

**Table S1.** Linear regressions results for (1) person-to-person comparisons to determine the consistency among different individuals digitizing the same data, and (2) person-to-data comparisons comparing digitized results generated by different individuals to actual data. Seven separate plots were evaluated, four of which were digitized by two different individuals to further check for operator consistency. For person-to-data comparisons, digitized data (x) were used to predict actual data (y). Sample size (*n*) for each regression denotes the number of data points digitized in each comparison. All regressions were significant ( $P < 0.0001$ ).

Comparison	<i>n</i>	Regression equation	$R^2$
Person to person	15	$y = 1.001x - 2.388$	0.9998
	19	$y = 0.979x + 0.086$	0.9988
	39	$y = 1.001x - 0.264$	1.00
	90	$y = 0.999x + 0.005$	1.00
	10	$y = 0.992x + 3.778$	0.9996
Person-to known-data	21	$y = 0.997x + 0.730$	0.9997
	21	$y = 0.993x + 0.009$	0.9997
	20	$y = 0.966x + 25.886$	0.9644
	19	$y = 0.996x - 2.436$	0.9999
	8	$y = 1.050x + 0.166$	0.9985
	39	$y = 0.991x + 1.357$	1.00
	39	$y = 0.992x + 1.109$	1.00
	90	$y = 1.001x + 0.006$	1.00
	90	$y = 1.000x + 0.009$	1.00
	10	$y = 1.003x - 1.779$	0.9996
	10	$y = 0.995x + 1.873$	0.9999

**Table S2.** Summary of number of observations for all variables by continent. Variable titles correspond to GriMeDB column titles and are defined in Tables A1-A4.

Variable	Africa	Asia	Central America	Europe	Green-land	North America	Oceania	South America	Total
Sites	561	761	5	1244	37	2031	117	281	5037
Elevation_m	552	376	5	255	0	1031	83	140	2442
Slope_m_per_m	3	37	0	41	0	396	0	0	477
Strahler_order	0	186	4	661	0	458	5	19	1333
Basin_size_km2	69	98	2	500	1	654	43	29	1396
CH4mean or CH4median	1854	2350	11	6157	181	12416	388	667	24024
CO2mean or CO2median	563	655	11	4887	125	10561	302	551	17655
N2Omean or N2Omedian	1721	591	0	1399	0	4338	179	181	8409
WaterTemp_degC	1800	2033	11	4959	181	11028	380	470	20862
Cond_uScm	1642	455	1	1467	181	8791	165	499	13201
pH	631	1620	0	2019	181	8954	345	416	14166
DO_mgL	230	837	0	936	125	6102	296	397	8923
DO_percentsat	1316	1302	0	1247	181	4267	194	192	8699
Q	102	104	10	2126	47	5528	223	290	8430
NO3	1061	1478	0	3045	117	7401	192	36	13330
NH4	1052	1486	0	2862	118	7211	182	39	12950
TN	75	138	0	2198	119	6624	8	180	9342
SRP	524	242	0	1910	118	6030	182	36	9042
TP	219	229	0	1294	0	5796	8	36	7582
DOC	1269	756	0	4019	119	8659	296	367	15485

**Table S2. Continued**

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Diffusive_CH4_Flux_Mean or Diffusive_CH4_Median	123	2360	10	1316	0	2670	197	321	6997
Eb_CH4_Flux_Mean_or_Median	0	313	0	78	0	214	4	12	621
Total_CH4_Flux_Mean_or_Median	39	329	0	113	0	91	3	12	587
CO2_Flux_Mean_or_Median	107	792	10	924	0	2237	158	216	4444
N2O_Flux_Mean_or_Median	74	622	0	42	0	595	42	144	1521

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**Table S3.** Regression statistics for mean  $\log_{10}$ -transformed  $\text{CH}_4$  concentration ( $\text{CH}_4\text{mean}$ ) and diffusive flux as a function of the absolute value of latitude and basin area ( $\text{km}^2$ ). Because of the  $\log_{10}$  transformation, concentrations reported as 0 or below detection ( $n = 769$  or 3.3% of all  $\text{CH}_4\text{mean}$  observations) and negative, 0, or below detection fluxes ( $n = 369$  or 5.3% of all diffusive flux measurements) were omitted from regression analyses.

Comparison	$n$	$P$	$R^2$
Concentration			
Absolute value of latitude	4597	<0.001	0.0024
Catchment area	1206	NS	$1.03 \times 10^{-5}$
Diffusive flux			
Absolute value of latitude	1858	<0.01	0.004
Basin area	648	NS	$8.6 \times 10^{-4}$

**Table S4.** Summary statistics for non-gas variables. Variable titles correspond to GriMeDB column titles and are defined in Table A3.

Var	Unit	Mean	Median	Max	Min	SD	CV
Temp	°C	13.3	12.5	37.5	-3.3	8.25	62.2
Cond_Uscm	µS cm <sup>-1</sup>	219	105	7650	2.6	294	135
pH		7.04	7.23	10.86	2.5	1.01	14.3
DO_mgL	mg L <sup>-1</sup>	8.84	8.95	22.62	0	3.03	34.2
DOpercentsat	%	80.4	88.5	301.4	0	28.6	35.6
Q	m <sup>3</sup> s <sup>-1</sup>	2349	0.11	6950000	-14.75	107859	4592
NO <sub>3</sub>	µmol L <sup>-1</sup>	44.5	3.1	2521	0	110	247
NH <sub>4</sub>	µmol L <sup>-1</sup>	29.7	1.5	4280	0	141	476
TN	µmol L <sup>-1</sup>	80.6	24.1	87813	0	1537	1906
SRP	µmol L <sup>-1</sup>	1.1	0.18	237	0	6.29	562
TP	µmol L <sup>-1</sup>	2.2	0.49	646	0	10.9	490
DOC	µmol L <sup>-1</sup>	767	445	214821	0	2628	343