC), versus log(Glevation (for Main-stem) $y = -0.00284^+ x + 2.799$ 0.33 0.0007 25 54 b Inundation extent versus log(CD-3) (for Main-stem) $y = 0.00284^+ x + 2.799$ 0.35 0.0007 25 54 d log(CPC), versus log(Grassland cover +1) $y = 0.00284^+ x + 2.799$ 0.35 0.0001 25	4 d	log(CH ₄) versus Upstream terrain slope (for Elevation < 180 m)	$y = -0.1775^*x + 2.5974$		0.21	<0.0001	174
4 f log(CH ₂ CO ₂) versus Upstream terrain slope (for Elevation < 180 m) $y = -0.408^{or} x \cdot 2.74$ 0.22 $e \cdot 0.0001$ 305 52 a Water temperature versus log(Elevation) $y = -0.1094^{or} x \cdot 2.74$ 0.08 0.023 64 52 b Kem versus Elevation (for Main-stem) $y = -0.001222^{or} x + 1.406$ 0.96 $e.0.001$ 25 52 b Kem versus Elevation (for Thain-stem) $y = 0.001322^{or} x + 1.406$ 0.96 $e.0.001$ 25 53 a Grassland cover versus Elevation (for Thain-stem) $y = 0.01934^{or} x - 3.572$ 0.33 $e.0.0001$ 27 53 b Forest cover versus Elevation (for Thain-stem) $y = -0.01556^{or} x + 8.63$ 0.85 $e.0.0001$ 25 53 c log(Inundation extert + 1) versus log(Elevation) (for Main-stem) $y = -1.337^{or} x + 3.613$ 0.55 0.0007 × 17 54 a log(CO ₂) versus log(Grassland cover +1) $y = -0.002844^{or} x + 2.799$ 0.33 e.0.001 39 54 b Inundation extert (versus log(CO ₂) (for Thain-stem) $y = -0.00284^{or} x + 2.799$ 0.33 e.0.001 35 54 d log(CH ₄) versus Innadation extert (for Thain-stem) $y = 0.0369^{or} x + 2.795$ 0.47 <td>4 e</td> <td>log(CH₄:CO₂) versus log(Elevation)</td> <td>$y = -0.2342^* x^3 + 0.9761^* x^2 - 0.5717^* x - 3.1345$</td> <td></td> <td>0.44</td> <td></td> <td>369</td>	4 e	log(CH ₄ :CO ₂) versus log(Elevation)	$y = -0.2342^* x^3 + 0.9761^* x^2 - 0.5717^* x - 3.1345$		0.44		369
4 ft log(CH_4CO_3) versus lupatram terrain slope (for Elevation < 180 m) $y = -0.001222^* x + 1.406$ 0.08 0.0239 64 52 b Water temperature versus log(Elevation) $y = -0.001222^* x + 1.406$ 0.98 -0.0001 42 52 b k_{60} versus Elevation (for Tributaries) $y = 0.01694^* x + 2.568$ 0.89 -0.0001 25 53 a Grassland cover versus Elevation (for Tributaries) $y = 0.01694^* x + 8.566$ 0.93 -0.0001 25 53 b Forest cover versus Elevation (for Tributaries) $y = 0.01556^* x + 68.6$ 0.85 -0.0001 25 53 b Forest cover versus Elevation (for Tributaries) $y = -0.01556^* x + 68.6$ 0.85 -0.0001 25 53 c log(Inundation extert + 1) versus log(Elevation) (for Tributaries) $y = -0.00374^* x + 3.613$ 0.55 0.0007 25 54 b Inundation extert versus log(Clevation) (for Tributaries) $y = -0.002844^* x + 2.799$ 0.35 0.0071 25 54 d log(CH_1) versus log(Grassland cover +1) $y = -0.0374^* x + 3.636$ 0.61 0.0002 17 54 d log(CH_1) versus log(Grassland cover +1) $y = 0.0374^* x + 2.956$ 0.47 -0.001<	4 f	log(CH ₄ :CO ₂) versus Upstream terrain slope (for Elevation > 180 m)	$y = -0.0489^*x - 1.8328$		0.22	<0.0001	305
S2 a Water temperature versus log(Elevation) $y = 0.00122y + 1.406$ 0.66 0.0001 44 S2 b k_{00} versus Elevation (for Thibutaries) $y = 0.01869'x + 2.266$ 0.89 $o.0001$ 17 S3 a Grassland cover versus Elevation (for Thibutaries) $y = 0.01946'x + 5.528$ 0.80 $o.0001$ 17 S3 a Grassland cover versus Elevation (for Thibutaries) $y = 0.01957'x + 8.66$ 0.88 $o.0001$ 25 S3 b Forest cover versus Elevation (for Thibutaries) $y = -0.0137'x + 8.613$ 0.65 0.0001 25 S3 c log(Inundation extent + 1) versus log(Elevation) (for Tributaries) $y = -0.0137'x + 8.613$ 0.33 0.0001 25 S4 a log(pCO) versus log(forassland cover +1) $y = -0.0137'x + 3.604$ 0.39 0.0011 25 S4 b Inundation extent (versus log(fOCO) (for Main-stern) $y = -0.0284'x + 2.799$ 0.35 0.0117 25 S4 d log(CH) versus log(Grassland cover +1) $y = -0.0378'x + 2.858$ 0.64 0.0001 37 S4 d log(CH) versus lundation extent (for Tributaries) $y = 0.037$	4 f	log(CH4:CO2) versus Upstream terrain slope (for Elevation < 180 m)	$y = -0.1094^*x - 2.74$		0.08	0.0239	64
S2 b k_{gas} versus Elevation (for Main-stern) $y = 0.0186^{\circ}x - 2.266$ 0.88 <0.0001 25 S2 b k_{gas} versus Elevation (for Tributaries) $y = 0.0136^{\circ}x - 5.528$ 0.80 <0.0001	S2 a	Water temperature versus log(Elevation)	$y = -0.0001222^*x + 1.406$		0.96	<0.0001	44
S2 b k_{000} versus Elevation (for Tributaries) $y = 0.01994^*x + 8.586$ 0.00 < 0.0001 17S3 aGrassland cover versus Elevation (for Tributaries) $y = 0.01994^*x + 8.586$ 0.83 < 0.0001 17S3 bForest cover versus Elevation (for Main-stern) $y = -0.01571^*x + 8.613$ 0.85 < 0.0001 17S3 bForest cover versus Elevation (for Tributaries) $y = -0.01371^*x + 8.613$ 0.550.002517S3 clog(Inundation extent + 1) versus log(Elevation) (for Tributaries) $y = -1.027^*x + 3.604$ 0.390.0007125S4 bInundation extent versus log(Co) (for Main-stern) $y = -0.023^*x + 3.604$ 0.390.0007125S4 bInundation extent versus log(Co) (for Main-stern) $y = 0.0206^*x + 2.858$ 0.610.000217S4 clog(Ch_4) versus log(Grassland cover +1) $y = -0.037^*x + 2.95$ 0.47 < 0.0001 39S4 dlog(Ch_4) versus log(Grassland cover +1) $y = 0.0379^*x + 2.95$ 0.47 < 0.0001 39S4 dlog(Ch_4) versus log(Grassland cover +1) $y = 0.0379^*x + 2.95$ 0.47 < 0.0001 39S4 dlog(Ch_4) versus log(Grassland cover +1) $y = 0.0374^*x + 8.98$ 0.640.002225S4 f%/NQ versus log(Grassland cover +1) $y = 0.0374^*x + 8.98$ 0.640.002225S4 f%/NQ versus log(Grassland cover +1) $y = 0.0374^*x + 8.98$ 0.640.002717S5 bNH_* cover versus Elevation (for Tributaries) $y = -0.126^*x + 1.875$ <	S2 b	k ₆₀₀ versus Elevation (for Main-stem)	$y = 0.01869^*x - 2.266$		0.89	<0.0001	25
S3 a Grassland cover versus Elevation (for Main-stem) $y = 0.01944^+ x + 8.586$ 0.33 <0.0001	S2 b	k ₆₀₀ versus Elevation (for Tributaries)	$y = 0.0436^*x - 5.528$		0.80	<0.0001	17
S3 a Grassland cover versus Elevation (for Tributaries) $y = 0.01456^{\circ} x + 88.6$ 0.93 $c.0001$ 17 S3 b Forest cover versus Elevation (for Tributaries) $y = -0.0156^{\circ} x + 88.6$ 0.83 $c.0001$ 25 S3 b Forest cover versus Elevation (for Tributaries) $y = -0.0137^{\circ} x + 8.63$ 0.55 0.0025 17 S3 c log(Inundation extert + 1) versus log(Elevation) (for Tributaries) $y = -1.027^{\circ} x + 3.604$ 0.33 $c.0001$ 25 S4 a log(pCQ) versus log(Grassland cover +1) $y = -0.01206^{\circ} x + 2.385$ 0.61 0.0007 25 S4 b Inundation extent versus log(pCQ) (for Tributaries) $y = -0.01206^{\circ} x + 2.385$ 0.61 0.0002 17 S4 c log(CH ₄) versus log(Grassland cover +1) $y = 0.01206^{\circ} x + 2.385$ 0.61 0.0002 17 S4 d log(CH ₄) versus lnundation extent (for Tributaries) $y = 0.01206^{\circ} x + 2.385$ 0.47 c0.0001 32 S4 d log(CH ₄) versus lnundation extent (for Tributaries) $y = 0.01360^{\circ} x + 2.365$ 0.34 0.0022 25^{\circ} S4 d log(CH ₄) versus lnundation extent (for Tributaries) $y = 0.0146^{\circ} x + 1.875$ 0.34<	S3 a	Grassland cover versus Elevation (for Main-stem)	$y = 0.01994^*x + 8.586$		0.93	<0.0001	25
S3 b Forest cover versus Elevation (for Main-stem) $y =01556^* x + 68.6$ 0.88 <0.0001 25 S3 b Forest cover versus Elevation (for Main-stem) $y =0137^* x + 86.13$ 0.685 <0.0001	S3 a	Grassland cover versus Elevation (for Tributaries)	$y = 0.01444^*x - 3.572$		0.93	<0.0001	17
S3 b Forest cover versus Elevation (for Tributaries) $y = -0.01371^* + 86.13$ 0.55 0.0025 17 S3 c log(fundation extent + 1) versus log(Elevation) (for Mini-stem) $y = -1.337 * + 4.702$ 0.49 0.0001 25 S3 c log(fDCD_) versus log(Cassiand cover +1) $y = -1.033^* + 4.702$ 0.39 0.0078 17 S4 a log(CD_2) versus log(CD_2) (for Main-stem) $y = -0.0403^* x + 3.418$ 0.53 0.0001 25 S4 b lnundation extent versus log(CD_2) (for Main-stem) $y = 0.0403^* x + 2.858$ 0.61 0.0002 17 S4 c log(CH_1) versus log(Grassland cover +1) $y = -0.08078^* x + 2.95$ 0.47 < 0.0001 25 S4 d log(CH_1) versus log(Grassland cover +1) $y = -0.0378^* x + 2.05$ 0.47 < 0.0002 36* S4 f %N_0 versus log(Grassland cover +1) $y = 0.0374^* x + 98.35$ 0.34 0.0022 25* S4 f %N_0 versus log(Grassland cover +1) $y = 0.02874^* x + 98.38$ 0.64 0.001 13* S4 g log(%O_2) versus log(Inudation extent (for Main-stem) $y = -0.2816^* x + 1.875$ 0.19 0.0309 25 S4 h	S3 b	Forest cover versus Elevation (for Main-stem)	$y = -0.01556^*x + 68.6$		0.85	<0.0001	25
S3 clog(Infundation extent + 1) versus log(Elevation) (for Main-stern) $y = -1.333 \times 4.4.702$ 0.479 0.0078 17S4 alog(pCO ₂) versus log(Grassland cover +1) $y = -0.4003^* x + 3.418$ 0.53 0.0078 17S4 bInundation extent versus log(pCO ₂) (for finibutaries) $y = -0.0284^4 x + 2.799$ 0.55 0.0017 25S4 bInundation extent versus log(pCO ₂) (for finibutaries) $y = 0.01266^* x + 2.858$ 0.611 0.0002 17S4 clog(CH ₄) versus log(Grassland cover +1) $y = 0.01266^* x + 2.858$ 0.471 <0.0001 39S4 dlog(CH ₄) versus lnundation extent (for Tributaries) $y = 0.01461^* x + 1.879$ 0.27 0.324 17S4 elog(GAC ₄) versus lnundation extent (for Tributaries) $y = 0.0374^* x + 98.38$ 0.44 0.0022 25*S4 f%hQO versus lnundation extent (for Tributaries) $y = 0.02816^* x + 1.875$ 0.49 0.0001 13*S4 glog(%O ₂) versus log(Grassland cover +1) $y = 0.02816^* x + 1.875$ 0.49 0.0001 13*S4 glog(%O ₂) versus log(Inundation extent+1) (for Tributaries) $y = -0.1262^* x + 1.88$ 0.46 0.0021 17*S4 hlog(%O ₂) versus log(Inundation extent+1) (for Tributaries) $y = -1.627^* x + 1.88$ 0.46 0.0001 13*S5 bNH ₄ * cover versus Elevation (for Main-stern) $y = 1.593^* x - 6.679$ 0.77 0.77 0.0004 25S5 cDIN cover versus Elevation (for Tributaries) $y = 1.593^* x - 6.679$	S3 b	Forest cover versus Elevation (for Tributaries)	$y = -0.01371^*x + 86.13$		0.55	0.0025	17
SolutionDegree integreeDegree integree integreeDegree integree integree integreeDegree integree inttegr	53 C 53 C	log(Inundation extent + 1) versus log(Elevation) (for Main-stern)	$y = -1.333^{\circ}x + 4.702$ $y = -1.027^{*}x + 3.604$		0.49	0.0001	25 17
Gr atLog(pCO2) winds log(pCO2) (for Main-stem) $y = 0.002844^* x + 2.799$ 0.330.000135S4 bInundation extent versus log(pCO2) (for Tributaries) $y = 0.002844^* x + 2.799$ 0.350.001725S4 blog(CH ₄) versus log(pCO2) (for Tributaries) $y = 0.002844^* x + 2.799$ 0.360.001139S4 dlog(CH ₄) versus log(Grassland cover +1) $y = 0.009493^* x + 1.635$ 0.47<0.0001	53 C	log(mundation extent + 1) versus log(Elevation) (for modianes)	$y = -1.027 \times + 3.004$		0.59	-0.0078	20
G4 bInitidation extent versus log(pCO2) (for ministerin) $y = 0.00246^{\circ} x + 2.858$ 0.61 0.0017 225 S4 bInitidation extent versus log(pCO2) (for Tributaries) $y = 0.00246^{\circ} x + 2.858$ 0.61 0.0002 17 S4 clog(CH ₄) versus lnudation extent (for Main-stern) $y = 0.00246^{\circ} x + 2.858$ 0.61 0.0002 25 S4 dlog(CH ₄) versus lnudation extent (for Tributaries) $y = 0.01461^{\circ} x + 1.879$ 0.27 0.0324 17 S4 elog(%Q) versus lnudation extent (for Main-stern) $y = 0.03509^{\circ} x + 2.044$ 0.35 0.0002 26° S4 f%N ₄ O versus lnudation extent (for Tributaries) $y = 0.02816^{\circ} x + 1.885$ 0.44 0.0022 25° S4 f%N ₄ O versus log(Grassland cover +1) $y = 0.02816^{\circ} x + 1.875$ 0.34 0.0022 25° S4 hlog(%O ₂) versus log(Inudation extent+1) (for Tributaries) $y = -0.1282^{\circ} x + 1.685$ 0.49 <0.0001 39 S4 hlog(%O ₂) versus log(Inudation extent+1) (for Tributaries) $y = -0.1282^{\circ} x + 1.88$ 0.64 0.001 13° S5 bNH ₄ * cover versus Elevation (for Main-stern) $y = -0.1262^{\circ} x + 1.88$ 0.46 0.0027 17 S5 bNH ₄ * cover versus Elevation (for Main-stern) $y = 1.58^{\circ} x - 8.237$ 0.71 <0.0001 17 S5 cDIN cover versus Elevation (for Main-stern) $y = 1.58^{\circ} x - 8.237$ 0.45 0.0004 25 S9 a $FCO_2 + 2$ versus Elevation (for Tributaries) $y = 1.98^{\circ}$	04 a	log(pCO ₂) versus log(Classiand Cover +1)	$y = -0.4003 \times + 3.410$		0.55	0.0017	39
SA bInitial doit extent Versus log(ICCs) (for Inducates) $y = 0.020 x + 2.05$ 0.010.000217S4 clog(CH ₄) versus log(Grassland cover +1) $y = 0.0078^{+}x + 2.95$ 0.47<0.001	04 D	Inundation extent versus log(pCO ₂) (for Main-Stern)	$y = 0.01206^{4} x + 2.733$		0.35	0.0017	20
S4 c log(CH ₄) versus log(Grassland cover +1) $y =0307 \times 2.95$ 0.47 (0.0001) 39 S4 d log(CH ₄) versus lnundation extent (for Main-stem) $y = 0.00493^* x + 1.635$ 0.34 0.0024 25 S4 d log(CH ₄) versus lnundation extent (for Tributaries) $y = 0.03693^* x + 2.044$ 0.35 0.002 36* S4 f %N ₂ O versus log(Grassland cover +1) $y = 0.0374^* x + 98.35$ 0.34 0.0022 25* S4 f %N ₂ O versus log(Grassland cover +1) $y = 0.0374^* x + 98.38$ 0.64 0.001 13* S4 g log(%O ₂) versus log(Grassland cover +1) $y = 0.02816^* x + 1.875$ 0.49 <0.0001 39 S4 h log(%O ₂) versus log(Inundation extent+1) (for Main-stem) $y = -0.1262^* x + 1.88$ 0.46 0.0027 17 S5 b NH ₄ * cover versus Elevation (for Main-stem) $y = 2.104^* x - 10.73$ 0.57 <0.0001 25 S5 c DIN cover versus Elevation (for Tributaries) $y = 1.593^* x - 8.631$ 0.45 0.0001 17 S9 a $FCO_2 + 2$ versus Elevation (for Tributaries) $y = 1.969^* x - 8.631$ 0.45 0.0001 17 S9 d<	54 D	Inundation extent versus log(pCO ₂) (for Tributaries)	y = 0.01200 x + 2.858		0.61	0.0002	17
SA dlog(CH,) versus lnundation extent (for Main-stem) $y = 0.00949^3 x + 1.635$ 0.340.002225S4 dlog(CH_a) versus lnundation extent (for Tributaries) $y = 0.01461^* x + 1.879$ 0.350.002236*S4 f%N_QO versus lnundation extent (for Main-stem) $y = 0.03749^* x + 96.35$ 0.340.002225*S4 f%N_QO versus lnundation extent (for Tributaries) $y = 0.03749^* x + 96.35$ 0.340.002225*S4 f%N_QO versus log(Grassland cover +1) $y = 0.02816^* x + 1.875$ 0.490.000139S4 hlog(%O_2) versus log(Inundation extent+1) (for Main-stem) $y = 0.123^* x + 1.685$ 0.490.000139S4 hlog(%O_2) versus log(Inundation extent+1) (for Tributaries) $y = 0.1262^* x + 1.875$ 0.190.030925S4 hlog(%O_2) versus log(Inundation extent+1) (for Tributaries) $y = -0.1262^* x + 1.88$ 0.460.00113*S5 bNH4,* cover versus Elevation (for Main-stem) $y = 1.58^* x - 8.237$ 0.71<0.0001	S4 c	log(CH ₄) versus log(Grassland cover +1)	$y = -0.8078^{\circ}x + 2.95$		0.47	<0.0001	39
S4 dlog(CH,) versus lnundation extent (for Tributaries) $y = 0.0146^{+7}x + 1.879$ 0.270.032417S4 elog(%N ₂ O) versus log(Grassland cover +1) $y = -0.03509^{+}x + 2.044$ 0.350.000236*S4 f%N ₂ O versus lnundation extent (for Main-stem) $y = 0.08749^{+}x + 96.35$ 0.340.002225*S4 f%N ₂ O versus lnundation extent (for Tributaries) $y = 0.08749^{+}x + 96.35$ 0.49<0.0001	S4 d	log(CH ₄) versus Inundation extent (for Main-stem)	$y = 0.009493^{\circ} x + 1.635^{\circ}$		0.34	0.0024	25
S4 elog(%N_2O) versus log(Grassland cover +1) $y = -0.0350^{9}x + 2.044$ 0.350.000235^{\circ}S4 f%N_2O versus lnundation extent (for Main-stem) $y = 0.08749^{\circ}x + 96.35$ 0.340.002225^{\circ}S4 f%N_2O versus lnundation extent (for Tributaries) $y = 0.3674^{\circ}x + 98.98$ 0.640.00113^{\circ}S4 glog(%O_2) versus log(Grassland cover +1) $y = 0.1261^{\circ}x + 1.885$ 0.490.000139S4 hlog(%O_2) versus log(Inundation extent+1) (for Tributaries) $y = -0.1262^{\circ}x + 1.885$ 0.460.002717S5 bNH4, cover versus Elevation (for Main-stem) $y = -0.1262^{\circ}x + 1.88$ 0.460.002717S5 bNH4, cover versus Elevation (for Tributaries) $y = -0.1262^{\circ}x + 1.88$ 0.460.000125S5 bNH4, cover versus Elevation (for Tributaries) $y = 1.58^{\circ}x - 8.237$ 0.71<0.0001	S4 d	log(CH ₄) versus Inundation extent (for Tributaries)	$y = 0.01461^{\circ}x + 1.879$		0.27	0.0324	17
S4 f%N_Q versus Inundation extent (for Main-stem) $y = 0.08749^*x + 96.35$ 0.340.002225*S4 f%N_Q versus Inundation extent (for Tributaries) $y = 0.3674^*x + 98.98$ 0.640.00113*S4 glog(%O_2) versus log(Grassland cover +1) $y = 0.123^*x + 1.685$ 0.49<0.0001	S4 e	log(%N ₂ O) versus log(Grassland cover +1)	$y = -0.03509^*x + 2.044$		0.35	0.0002	36*
S4 f%N_2O versus Inundation extent (for Tributaries) $y = 0.3674^*x + 98.98$ 0.640.00113*S4 glog(%O_2) versus log(Grassland cover +1) $y = 0.123^*x + 1.685$ 0.49<0.0001	S4 f	%N ₂ O versus Inundation extent (for Main-stem)	$y = 0.08749^*x + 96.35$		0.34	0.0022	25*
S4 glog(%O2) versus log(Grassland cover +1) $y = 0.123^*x + 1.685$ 0.49<0.000139S4 hlog(%O2) versus log(Inundation extent+1) (for Main-stem) $y = -0.02816^*x + 1.875$ 0.190.030925S4 hlog(%O2) versus log(Inundation extent+1) (for Tributaries) $y = -0.1262^*x + 1.885$ 0.460.002717S5 bNH4,* cover versus Elevation (for Main-stem) $y = -0.1262^*x + 1.88$ 0.460.000717S5 bNH4,* cover versus Elevation (for Tributaries) $y = 1.58^*x - 8.237$ 0.71<0.0001	S4 f	%N ₂ O versus Inundation extent (for Tributaries)	$y = 0.3674^*x + 98.98$		0.64	0.001	13*
S4 hlog(%O2) versus log(hundation extent+1) (for Main-stem) $y = -0.2816^*x + 1.875$ 0.190.030925S4 hlog(%O2) versus log(hundation extent+1) (for Tributaries) $y = -0.1262^*x + 1.88$ 0.460.002717S5 bNH4* cover versus Elevation (for Main-stem) $y = 2.104^*x - 10.73$ 0.57<0.0001	S4 g	log(%O ₂) versus log(Grassland cover +1)	$y = 0.123^*x + 1.685$		0.49	<0.0001	39
S4 h log(%O ₂) versus log(hundation extent+1) (for Tributaries) $y = -0.1262^*x + 1.88$ 0.46 0.0027 17 S5 b NH4* cover versus Elevation (for Main-stem) $y = 2.104^*x - 10.73$ 0.57 <0.0001	S4 h	log(%O ₂) versus log(Inundation extent+1) (for Main-stem)	$y = -0.02816^*x + 1.875$		0.19	0.0309	25
S5 b NH4* cover versus Elevation (for Main-stem) $y = 2.104*x - 10.73$ 0.57 <0.0001 25 S5 b NH4* cover versus Elevation (for Tributaries) $y = 1.58*x - 8.237$ 0.71 <0.0001	S4 h	log(%O ₂) versus log(Inundation extent+1) (for Tributaries)	$y = -0.1262^*x + 1.88$		0.46	0.0027	17
S5 b NH ₄ * cover versus Elevation (for Tributaries) $y = 1.58^*x \cdot 8.237$ 0.71 <0.0001 17 S5 c DIN cover versus Elevation (for Main-stem) $y = 1.989^*x \cdot 5.851$ 0.45 0.0004 25 S5 c DIN cover versus Elevation (for Tributaries) $y = 1.989^*x \cdot 5.851$ 0.62 <0.001	S5 b	NH4 ⁺ cover versus Elevation (for Main-stem)	$y = 2.104^*x - 10.73$		0.57	<0.0001	25
S5 c DIN cover versus Elevation (for Main-stem) $y = 1.989^*x - 5.851$ 0.45 0.0004 25 S5 c DIN cover versus Elevation (for Tributaries) $y = 1.989^*x - 5.851$ 0.62 <0.0001	S5 b	NH ⁺ cover versus Elevation (for Tributaries)	$v = 1.58^*x - 8.237$		0.71	<0.0001	17
S5 c DIN cover versus Elevation (for Tributaries) $y = 1.593*x - 4.679$ 0.62 <0.001 17 S9 a FCO_2+2 versus Elevation $y = 3.858E+04^*EXP(-2.674E-02^*x)+7.031E+01$ $1.05E+02$ 42 S9 b FCO_2+2 versus Upstream terrain slope $y = 6.936E+02^*EXP(-6.181E-01^*x)+9.523E+01$ $1.10E+02$ 42 S9 d FCO_2 versus Upstream terrain slope $y = 7.324E+03^*EXP(-1.036E-02^*x)+6.882E+02$ 9.56E+002 42 S9 e FCH_4 versus Elevation $y = 7.324E+03^*EXP(-1.036E-00^*x)+7.622E+02$ 8.02E+02 42 S9 f FCH_4 versus Upstream terrain slope $y = 9.751E+03^*EXP(-1.635E+00^*x)+7.622E+02$ 8.02E+02 42 S9 f FCH_4 versus CH_4 $y = 2.711^*x + 217$ 0.38 <0.0001	S5 c	DIN cover versus Elevation (for Main-stem)	$v = 1.989^*x - 5.851$		0.45	0.0004	25
S9 a FCO2+2 versus Elevation y = 3.858E+04*EXP(-2.674E-02*x)+7.031E+01 1.05E+02 42 S9 b FCO2+2 versus Upstream terrain slope y = 6.936E+02*EXP(-6.181E-01*x)+9.523E+01 1.10E+02 42 S9 d FCO2 versus pCO2 y = 0.1045*x + 6.451 0.45 <0.0001	S5 c	DIN cover versus Elevation (for Tributaries)	$y = 1.593^*x - 4.679$		0.62	<0.0001	17
S9 b FCO2+2 versus Upstream terrain slope y = 6.936E+02*EXP(-6.181E-01*x)+9.523E+01 1.10E+02 42 S9 d FCO2 versus pCO2 y = 0.1045*x + 6.451 0.45 <0.0001	S9 a	FCO ₂ +2 versus Elevation	y = 3.858E+04*EXP(-2.674E-02*x)+7.031E+01	1.05E+02			42
S9 d FCO2 versus pCO2 y = 0.1045*x + 6.451 0.45 <0.0001 42 S9 e FCH4 versus Elevation y = 7.324E+03*EXP(-1.036E-02*x)+6.882E+02 9.56E+02 42 42 S9 f FCH4 versus Upstream terrain slope y = 9.751E+03*EXP(-1.635E+00*x)+7.622E+02 8.02E+02 42 42 S9 h FCH4 versus CH4 y = 2.711*x + 217 0.38 <0.0001	S9 b	FCO ₂ +2 versus Upstream terrain slope	y = 6.936E+02*EXP(-6.181E-01*x)+9.523E+01	1.10E+02			42
S9 e FCH_4 versus Elevation $y = 7.324E+03^*EXP(-1.036E-02^*x)+6.882E+02$ $9.56E+02$ 42 S9 f FCH_4 versus Upstream terrain slope $y = 9.751E+03^*EXP(-1.635E+00^*x)+7.622E+02$ $8.02E+02$ 42 S9 h FCH_4 versus Upstream terrain slope $y = 9.751E+03^*EXP(-1.635E+00^*x)+7.622E+02$ $8.02E+02$ 42 S9 h FCH_4 versus CH_4 $y = 0.751E+03^*EXP(-1.635E+00^*x)+7.622E+02$ $8.02E+02$ 42 S9 h FCH_4 versus CH_4 $y = 0.751E+03^*EXP(-1.635E+00^*x)+7.622E+02$ 0.38 <0.0001 42 S9 i FOL_4 versus N ₂ O $y = 0.316^*x - 28.72$ 0.13 0.0206 42 Excluding Guamanyacu, Inmiyana, Tiputini, and Huirima Rivers $0.16^*x - 28.72$ 0.13 0.0206 42	S9 d	FCO ₂ versus pCO2	$y = 0.1045^*x + 6.451$		0.45	<0.0001	42
S9 f FCH_4 versus Upstream terrain slope $y = 9.751E+03^*EXP(-1.635E+00^*x)+7.622E+02$ $8.02E+02$ 42 S9 h FCH_4 versus Upstream terrain slope $y = 9.751E+03^*EXP(-1.635E+00^*x)+7.622E+02$ $8.02E+02$ 42 S9 h FCH_4 versus CH_4 $y = 2.711^*x + 217$ 0.38 <0.0001 42 S9 i FN_2O versus N ₂ O $y = 0.316^*x - 28.72$ 0.13 0.0206 42 Excluding Guamanyacu, Inmiyana, Tiputini, and Huirima Rivers $y = 0.316^*x - 28.72$ 0.13 0.0206 42	S9 e		y = 7.324E+03*EXP(-1.036E-02*x)+6.882E+02	9.56E+02			42
S9 h FCH ₄ versus CH ₄ $y = 2.711^*x + 217$ 0.38 <0.0001 42 S9 i FN ₂ O versus N ₂ O $y = 0.316^*x - 28.72$ 0.13 0.0206 42	S9 f	FCH, versus Upstream terrain slope	y = 9.751E+03*EXP(-1.635E+00*x)+7.622E+02	8.02F+02			42
S9 i FN_2O y = 0.316*x - 28.72 0.33 0.0206 42 Excluding Guamanyacu, Inmiyana, Tiputini, and Huirima Rivers 0.13 0.0206 42	59 h	FCH, versus CH.	$v = 2.711^* x + 217$	0.022.02	0.38	<0.0001	42
Excluding Guamanyacu, Inniyana, Tiputini, and Huirima Rivers	Sai		$v = 0.316^* x - 28.72$		0.30	0.0206	42
	* Excluding	Guamanyacu, Inmiyana, Tiputini, and Huirima Rivers	,	II	0.10	0.0200	-72

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