SI Appendix for

Climate control on terrestrial biospheric carbon turnover

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This PDF file includes:

Figures S1 to S8
Tables S1 to S5
Caption for Dataset S1
References for SI Appendix

Other Supporting Information for this manuscript include the following:

Dataset S1

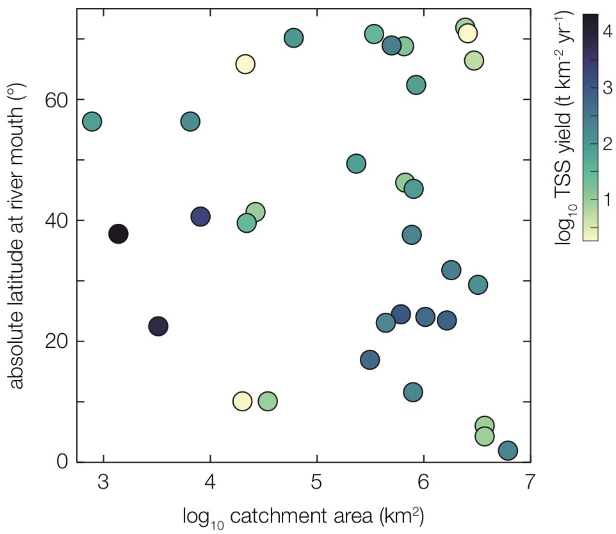

Figure S1. Catchment latitude as a function of area. Absolute value of latitude at the river mouth plotted as a function of catchment area for all river basins used in this study. Markers are additionally color coded by total suspended sediment (TSS) yield. There exists no correlation between catchment area and latitude at the river mouth, indicating that our sample set provides adequate global coverage and that covariance between these properties will not bias our results.

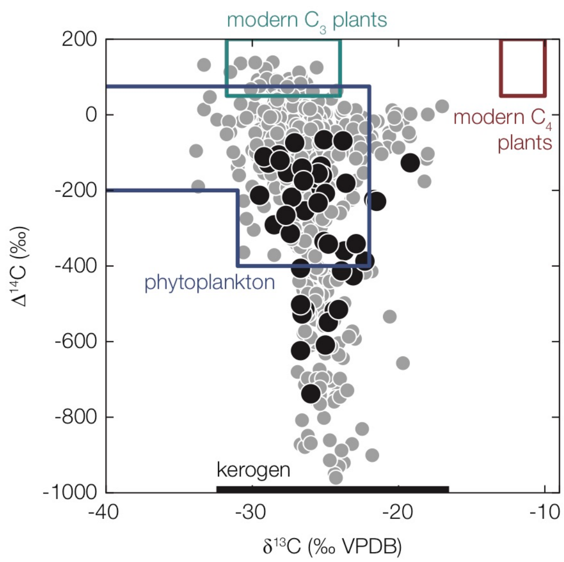

Figure S2. River POC dual isotope plot. Bulk POC $\delta^{13}C$ values (relative to Vienna Pee Dee Belemnite) vs. ^{14}C content reported in $\Delta^{14}C$ notation (*1*), which allows for the inclusion of samples with "above modern" ^{14}C ages due to incorporation of nuclear-bomb-derived ^{14}C. All samples from the database of Marwick et al. (*2*) are shown as gray circles; all samples from this study are shown as black circles. Importantly, samples from this study span a majority of the variability seen in the global database, indicating that results from our sample set likely reflect global phenomena. Estimates of end-member OC compositions are also plotted as colored boxes (*2*).

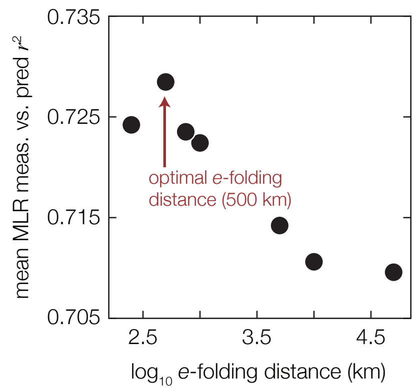

Figure S3. MLR correlations with *e*-folding distance. The mean of multiple linear regression (MLR) r^2 values for all biomarker and POC ^{14}C and $\delta^{13}C$ response variables plotted as a function of weighting *e*-folding distance. Higher *e*-folding distances result in control variable values that are more uniformly integrated across the river basin, with the longest *e*-folding length equivalent to catchment-wide integration. Here, we choose 500 km as the optimal *e*-folding distance for determination of catchment-weighted parameters, as this value maximizes MLR r^2 values.

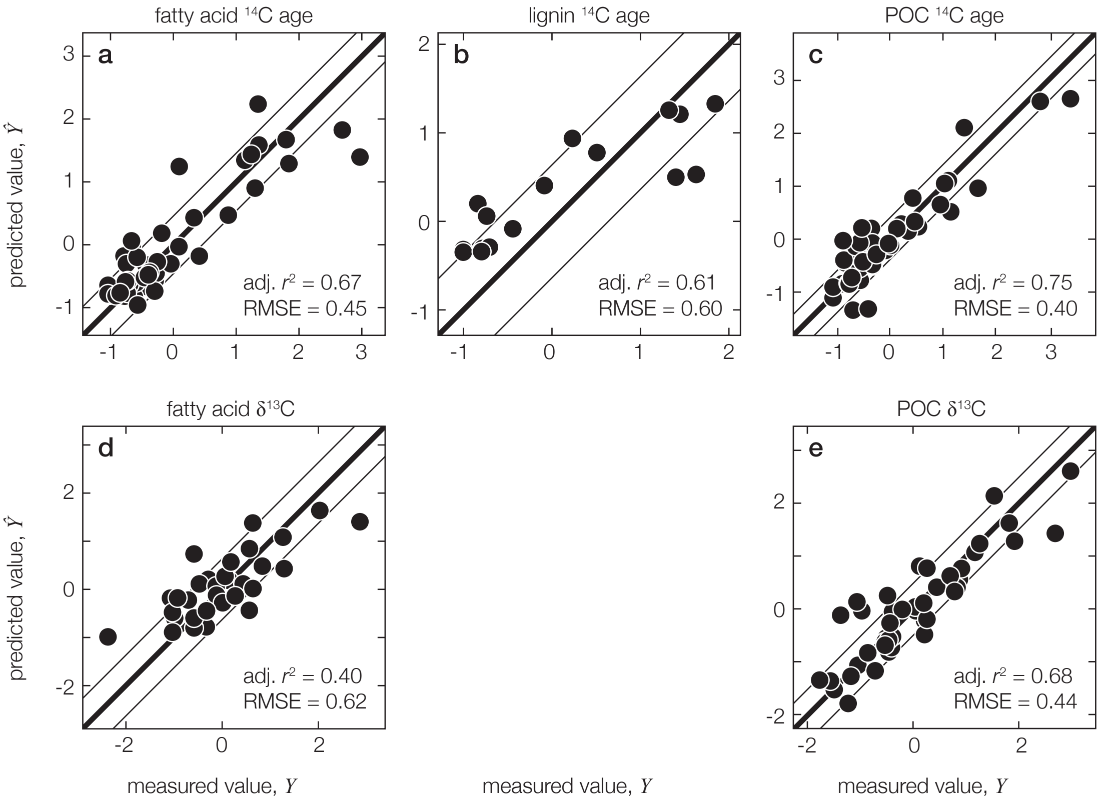

Figure S4. Measured vs. MLR-predicted response variables. Multiple-linear-regression (MLR) predicted **A**, plant-wax fatty acid ^{14}C age, **B**, lignin phenol ^{14}C age, **C**, bulk POC ^{14}C age, **D**, plant-wax fatty acid ^{13}C composition, and **E**, bulk POC ^{13}C composition as a function of their measured values. For each panel, thick black line is the 1:1 line and thin black lines represent ± 1 root mean square error (RMSE) about the 1:1 line; adj. r^2 refers to the adjusted r^2 value that removes the effect of spurious improvement resulting from increasing the number of predictor variables. All measured and predicted values have been scaled such that each distribution has a mean of zero and a standard deviation of unity.

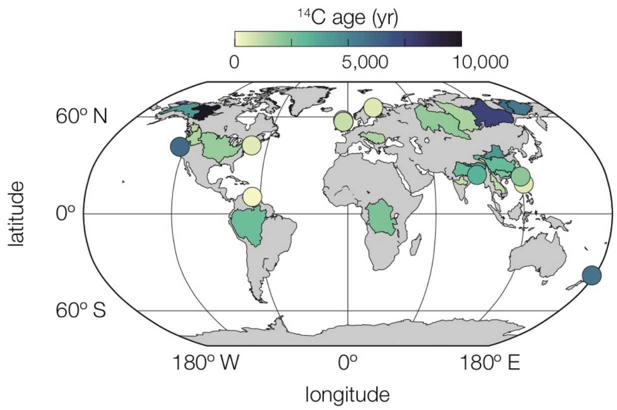

Figure S5. Riverine POC ^{14}C ages. Catchment areas of all rivers analyzed in this study color-coded by bulk POC ^{14}C ages (*SI Appendix*, Table S1). Rivers with catchment areas smaller than 30,000 km^2 are shown as colored circles for clarity. Legend is the same as in Fig. 1.

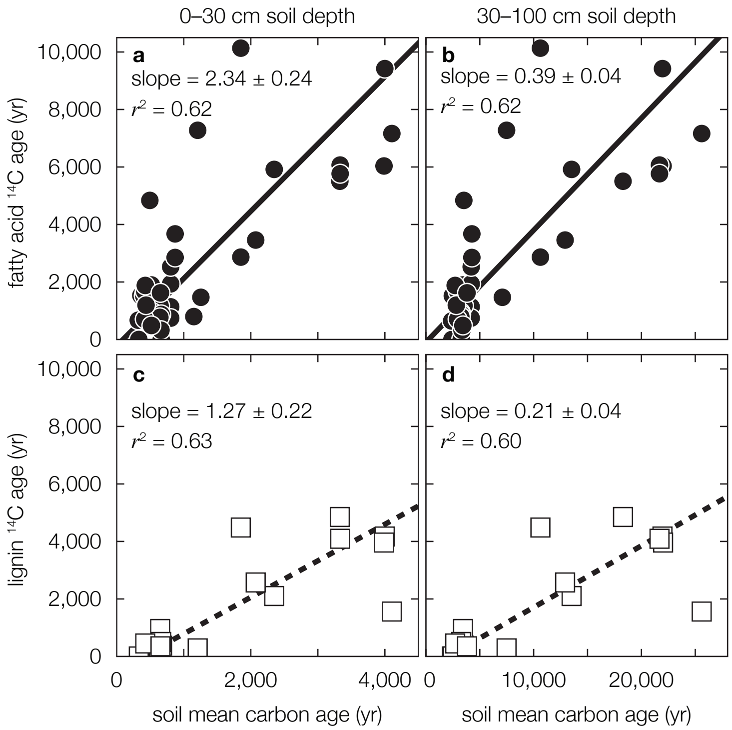

Figure S6. **Relationships between soil mean carbon age and biomarker ^{14}C age**. **a** and **b**, Plant-wax fatty acid, and **c** and **d**, lignin phenol ^{14}C ages as a function of soil mean carbon age (0-30 cm, left panels; 30-100 cm, right panels). Solid and dashed black lines are reduced major axis regression lines; reported values are the corresponding reduced major axis regression slopes and r^2 values (*Materials and Methods*). Uncertainty ($\pm 1\sigma$) is always smaller than marker points.

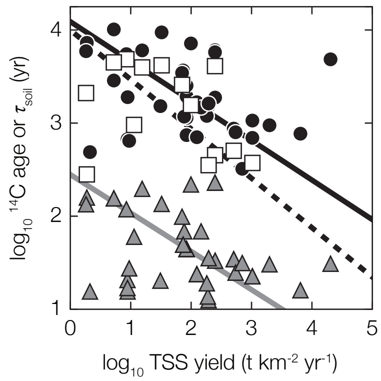

Figure S7. TSS controls on soil carbon turnover times and biomarker ^{14}C ages. Logarithmic plant-wax fatty acid ^{14}C ages (black circles), lignin phenol ^{14}C ages (white squares), and catchment soil carbon turnover times (τ_{soil}; gray triangles) (*3*) as functions of total suspended sediment (TSS) yield (*SI Appendix*, Tables S1, S3). Solid black, dashed black, and gray lines are plant-wax fatty acid, lignin phenol, and τ_{soil} reduced major axis regression lines, respectively (*Materials and Methods*). Relationship slopes and r^2 values are as follows: fatty acid ^{14}C ages: slope = -0.42 ± 0.08, r^2 = 0.07; lignin phenol ^{14}C ages: slope = -0.53 ± 0.18, r^2 = 0.12, τ_{soil}: slope = -0.41 ± 0.08, r^2 = 0.10.

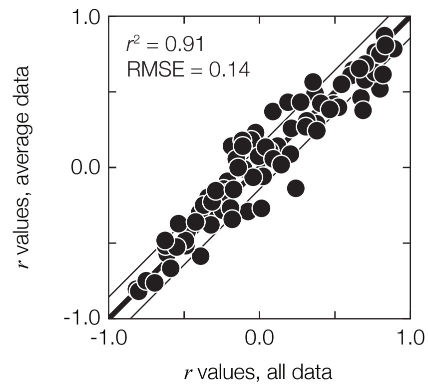

Figure S8. **All vs. averaged correlation coefficients**. Cross plot of all correlation coefficients between environmental control variables and isotope response variables when either "all" or "catchment-averaged" response variable datasets are used (i.e., *SI Appendix*, Table S1 or S2). Thick black line is the 1:1 line and thin black lines represent ± 1 root mean square error (RMSE) about the 1:1 line. Although some scatter exists, correlation coefficients are largely independent of the chosen response variable dataset used; that is, they plot close to the 1:1 line.

Table S1. Average bulk POC, fatty acid, and lignin ^{14}C ages and $\delta^{13}C$ values for all river basins used in this study, including information on sample type (suspended sediment, bedload, or deposit sediment), collection year, GPS coordinates, and original data source.

Table S2. Similar to Supplementary Table 1 but including all individual data points for all river basins.

Table S3. All environmental and geomorphic control variables, including spatially resolved variables at various *e*-folding distances as well as notes on data sources.

Table S4. Multiple linear regression (MLR) results and statistics, including correlation coefficients (*r* values) and statistical significance *p* values.

Table S5. Redundancy analysis (RDA) results and statistics, including control variable loadings, response variable loadings, and individual sample scores for each RDA canonical axis.

Supplementary Dataset S1. Input Python code needed to perform all statistical analyses and generate all tables and figures provided in this manuscript.

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Table S1. Average bulk POC, fatty acid, and lignin ^{14}C ages and $\delta^{13}C$ values for all river basins used in this study, including information on sample type (suspended sediment, bedload, or deposit sediment), collection year, GPS coordinates, and original data source.

River	Sample Type	Collection yr	Deposition yr	Longitude ° E	Latitude ° N	bulk POC					*n*-alkanoic ("fatty") acids							lignin phenols					Data source/SI Ref.#
						$\delta^{13}C$ ‰ VPDB	Fm	$\Delta^{14}C$† ‰	^{14}C age‡ yr	*n*	$\delta^{13}C$ ‰ VPDB	Fm	$\Delta^{14}C$† ‰	^{14}C age‡ yr	Conc. µg gC^{-1}	*n*	*C#*	Fm	$\Delta^{14}C$† ‰	^{14}C age‡ yr	Conc. µg gC^{-1}	*n*	
Amazon @ Obidos	Suspended sed.	2005	2005	-55.508	-1.935	-28.5	0.7136	-291.1	2710	1	-36.3	0.8266	-178.9	1530	857.3	1	24-30						This study
Brahmaputra @ Jamuna Bridge	Bedload	2004	2004	89.730	24.470	-23.1	0.5776	-426.2	4409	1	-28.8	0.9173	-88.7	693	207.4	1	24-32	0.9617	-51.6	373	9215.6	1	Ref. 4; this study
Brahmaputra @ Jamuna Bridge	Suspended sed.	2007	2007	89.800	24.410	-23.7	0.6445	-359.9	3528	1	-30.4	0.8760	-130.1	1064	168.3	1	24-32						Ref. 4; this study
Cagayan @ mouth	Floodplain deposit	2016	2016	121.673	18.123	-25.1	0.9419	-65.6	481	1		0.9911	-16.7	71	8051.6	1	24,26,30						This study
Cariaco (composite) @ mouth	Slope deposit		BS average*			-19.8	1.0024	-6.1	0	5	-27.7	0.7896	-217.0	1897		5	30,32						Ref. 5
Columbia @ Portland	Shelf deposit	1993	BS average*	-124.254	45.252	-25.3	0.8400	-164.4	1406	2	-31.4	0.8876	-117.0	971	150.0	2	26-32	0.8946	-116.6	955	56000.0	2	Ref. 6
Colville @ Nuiqsut	Suspended sed.	2007	2007	150.980	70.220	-26.6	0.4338	-569.1	6773	2		0.4108	-592.1	7163	454.6	2	24-28	0.8295	-182.3	1562	2142.1	2	Ref. 7
Congo @ Boma	Floodplain deposit	1976	1976	12.567	-6.050	-26.4	1.2593	251.0	0	1	-32.4	1.0316	28.4	0	2641.7	1	24-30	1.1050	101.5	0		1	This study
Congo @ Brazzaville	Suspended sed.	2011-2013	2011-2013	12.567	-6.050	-26.4	0.9059	-100.8	794	1	-31.5	0.9097	-86.8	670	1129.9	1	24-32						This study
Connecticut @ Lyme	Suspended sed.	2010	2010	-72.400	41.400	-28.8				1	-33.0	0.9230	-83.7	644	1167.3	1	24-32						This study
Danube @ Tulcea	Floodplain deposit	2013-2014	2013-2014	28.755	45.216	-26.7	0.7740	-232.0	2058	2	-33.3	0.7861	-220.0	1934	477.6	2	24-30						Ref. 8
Danube @ Tulcea	Suspended sed. (depth integrated)	2013-2014	2013-2014	28.755	45.216	-27.8	0.9236	-83.5	638	2	-33.2	0.8682	-138.5	1135		2	24-30						Ref. 8
Danube @ Tulcea	Delta lake sed.			28.628	45.218	-27.6	0.8532	-153.3	1276	1	-31.8	0.9117	-95.2	742	1824.6	1	24-32						This study
Danube @ Tulcea	Shelf deposit	2008		29.778	45.078	-25.5	0.8427	-163.2	1375	2	-29.7	0.7342	-270.9	2527		2	26-30						Ref. 9
Delaware @ state border	Suspended sed.	2011	2011	-75.553	39.577	-25.1				1	-29.4	0.8276	-178.5	1520		1	24-28						Ref. 10
Dulnain @ Dulnain Bridge	Suspended sed.	2016	2016	-3.699	57.302	-28.2	0.9015	-105.6	833	1		0.7812	-225.0	1983	19552.2	1	24-32						This study
Earn @ Bridge of Earn	Suspended sed.	2016	2016	-3.403	56.350	-28.9	0.8794	-127.5	1032	1		0.8641	-142.7	1173		1	24-32						This study
Eel @ mouth	Shelf deposit	2000		-124.252	40.648	-24.6	0.4697	-533.7	6074	2	-31.0	0.8889	-117.5	947	454.2	2	24-32; 24-30						Ref. 11; Ref. 12
Fraser @ Hope	Floodplain deposit (<63µm)	2010	2010	-121.451	49.381	-25.5	0.8509	-155.3	1297	1		0.6330	-371.5	3673	771.0	1	24-32						This study
Fraser @ Hope	Fjord basin	2003	BS average*				0.8536	-151.9	1272	8	-30.6	0.7011	-303.6	2852		8	26-32						Ref. 5
Ganga @ Harding Bridge	Suspended sed.	2007	2007	89.030	24.050	-21.7	0.7814	-224.0	1981	1	-27.8	1.0111	4.2	0	405.4	1	24-32	0.9462	-67.2	504	7318.5	1	Ref. 4; this study
Ganga @ Harding Bridge	Bedload	2005	2005	89.040	24.040	-22.3	0.6171	-387.0	3878	1	-29.2	0.8971	-108.8	872	448.2	1	24-32						Ref. 4; this study
Gaoping @ mouth	Floodplain deposit	2017	2017	120.416	22.498		0.7766	-229.7	2031	1		0.9087	-98.6	769		1	26-30						This study
Godavari @ Rajahmundi	Slope deposit			82.683	16.593	-19.2	0.8793	-127.1	1034	1	-26.0	0.9056	-101.0	797	135.5	1	24-32						This study
Indigirka @ mouth	Shelf deposit	2004-2005	1984-2004	150.460	72.060	-26.6	0.4765	-526.6	5955	1	-30.3	0.3095	-692.6	9422	346.8	1	24-28	0.5993	-409.0	4172	21374.0	1	Ref. 13; Ref. 14
Kalix @ mouth	Shelf deposit	2004-2005	1984-2004	23.200	65.440	-27.1	0.9329	-73.2	558	1	-32.1	0.4042	-598.4	7276	282.5	1	24-28	0.9728	-40.6	281	14352.0	1	Ref. 13; Ref. 14
Kolyma @ mouth	Shelf deposit	2004-2005	1984-2004	163.700	70.000	-26.7	0.5017	-501.6	5541	1	-32.9	0.4718	-531.3	6035	546.4	1	24-28	0.6152	-393.3	3961	22776.5	1	Ref. 13; Ref. 14
Lena @ mouth	Shelf deposit	2004-2005	1984-2004	129.540	71.960	-25.0	0.3939	-608.7	7484	1	-24.0	0.5040	-499.3	5504	178.2	1	24-28	0.5508	-456.9	4851	11408.9	1	Ref. 13; Ref. 14
Mackenzie + Peel @ Tsiigehtchic	Shelf sediment	1987	1987	-133.433	70.170	-26.0	0.2640	-737.2	10700	1	-31.0	0.4699	-532.2	6067	300.0	1	24-28	0.6052	-401.9	4093	4322.1	1	Ref. 7; Ref. 15
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2007	BS average*			-26.4	0.2184	-783.3	12259	12		0.4879	-515.5	5765		18	24-32						Ref. 5
Mekong @ Phnom Penh	Suspended sed. (<63µm)	2008-2010	2008-2010	104.943	11.596	-26.6	0.8650	-141.0	1165	3								1.0953	80.0	0	18700.0	3	Ref. 16
Mississippi @ mouth	Upper slope deposit					-21.5	0.7765	-228.8	2032	1	-29.2	0.8119	-193.6	1674		1	24-28						This study
Mississippi @ mouth	Bedload	2003	2003	-89.507	29.262	-23.6	0.8252	-180.1	1544	1	-30.7	0.9160	-89.9	705		1	24-30						Ref. 12
Ob @ mouth	Floodplain lake sed.	1994		68.542	66.667	-29.4	0.8437	-160.7	1380	2	-33.1	0.7001	-303.7	2865	4814.4	2	24-32						This study
Ob @ mouth	Shelf deposit	2004-2005	20 years	73.440	72.650	-27.4	0.6911	-313.4	2968	1	-32.1	0.2833	-718.6	10133	169.6	1	24-28	0.5765	-431.5	4484	13361.0	1	Ref. 13; Ref. 14
Padma @ Mawa	Suspended sed.	2007	2007	90.250	23.460	-22.9	0.6639	-340.7	3291	1	-29.4	0.9606	-46.0	323	519.2	1	24-32						Ref. 4; this study
Pearl @ Guangzhou	Suspended sed.	2018	2018	113.490	23.090	-27.8	0.7567	-249.6	2240	3		0.8619	-145.3	1194	984.2	3	24-30						This study
Pettaquamscutt @ Narragansett	Estuarine deposit		BS average*			-23.8	0.9376	-70.3	518	4	-30.1	0.7641	-242.4	2162		4	30,32						Ref. 17
Tay @ Earn confluence	Suspended sed.	2016	2016	-3.246	56.353	-28.1	0.8865	-120.5	968	1		0.8331	-173.5	1467		1	24-32						This study
Unare @ mouth	Floodplain deposit					-25.0	0.7975	-209.2	1818	1		0.9411	-66.8	488	471.3	1	24-32						This study
Waiapu @ Ruatoria	Shelf deposit			178.386	-37.815	-24.1	0.4882	-515.9	5760	1		0.5476	-457.0	4838	319.2	1	24-32						This study
Yangzte @ Zhenjiang	Suspended sed.	2007-2009	2007-2009	120.930	31.780	-25.1	0.7018	-303.3	2864	3		0.7921	-213.5	1879	1475.5	2	24-32	0.9453	-68.2	452		3	This study
Yellow @ Binzhou	Suspended sed.	2011-2016	2011-2016			-23.9	0.5917	-413.3	4216	18	-31.5	0.8172	-189.3	1622	288.2	18	24-32	0.9641	-51.1	353		5	Ref. 18; Ref. 19
Yenisey @ mouth	Shelf deposit			79.860	72.610	-26.5	0.8311	-175.9	1486	1	-32.1	0.4788	-525.2	5916	159.9	1	24-28	0.7755	-236.7	2102	11151.7	1	Ref. 13; Ref. 14
Yukon @ mouth	Floodplain deposit	2007	2007			-26.7	0.5989	-405.2	4118	1		0.6502	-354.3	3458	726.9	1	24-28	0.7313	-279.1	2574	7506.6	1	Ref. 7

*Indicates that deposit samples likely integrate across the nuclear-bomb-derived ^{14}C spike (~1955 – present).
†Calculated as Δ14C = [Fm*exp((1950 – collection year)/8267) - 1]*1000 ‰; for samples with unknown collection year, 2020 was used.
‡Samples with Fm > 1.0 are designated as ^{14}C age = 0 yr for all statistical analyses.

Table S2. Similar to Supplementary Table 1 but including all individual data points for all river basins.

River	Sample Type	Collection yr	Deposition yr	Longitude °E	Latitude °N	bulk POC $\delta^{13}C$ ‰ VPDB	bulk POC Fm	bulk POC $\Delta^{14}C$† ‰	bulk POC ^{14}C age yr	*n*-alkanoic ("fatty") acids $\delta^{13}C$ ‰ VPDB	*n*-alkanoic acids Fm	*n*-alkanoic acids $\Delta^{14}C$† ‰	*n*-alkanoic acids ^{14}C age‡ yr	*n*-alkanoic acids Conc. $\mu g\ gC^{-1}$	*n*-alkanoic acids C#	lignin phenols Fm	lignin phenols $\Delta^{14}C$† ‰	lignin phenols ^{14}C age‡ yr	lignin phenols Conc. $\mu g\ gC^{-1}$	Data source/SI Ref. #
Amazon @ Obidos	Suspended sed.	2005	2005	-55.508	-1.935	-28.5	0.7136	-291.1	2710	-36.3	0.8266	-178.9	1530	857.3	24-30					This study
Brahmaputra @ Jamuna Bridge	Bedload	2004	2004	89.730	24.470	-23.1	0.5776	-426.2	4409	-28.8	0.9173	-88.7	693	207.4	24-32	0.9617	-51.6	373	9215.6	Ref. 4; this study
Brahmaputra @ Jamuna Bridge	Suspended sed.	2007	2007	89.800	24.410	-23.7	0.6445	-359.9	3528	-30.4	0.8760	-130.1	1064	168.3	24-32					Ref. 4; this study
Cagayan @ mouth	Floodplain deposit	2016	2016	121.673	18.123	-25.1	0.9419	-65.6	481		0.9911	-16.7	71	8051.6	24,26,30					This study
Cariaco (composite) @ mouth	Slope deposit		1996			-20.1	1.0602	53.0	0	-26.6	0.7422	-262.8	2395		30,32					Ref. 5
Cariaco (composite) @ mouth	Slope deposit		1981			-20.1	1.0662	59.0	0	-28.6	0.8108	-194.7	1685		30,32					Ref. 5
Cariaco (composite) @ mouth	Slope deposit		1971			-19.8	1.0078	1.0	0	-28.1	0.8587	-147.1	1224		30,32					Ref. 5
Cariaco (composite) @ mouth	Slope deposit		1966			-19.7	0.9534	-53.0	383	-28.9	0.7798	-225.5	1998		30,32					Ref. 5
Cariaco (composite) @ mouth	Slope deposit		1946			-19.5	0.9242	-82.0	633	-26.6	0.7574	-247.7	2232		30,32					Ref. 5
Columbia @ Portland	Shelf deposit	1993	BS average*	-124.254	45.252	-25.3	0.8103	-193.9	1690	-31.8	0.9379	-67.0	515	180.0	30,32	0.9057	-105.7	855	60700.0	Ref. 6
Columbia @ Portland	Shelf deposit	1993	BS average*	-124.334	46.417	-25.3	0.8697	-134.8	1122	-31.0	0.8373	-167.1	1427	120.0	30,32	0.8835	-127.5	1054	51300.0	Ref. 6
Colville @ Nuiqsut	Suspended sed.	2007	2007	150.980	70.220	-26.4	0.4888	-514.6	5751		0.4366	-566.4	6657	445.3	24-28	0.8395	-172.4	1465	2208.8	Ref. 7
Colville @ Nuiqsut	Suspended sed.	2007	2007	150.990	70.220	-26.7	0.3789	-623.7	7795		0.3849	-617.7	7670	463.9	24-28	0.8194	-192.2	1659	2075.3	Ref. 7
Congo @ Boma	Floodplain deposit	1976	1976	12.567	-6.050	-26.4	1.2593	251.0	0	-32.4	1.0316	28.4	0	2641.7	24-30	1.1050	101.5	0		This study
Congo @ Brazzaville	Suspended sed.	2011-2013	2011-2013	12.567	-6.050	-26.4	0.9059	-100.8	794	-31.5	0.9097	-86.8	670	1129.9	24-32					This study
Connecticut @ Lyme	Suspended sed.	2010	2010	-72.400	41.400	-28.8				-33.0	0.9230	-83.7	644	1167.3	24-32					This study
Danube @ Tulcea	Floodplain deposit	2013	2013	28.755	45.216	-27.3	0.7822	-224.0	1973	-33.5	0.7752	-231.0	2046		24-30					Ref. 8
Danube @ Tulcea	Floodplain deposit	2014	2014	28.755	45.216	-26.0	0.7661	-240.0	2140	-33.0	0.7973	-209.0	1819		24-30					Ref. 8
Danube @ Tulcea	Suspended sed.	2013	2013	28.755	45.216	-28	0.8780	-129.0	1045	-33.5	0.8729	-134.0	1092		24-30					Ref. 8
Danube @ Tulcea	Suspended sed.	2014	2014	28.755	45.216	-27.6	0.9697	-38.0	247	-32.8	0.8639	-143.0	1175		24-30					Ref. 8
Danube @ Tulcea	Delta lake sed.			28.628	45.218	-27.6	0.8532	-153.3	1276	-31.8	0.9117	-95.2	742	1824.6	24-32					This study
Danube @ Tulcea	Shelf deposit	2008		29.778	45.078	-25.7	0.8399	-166.0	1402	-30.6	0.8120	-193.7	1673		26-30					Ref. 9
Danube @ Tulcea	Shelf deposit	2008		29.778	44.596	-25.2	0.8455	-160.4	1348	-28.8	0.6565	-348.1	3381		26-30					Ref. 9
Delaware @ state border	Suspended sed.	2011	2011	-75.553	39.577	-25.1				-29.4	0.8276	-178.5	1520		24-28					Ref. 10
Dulnain @ Dulnain Bridge	Suspended sed.	2016	2016	-3.699	57.302	-28.2	0.9015	-105.6	833		0.7812	-225.0	1983	19552.2	24-32					This study
Earn @ Bridge of Earn	Suspended sed.	2016	2016	-3.403	56.350	-28.9	0.8794	-127.5	1032		0.8641	-142.7	1173		24-32					This study
Eel @ mouth	Shelf deposit					-24.4	0.4852	-518.9	5810	-31.0	0.8791	-128.3	1035	454.2	24-32					Ref. 11
Eel @ mouth	Shelf deposit	2000		-124.252	40.648	-24.8	0.4543	-548.5	6339		0.8986	-106.8	858		24-30					Ref. 12
Fraser @ Hope	Floodplain deposit (<63µm)	2010	2010	-121.451	49.381	-25.5	0.8509	-155.3	1297		0.6330	-371.5	3673	771.0	24-32					This study
Fraser @ Hope	Fjord basin	2003	1924			-21.8	0.7803	-225.0	1993	-29.3	0.7007	-304.0	2857		26-32					Ref. 5
Fraser @ Hope	Fjord basin	2003	1951			-22.2	0.8085	-197.0	1708	-30.9	0.6423	-362.0	3556		26-32					Ref. 5
Fraser @ Hope	Fjord basin	2003	1959			-22.7	0.8276	-178.0	1520	-30.8	0.7482	-256.8	2330		26-32					Ref. 5
Fraser @ Hope	Fjord basin	2003	1963			-22.7	0.8548	-151.0	1261	-30.5	0.6625	-342.0	3308		26-32					Ref. 5
Fraser @ Hope	Fjord basin	2003	1964			-22.7	0.8578	-148.0	1232	-30.5	0.7370	-268.0	2452		26-32					Ref. 5
Fraser @ Hope	Fjord basin	2003	1967			-23.1	0.8809	-125.0	1018	-31.6	0.6977	-307.0	2891		26-32					Ref. 5
Fraser @ Hope	Fjord basin	2003	1975			-22.7	0.9031	-103.0	819	-30.6	0.7340	-271.0	2485		26-32					Ref. 5
Fraser @ Hope	Fjord basin	2003	1987			-22.1	0.9182	-88.0	686	-30.6	0.6866	-318.0	3020		26-32					Ref. 5
Ganga @ Harding Bridge	Suspended sed.	2007	2007	89.030	24.050	-21.7	0.7814	-224.0	1981	-27.8	1.0111	4.2	0	405.4	24-32	0.9462	-67.2	504	7318.5	Ref. 4; this study
Ganga @ Harding Bridge	Bedload	2005	2005	89.040	24.040	-22.3	0.6171	-387.0	3878	-29.2	0.8971	-108.8	872	448.2	24-32					Ref. 4; this study
Gaoping @ mouth	Floodplain deposit	2017	2017	120.416	22.498		0.7766	-229.7	2031		0.9087	-98.6	769		26-30					This study
Godavari @ Rajahmundi	Slope deposit			82.683	16.593	-19.2	0.8793	-127.1	1034	-26.0	0.9056	-101.0	797	135.5	24-32					This study
Indigirka @ mouth	Shelf deposit	2004-2005	1984-2004	150.460	72.060	-26.6	0.4765	-526.6	5955	-30.3	0.3095	-692.6	9422	346.8	24-28	0.5993	-409.0	4172	21374.0	Ref. 13; Ref. 14
Kalix @ mouth	Shelf deposit	2004-2005	1984-2004	23.200	65.440	-27.1	0.9329	-73.2	558	-32.1	0.4042	-598.4	7276	282.5	24-28	0.9728	-40.6	281	14352.0	Ref. 13; Ref. 14
Kolyma @ mouth	Shelf deposit	2004-2005	1984-2004	163.700	70.000	-26.7	0.5017	-501.6	5541	-32.9	0.4718	-531.3	6035	546.4	24-28	0.6152	-393.3	3961	22776.5	Ref. 13; Ref. 14
Lena @ mouth	Shelf deposit	2004-2005	1984-2004	129.540	71.960	-25.0	0.3939	-608.7	7484	-24.0	0.5040	-499.3	5504	178.2	24-28	0.5508	-456.9	4851	11408.9	Ref. 13; Ref. 14
Mackenzie + Peel @ Tsiigehtchic	Shelf sediment	1987	1987	-133.433	70.170	-26.0	0.2640	-737.2	10700	-31.0	0.4699	-532.2	6067	300.0	24-28	0.6052	-401.9	4093	4322.1	Ref. 7; Ref. 15
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	2006			-26.4	0.2526	-749.4	11053		0.4947	-509.0	5654		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	2007								0.3667	-636.1	8059		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	2005								0.4145	-588.6	7074		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	2002			-26.3	0.1799	-821.5	13778		0.5151	-488.7	5329		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1997			-26.4	0.2315	-770.3	11752		0.5495	-454.6	4810		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1989			-26.4	0.2287	-773.1	11851		0.5326	-471.3	5060		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1978			-26.3	0.1945	-807.0	13151		0.4745	-529.1	5989		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1976			-26.4	0.2071	-794.5	12647		0.4991	-504.6	5583		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1974			-26.3	0.2563	-745.7	10935		0.5367	-467.3	4998		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1970			-26.4	0.2101	-791.6	12534		0.5515	-452.7	4781		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1968			-26.4	0.2249	-776.9	11986		0.5679	-436.4	4546		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1964			-26.4	0.2016	-800.0	12864		0.5232	-480.7	5203		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1958								0.4962	-507.5	5630		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1949								0.4473	-556.1	6463		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1933								0.4671	-536.4	6115		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1918			-26.4	0.2226	-779.2	12070		0.4846	-519.0	5819		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1906			-26.5	0.2113	-790.4	12488		0.3459	-656.7	8527		24-32					Ref. 5
Mackenzie + Peel @ Tsiigehtchic	Delta lake sed.	2009	1894								0.5052	-498.6	5486		24-32					Ref. 5
Mekong @ Phnom Penh	Suspended sed. (<63µm)	Sep.08		104.943	11.596	-26.4	1.0334	25.9	0							1.0898	81.9	0	25300.0	Ref. 16
Mekong @ Phnom Penh	Suspended sed. (<63µm)	Jun.09		104.943	11.596	-26	0.6966	-308.4	2904							1.0989	91.0	0	11900.0	Ref. 16
Mekong @ Phnom Penh	Suspended sed. (<63µm)	Jul.09		104.943	11.596	-26.4	0.7810	-224.6	1985							1.0953	87.4	0	18900.0	Ref. 16
Mississippi @ mouth	Upper slope deposit					-21.5	0.7765	-228.8	2032	-29.2	0.8119	-193.6	1674		24-28					This study
Mississippi @ mouth	Bedload	2003	2003	-89.507	29.262	-23.6	0.8252	-180.1	1544	-30.7	0.9160	-89.9	705		24-30					Ref. 12
Ob @ mouth	Floodplain lake sed.	1994		68.542	66.667	-29.2	0.8947	-110.0	894		0.6933	-310.4	2943	6374.3	24-32					This study
Ob @ mouth	Floodplain lake sed.	1994		68.542	66.667	-29.5	0.7928	-211.5	1866	-33.1	0.7068	-296.9	2787	3254.5	24-32					This study
Ob @ mouth	Shelf deposit	2004-2005	20 years	73.440	72.650	-27.4	0.6911	-313.4	2968	-32.1	0.2833	-718.6	10133	169.6	24-28	0.5765	-431.5	4484	13361.0	Ref. 13; Ref. 14
Padma @ Mawa	Suspended sed.	2007	2007	90.250	23.460	-22.9	0.6639	-340.7	3291	-29.4	0.9606	-46.0	323	519.2	24-32					Ref. 4; this study
Pearl @ Guangzhou	Suspended sed.	Apr.18		113.490	23.090	-27.3	0.8200	-186.8	1594		0.8862	-121.2	971	452.1	24-30					This study
Pearl @ Guangzhou	Suspended sed.	Sep.18		113.490	23.090	-27.8	0.7200	-286.0	2639		0.8647	-142.5	1168	2096.6	24-30					This study
Pearl @ Guangzhou	Suspended sed.	Nov.18		113.490	23.090	-28.5	0.7300	-276.1	2528		0.8349	-172.1	1450	403.9	24-30					This study
Pettaquamscutt @ Narragansett	Estuarine deposit		1991			-23.1	1.0030	-3.8	0	-30.0	0.7084	-296.4	2769		30,32					Ref. 17
Pettaquamscutt @ Narragansett	Estuarine deposit		1972			-24.1	1.0270	20.1	0	-30.2	0.7852	-220.1	1943		30,32					Ref. 17
Pettaquamscutt @ Narragansett	Estuarine deposit		1947			-23.9	0.8800	-125.9	1027	-30.0	0.7316	-273.3	2510		30,32					Ref. 17
Pettaquamscutt @ Narragansett	Estuarine deposit		1885			-23.7	0.9050	-101.1	802	-30.2	0.8311	-174.5	1486		30,32					Ref. 17
Tay @ Earn confluence	Suspended sed.	2016	2016	-3.246	56.353	-28.1	0.8865	-120.5	968		0.8331	-173.5	1467		24-32					This study
Unare @ mouth	Floodplain deposit					-25.0	0.7975	-209.2	1818		0.9411	-66.8	488	471.3	24-32					This study
Waiapu @ Ruatoria	Shelf deposit			178.386	-37.815	-24.1	0.4882	-515.9	5760		0.5476	-457.0	4838	319.2	24-32					This study
Yangzte @ Zhenjiang	Suspended sed.	2007	2007	120.930	31.780	-25.1	0.6698	-334.8	3219					288.7	24-32	0.9710	-42.7	295		This study
Yangzte @ Zhenjiang	Suspended sed.	2008	2008	120.930	31.780	-24.8	0.6627	-341.9	3305		0.8258	-180.0	1537	2256.4	24-32	1.0470	32.1	0		This study

Yangzte @ Zhenjiang	Suspended sed.	2009	2009	120.930	31.780	-25.5	0.7729	-232.6	2069		0.7584	-247.0	2221	694.7	24-32	0.8179	-193.9	1674		This study
Yellow @ Binzhou	Suspended sed.	40722				-23.8	0.5859	-418.6	4294	-31.0	0.8529	-153.7	1278		24-32	0.9688	-38.7	255		Ref. 18
Yellow @ Binzhou	Suspended sed.	40808				-24.2	0.5893	-415.2	4248	-31.2	0.8430	-163.5	1372		24-32	0.9973	-10.4	22		Ref. 18
Yellow @ Binzhou	Suspended sed.	40864				-24.0	0.6043	-400.3	4046	-31.3	0.8149	-191.4	1645		24-32					Ref. 18
Yellow @ Binzhou	Suspended sed.	40921				-23.9	0.5963	-408.3	4154	-31.0	0.8201	-186.2	1593		24-32	0.8792	-127.6	1034		Ref. 18
Yellow @ Binzhou	Suspended sed.	41021				-24.2	0.5613	-443.0	4639	-31.3	0.7862	-219.9	1933		24-32	0.8982	-108.8	863		Ref. 18
Yellow @ Binzhou	Suspended sed.	41079				-24.0	0.6075	-397.2	4004	-31.1	0.8209	-185.4	1585		24-32	1.0097	1.9	0		Ref. 18
Yellow @ Binzhou	Suspended sed.	41087				-23.8	0.5686	-435.8	4535	-31.2	0.7893	-216.8	1901		24-32					Ref. 18
Yellow @ Binzhou	Suspended sed.	41195				-23.5	0.5581	-446.2	4685	-30.7	0.7837	-222.3	1958		24-32					Ref. 18
Yellow @ Binzhou	Suspended sed.	41278				-23.6	0.5688	-435.6	4532	-30.5	0.7879	-218.1	1914		24-32					Ref. 18
Yellow @ Binzhou	Suspended sed.	41392				-23.7	0.5915	-413.1	4218	-31.1	0.8442	-162.3	1360		24-32					Ref. 18
Yellow @ Binzhou	Suspended sed.	41444				-23.4	0.5758	-428.7	4435	-30.6	0.8064	-199.9	1729		24-32					Ref. 18
Yellow @ Binzhou	Suspended sed.	41459				-23.5	0.5578	-446.5	4690	-30.7	0.8177	-188.6	1617		24-32					Ref. 18
Yellow @ Binzhou	Suspended sed.	42159				-23.3	0.5923	-412.5	4207	-32.3	0.7919	-214.5	1874		24-32					Ref. 19
Yellow @ Binzhou	Suspended sed.	42194				-23.9	0.5963	-408.5	4153	-32.5	0.8719	-135.1	1101		24-32					Ref. 19
Yellow @ Binzhou	Suspended sed.	42220				-23.5	0.6547	-350.6	3403	-32.2	0.8611	-145.8	1201		24-32					Ref. 19
Yellow @ Binzhou	Suspended sed.	42332				-24.3	0.5759	-428.7	4433	-33.3	0.7821	-224.2	1975		24-32					Ref. 19
Yellow @ Binzhou	Suspended sed.	42390				-24.3	0.5650	-439.6	4586	-31.8	0.8121	-194.5	1672		24-32					Ref. 19
Yellow @ Binzhou	Suspended sed.	42497				-24.9	0.7018	-303.8	2844	-33.1	0.8216	-185.1	1579		24-32					Ref. 19
Yenisey @ mouth	Shelf deposit			79.860	72.610	-26.5	0.8311	-175.9	1486	-32.1	0.4788	-525.2	5916	159.9	24-28	0.7755	-236.7	2102	11151.7	Ref. 13; Ref. 14
Yukon @ mouth	Floodplain deposit	2007	2007			-26.7	0.5989	-405.2	4118		0.6502	-354.3	3458	726.9	24-28	0.7313	-279.1	2574	7506.6	Ref. 7

*Indicates that deposit samples likely integrate across the nuclear-bomb-derived ^{14}C spike (~1955 – present).

†Calculated as Δ14C = [Fm*exp((1950 – collection year)/8267) - 1]*1000 ‰; for samples with unknown collection year, 2020 was used.

‡Samples with Fm > 1.0 are designated as ^{14}C age = 0 yr for all statistical analyses.

Table S3. All environmental and geomorphic control variables, including spatially resolved variables at various *e*-folding distances as well as notes on data sources.

weighting e-folding distance = 50,000 km

River	Longitude ° E	Latitude ° N	Area km^2	Runoff† cm yr^{-1}	TSS Yield† t km^{-2} yr^{-1}	POC Yield‡ tC km^{-2} yr^{-1}	Permafrost cover| % contin.	% discontin.	Elevation§ m	Slope§ % rise	floodplain§ fractional	MAT¶ Kelvin	T CV¶ unitless	MAP¶ cm yr^{-1}	P CV¶ unitless	C_{soil}¬ tC km^{-2}	NPP** tC km^{-2} yr^{-1}	$\tau_{ecosystem}$¬ yr	τ_{soil}** yr	anthro.|| fractional
Amazon @ Obidos	-55.508	-1.935	6.1E+06	102.7	194.6	1.9	0	0	469	2.7	0.70	297.9	0.003	183.3	0.469	23078.8	308.4	13.408	17.948	0.06
Brahmaputra @ Jamuna Bridge	89.730	24.470	6.1E+05	99.9	1032.8	2.9	0	0	3143	15.2	0.16	280.9	0.021	94.8	0.959	10975.4	121.0	79.936	54.773	0.12
Cagayan @ mouth	121.673	18.123	2.7E+04	185.3			0	0	531	8.3	0.18	297.0	0.005	217.1	0.635	15556.0	265.5	10.783	12.959	0.90
Cariaco (composite) @ mouth	-65.187	10.089	3.5E+04	17.8	8.9	0.2	0	0	136	1.0	0.76	299.7	0.002	82.7	0.798	19119.6	194.9	11.361	15.666	0.14
Columbia @ Portland	-123.991	46.245	6.7E+05	35.3	11.4	0.1	0	0	1324	9.7	0.09	278.9	0.029	52.8	0.377	20769.4	90.4	42.401	67.415	0.09
Colville @ Nuiqsut	-150.913	70.174	6.0E+04	31.3	99.3	2.6	100	0	567	5.1	0.15	262.2	0.055	19.2	0.618	36293.8	51.4	118.586	181.691	0.00
Congo @ Boma	12.567	-6.050	3.7E+06	34.6	8.8	0.5	0	0	729	1.6	0.46	296.9	0.003	125.8	0.614	18604.4	280.6	13.060	15.212	0.11
Congo @ Brazzaville	15.289	-4.289	3.7E+06	34.6	8.8	0.5	0	0	733	1.6	0.47	297.0	0.003	126.2	0.610	18597.0	282.4	13.076	15.054	0.11
Connecticut @ Lyme	-72.394	41.388	2.7E+04	64.1	9.4	0.5	0	0	352	4.6	0.04	279.5	0.036	93.1	0.109	26195.4	245.9	24.628	27.648	0.02
Danube @ Tulcea	28.628	45.218	8.0E+05	25.3	84.1	1.2	0	0	460	5.0	0.28	282.0	0.028	64.6	0.298	18148.4	145.1	18.154	30.292	0.65
Delaware @ state border	-75.553	39.577	2.2E+04	78.9	31.0	0.3	0	0	295	2.8	0.23	282.5	0.033	94.3	0.128	12603.3	203.7	12.665	20.114	0.23
Dul @ Dulnain Bridge	-3.699	57.302	3.1E+02	61.0			0	0	454	4.9	0.00	278.5	0.016	101.0	0.217	39385.8	123.2	34.927	101.152	0.80
Earn @ Bridge of Earn	-3.403	56.350	7.8E+02	116.2	76.8	0.9	0	0	243	7.3	0.00	280.9	0.016	92.7	0.227	21816.9	117.8	16.286	68.715	0.88
Eel @ mouth	-124.263	40.625	8.1E+03	88.6	1983.2	12.2	0	0	768	11.7	0.01	283.9	0.014	103.6	0.871	29865.7	225.2	25.515	29.270	0.01
Fraser @ Hope	-121.451	49.381	2.3E+05	48.9	73.6	0.6	0	0	1201	10.5	0.06	275.4	0.030	61.4	0.265	17426.4	115.9	34.674	43.286	0.01
Ganga @ Harding Bridge	89.032	24.040	1.0E+06	47.4	507.2	1.6	0	0	853	5.2	0.64	294.7	0.020	88.6	1.267	14203.3	86.7	45.710	36.463	0.78
Gaoping @ mouth	120.416	22.498	3.3E+03	248.6	6449.6	17.4	0	0	1131	17.9	0.13	295.0	0.012	168.5	0.848	14244.5	241.8	11.560	15.999	0.90
Godavari @ Rajahmundi	81.755	16.949	3.1E+05	38.4	543.9	2.4	0	0	432	1.6	0.58	299.8	0.013	92.5	1.203	19361.9	106.4	25.958	31.178	0.68
Indigirka @ mouth	148.894	70.813	3.4E+05	14.7	32.5	0.5	100	0	620	5.7	0.28	257.2	0.078	23.8	0.756	24074.5	41.9	75.828	147.698	0.00
Kalix @ mouth	23.183	65.832	2.1E+04	41.8	1.9	0.1	5	15	368	3.2	0.26	271.1	0.038	40.4	0.398	43450.0	94.7	67.783	172.491	0.01
Kolyma @ mouth	161.302	68.790	6.5E+05	20.2	15.5	0.5	100	0	434	4.8	0.26	260.1	0.070	23.1	0.575	28649.5	51.3	76.099	175.406	0.00
Lena @ mouth	127.158	71.874	2.4E+06	21.7	8.5	0.5	79	20	562	4.9	0.18	263.4	0.073	31.9	0.695	20741.4	91.4	47.421	72.464	0.01
Mackenzie + Peel @ Tsiigehtchic*	-134.769	68.924	5.0E+05	17.9	248.4	4.0	16	66	678	5.2	0.36	267.1	0.055	30.9	0.459	35496.1	64.6	104.517	207.472	0.00
Mekong @ Phnom Penh	104.943	11.596	7.9E+05	59.3	189.3	4.1	0	0	1123	6.8	0.31	294.4	0.011	124.5	0.857	16021.7	226.9	16.393	22.736	0.32
Mississippi @ mouth	-89.511	29.355	3.2E+06	18.0	124.3	0.3	0	0	662	1.6	0.55	283.4	0.035	64.2	0.439	20510.0	110.4	31.628	49.967	0.47
Ob @ mouth	70.686	66.428	3.0E+06	13.7	5.3	0.1	2	24	330	1.8	0.72	273.0	0.050	36.7	0.481	33707.8	95.0	54.747	116.290	0.32
Padma @ Mawa	90.250	23.460	1.6E+06	66.9	702.4	2.2	0	0	1660	8.7	0.47	289.9	0.020	91.8	1.153	13166.1	98.7	57.973	43.195	0.55
Pearl @ Guangzhou	113.468	23.071	4.4E+05	68.6	181.8	1.2	0	0	657	6.4	0.09	292.5	0.021	123.9	0.713	20965.4	173.6	16.309	23.152	0.67
Pettaquamscutt @ Narragansett	-71.452	41.453	3.5E+01				0	0	39	0.4	1.00	282.7	0.032	100.1	0.100	22829.2	253.8	21.018	26.701	0.00
Tay @ Earn confluence	-3.246	56.353	6.5E+03	92.3	146.2	1.4	0	0	391	8.0	0.03	279.8	0.016	96.6	0.244	33859.7	117.8	28.448	68.715	0.88
Unare @ mouth	-65.187	10.089	2.0E+04	8.9	2.1	0.1	0	0	136	1.0	0.76	299.7	0.002	82.7	0.798	19119.6	194.9	11.361	15.666	0.14
Waiapu @ Ruatoria	178.480	-37.779	1.4E+03	200.1	20319.3	116.6	0	0	566	9.0	0.00	285.5	0.013	166.2	0.252	17942.2	315.6		30.839	0.00
Yangzte @ Zhenjiang	120.930	31.780	1.8E+06	48.9	249.4	2.4	0	0	1633	9.2	0.15	284.6	0.027	89.8	0.755	17675.4	128.6	31.846	36.730	0.43
Yellow @ Binzhou	118.544	37.612	7.7E+05	6.3	194.8	0.5	0	0	1881	4.8	0.18	279.3	0.036	39.8	0.971	14842.3	59.8	74.673	74.507	0.26
Yenisey @ mouth	83.356	70.939	2.6E+06	24.0	1.8	0.1	33	55	544	4.4	0.17	267.1	0.059	42.2	0.509	19636.9	100.8	37.290	73.426	0.04
Yukon @ mouth	-163.818	62.400	8.5E+05	24.2	70.8	0.9	23	76	692	6.8	0.16	266.9	0.052	26.2	0.665	18835.3	71.4	46.488	112.322	0.00

*Mackenzie River area upstream of Great Slave Lake is omitted from spatial statistics.

†Data from Peucker-Ehrenbrink (2009).

‡Data from Galy et al. (2015).

|Data from Feng et al. (2013).

§Data from GTOPO30 digital elevation model, US Geological Survey; floodplain calculated as area with slope ≤ 1 % rise.

¶Data from New et al. (2002); coefficient of variation (CV) calculated as σ / mean MAT, where σ = std. dev. of monthly average temperatures

¬Data from Carvalhais et al. (2014).

**Data from Bloom et al. (2016).

||Data from the Global Land Cover Characterization (GLCC) database; anthropogenic taken as the sum of "croplands", "urban and built-up", and "croplands/natural vegetation mosaic" (International Geosphere Biosphere Programme classification)

^Data are carbon-weighted averages for the designated depth ranges from Shi et al. (2020).

weighting e-folding distance = 10,000 km

Elevation§ m	Slope§ % rise	floodplain§ fractional	MAT¶ Kelvin	T CV¶ unitless	MAP¶ cm yr^{-1}	P CV¶ unitless	C_{soil}¬ tC km^{-2}	NPP** tC km^{-2} yr^{-1}	$\tau_{ecosystem}$¬ yr	τ_{soil}** yr	anthro.‖ fractional
432	2.5	0.71	298.0	0.003	184.6	0.468	22977.7	311.4	13.223	17.373	0.05
3071	15.1	0.16	281.3	0.021	97.9	0.956	11140.3	124.2	77.477	53.191	0.13
530	8.3	0.19	297.0	0.005	217.0	0.635	15557.1	265.5	10.781	12.957	0.90
136	1.0	0.76	299.7	0.002	82.7	0.798	19118.5	194.8	11.360	15.663	0.14
1308	9.7	0.09	279.0	0.029	53.1	0.381	20930.3	90.6	42.461	67.600	0.09
564	5.0	0.15	262.2	0.055	19.2	0.618	36383.5	51.3	118.929	182.115	0.00
713	1.6	0.46	297.0	0.003	126.7	0.605	18460.8	281.6	12.944	15.054	0.10
717	1.6	0.47	297.0	0.003	127.2	0.600	18448.6	283.8	12.958	14.869	0.10
350	4.6	0.04	279.5	0.036	93.1	0.108	26190.1	245.8	24.617	27.643	0.02
453	5.0	0.29	282.1	0.028	64.0	0.298	18210.0	144.4	18.244	30.510	0.66
293	2.8	0.23	282.5	0.033	94.3	0.128	12611.4	203.6	12.664	20.117	0.23
453	4.9	0.00	278.5	0.016	101.0	0.217	39385.8	123.2	34.927	101.152	0.80
243	7.2	0.00	280.9	0.016	92.7	0.227	21816.9	117.8	16.286	68.715	0.88
766	11.7	0.01	283.9	0.014	103.6	0.871	29859.6	225.2	25.506	29.293	0.01
1200	10.5	0.06	275.4	0.030	61.1	0.265	17457.3	115.4	34.815	43.478	0.01
851	5.2	0.64	294.7	0.020	89.1	1.264	14185.0	87.1	45.708	36.284	0.78
1129	17.9	0.13	295.0	0.012	168.5	0.848	14244.5	241.8	11.560	15.999	0.90
430	1.6	0.58	299.8	0.013	92.7	1.203	19326.2	107.1	25.772	31.033	0.67
599	5.5	0.29	257.2	0.078	23.6	0.750	24170.7	42.0	75.907	147.483	0.00
367	3.2	0.26	271.1	0.038	40.5	0.397	43507.1	94.8	67.773	172.235	0.01
421	4.6	0.27	260.1	0.070	22.8	0.573	28669.4	51.3	76.271	175.978	0.00
544	4.8	0.18	263.2	0.073	31.5	0.688	20816.2	90.4	47.744	73.277	0.01
670	5.2	0.37	267.1	0.055	30.7	0.460	35836.6	63.9	105.717	209.588	0.00
1061	6.6	0.32	294.8	0.010	125.8	0.855	16114.0	230.3	16.118	21.916	0.33
629	1.6	0.56	283.6	0.035	66.2	0.428	20514.2	114.5	30.410	48.107	0.47
302	1.6	0.73	272.8	0.050	37.1	0.479	34529.4	95.9	54.519	118.499	0.31
1636	8.7	0.47	290.0	0.020	93.3	1.149	13214.5	100.2	57.144	42.568	0.55
641	6.4	0.09	292.6	0.021	124.6	0.711	20974.3	174.5	16.227	22.995	0.68
39	0.4	1.00	282.7	0.032	100.1	0.100	22829.2	253.8	21.018	26.701	0.00
390	8.0	0.03	279.8	0.016	96.6	0.244	33854.4	117.8	28.442	68.715	0.88
136	1.0	0.76	299.7	0.002	82.7	0.798	19118.5	194.8	11.360	15.663	0.14
566	9.0	0.00	285.5	0.013	166.2	0.252	17942.2	315.6		30.839	0.00
1536	9.0	0.16	285.0	0.027	91.5	0.743	17984.9	131.1	30.272	35.658	0.45
1794	4.7	0.19	279.7	0.036	40.1	0.969	14933.2	60.9	73.898	72.917	0.28
520	4.3	0.18	267.0	0.059	42.3	0.497	19894.1	99.4	37.745	75.822	0.04
669	6.7	0.17	267.0	0.052	26.2	0.667	18997.7	72.0	46.374	114.044	0.00

weighting e-folding distance = 5,000 km

Elevation§ m	Slope§ % rise	floodplain§ fractional	MAT¶ Kelvin	T CV¶ unitless	MAP¶ cm yr^{-1}	P CV¶ unitless	C_{soil}¬ tC km^{-2}	NPP** tC km^{-2} yr^{-1}	$\tau_{ecosystem}$¬ yr
391	2.3	0.72	298.2	0.002	186.0	0.468	22844.5	314.8	13.006
2981	15.0	0.17	281.8	0.021	101.8	0.952	11345.4	128.1	74.450
529	8.2	0.19	297.0	0.005	216.9	0.636	15558.6	265.6	10.778
136	1.0	0.76	299.7	0.002	82.6	0.798	19117.0	194.8	11.358
1288	9.6	0.09	279.1	0.028	53.5	0.386	21131.1	90.8	42.522
561	5.0	0.15	262.2	0.055	19.2	0.617	36496.1	51.2	119.364
694	1.6	0.46	297.1	0.003	127.8	0.595	18292.6	282.6	12.808
699	1.6	0.47	297.1	0.003	128.4	0.589	18273.0	285.2	12.822
349	4.6	0.04	279.5	0.036	93.1	0.108	26183.4	245.8	24.602
444	4.9	0.29	282.1	0.028	63.4	0.298	18287.8	143.6	18.359
290	2.8	0.24	282.5	0.033	94.4	0.128	12621.5	203.3	12.663
453	4.9	0.00	278.5	0.016	101.0	0.217	39385.8	123.2	34.927
243	7.2	0.00	280.9	0.016	92.7	0.227	21816.9	117.8	16.286
765	11.7	0.01	283.9	0.014	103.7	0.871	29852.0	225.2	25.494
1200	10.4	0.06	275.4	0.030	60.7	0.266	17498.0	114.9	34.992
847	5.2	0.64	294.7	0.020	89.9	1.260	14164.1	87.6	45.678
1127	17.9	0.13	295.0	0.012	168.5	0.848	14244.5	241.8	11.560
427	1.6	0.58	299.8	0.013	93.1	1.203	19281.4	107.8	25.540
573	5.3	0.30	257.3	0.078	23.3	0.742	24291.8	42.0	76.042
365	3.2	0.26	271.1	0.038	40.5	0.396	43578.3	95.1	67.761
404	4.5	0.29	260.1	0.070	22.5	0.570	28696.3	51.3	76.535
521	4.7	0.20	263.0	0.074	31.0	0.679	20912.8	88.9	48.198
660	5.1	0.37	267.0	0.056	30.4	0.461	36245.9	63.0	107.160
990	6.4	0.33	295.2	0.010	127.3	0.853	16214.6	234.2	15.804
590	1.5	0.58	284.0	0.035	68.6	0.415	20492.6	119.5	28.972
269	1.5	0.75	272.7	0.050	37.6	0.477	35468.8	96.9	54.354
1607	8.6	0.48	290.1	0.020	95.3	1.143	13278.1	102.1	56.087
621	6.3	0.09	292.7	0.021	125.4	0.708	20986.7	175.6	16.129
39	0.4	1.00	282.7	0.032	100.1	0.100	22829.2	253.8	21.018
390	7.9	0.03	279.8	0.016	96.6	0.244	33847.8	117.8	28.435
136	1.0	0.76	299.7	0.002	82.6	0.798	19117.0	194.8	11.358
566	9.0	0.00	285.5	0.013	166.2	0.252	17942.2	315.6	
1421	8.8	0.17	285.5	0.027	93.5	0.729	18359.9	134.0	28.502
1693	4.6	0.19	280.1	0.036	40.6	0.967	15034.8	62.4	72.727
491	4.2	0.20	266.8	0.059	42.5	0.482	20240.9	97.4	38.383
640	6.5	0.18	267.1	0.052	26.3	0.668	19187.6	72.8	46.173

weighting e-folding distance = 1,000 km												weighting e-folding distance = 750 km										
τ_{soil}** yr	anthro.|| fractional	Elevation§ m	Slope§ % rise	floodplain§ fractional	MAT¶ Kelvin	T CV¶ unitless	MAP¶ cm yr^{-1}	P CV¶ unitless	C_{soil}¬ tC km^{-2}	NPP** tC km^{-2} yr^{-1}	$\tau_{ecosystem}$¬ yr	τ_{soil}** yr	anthro.|| fractional	Elevation§ m	Slope§ % rise	floodplain§ fractional	MAT¶ Kelvin	T CV¶ unitless	MAP¶ cm yr^{-1}	P CV¶ unitless	C_{soil}¬ tC km^{-2}	NPP** tC km^{-2} yr^{-1}
16.722	0.05	200	1.3	0.75	299.2	0.002	190.6	0.476	21934.2	331.8	11.881	13.637	0.04	168.738	1.108	0.745	299.341	0.002	189.980	0.481	21761.825	335.211
51.253	0.14	2320	14.0	0.25	285.3	0.019	131.5	0.939	12852.8	153.9	53.163	38.058	0.20	2090.359	13.487	0.282	286.558	0.018	142.292	0.940	13365.840	161.560
12.955	0.90	518	8.1	0.19	297.0	0.005	216.3	0.638	15571.3	266.3	10.754	12.938	0.90	513.465	8.088	0.193	297.031	0.005	216.040	0.640	15577.133	266.592
15.659	0.14	134	1.0	0.76	299.7	0.002	82.3	0.798	19105.2	194.4	11.347	15.628	0.14	133.709	0.970	0.765	299.694	0.002	82.188	0.798	19100.269	194.194
67.812	0.10	1126	8.7	0.10	279.8	0.027	58.3	0.430	22649.9	93.7	42.442	68.582	0.12	1060.409	8.444	0.099	280.079	0.026	60.969	0.448	23196.230	95.623
182.665	0.00	533	4.8	0.18	262.4	0.055	19.0	0.615	37406.5	50.2	123.096	187.907	0.00	521.009	4.706	0.188	262.473	0.055	18.902	0.615	37788.436	49.782
14.890	0.09	584	1.6	0.46	297.4	0.002	132.8	0.555	17436.0	280.3	12.086	14.761	0.05	555.141	1.578	0.449	297.471	0.003	133.146	0.555	17310.914	275.329
14.667	0.09	591	1.5	0.47	297.5	0.002	135.1	0.534	17291.1	288.3	12.060	14.050	0.05	563.738	1.492	0.476	297.563	0.002	136.563	0.524	17074.378	286.456
27.636	0.02	337	4.4	0.05	279.6	0.036	93.4	0.105	26122.8	245.5	24.479	27.589	0.02	332.303	4.389	0.051	279.685	0.036	93.490	0.103	26094.395	245.404
30.799	0.66	380	4.2	0.32	282.5	0.029	58.3	0.301	18904.4	135.9	19.366	33.658	0.71	358.178	3.958	0.324	282.652	0.029	56.348	0.303	19131.762	132.513
20.122	0.24	272	2.7	0.26	282.7	0.033	94.6	0.128	12701.1	201.7	12.651	20.157	0.26	264.550	2.631	0.269	282.744	0.033	94.647	0.127	12733.594	201.007
101.152	0.80	452	4.9	0.00	278.5	0.016	101.0	0.217	39385.8	123.2	34.927	101.152	0.80	451.997	4.939	0.000	278.481	0.016	101.015	0.217	39385.780	123.162
68.715	0.88	241	7.2	0.00	280.9	0.016	92.7	0.227	21816.9	117.8	16.286	68.715	0.88	239.539	7.138	0.000	280.923	0.016	92.672	0.227	21816.858	117.829
29.322	0.01	753	11.6	0.02	283.9	0.014	103.9	0.871	29790.1	225.4	25.401	29.550	0.01	747.431	11.629	0.015	283.901	0.014	103.967	0.871	29763.948	225.516
43.717	0.01	1201	10.2	0.07	275.4	0.030	58.0	0.272	17882.6	111.0	36.317	45.542	0.01	1203.837	10.221	0.070	275.437	0.030	57.074	0.274	18059.430	109.568
36.068	0.78	800	5.1	0.65	294.7	0.019	95.6	1.229	14084.4	90.4	44.331	34.750	0.78	770.291	4.937	0.656	294.753	0.019	97.912	1.218	14095.742	91.043
15.999	0.90	1111	17.7	0.13	295.0	0.012	168.5	0.848	14244.5	241.8	11.560	15.999	0.90	1104.652	17.655	0.132	295.027	0.012	168.498	0.848	14244.510	241.831
30.851	0.67	405	1.7	0.56	299.9	0.013	95.5	1.200	18917.7	114.3	23.719	29.435	0.63	396.868	1.791	0.556	299.954	0.013	96.403	1.198	18766.073	116.961
147.229	0.00	376	4.0	0.42	258.0	0.074	21.4	0.682	25208.6	42.0	78.216	145.476	0.00	308.275	3.420	0.462	258.263	0.073	20.839	0.658	25515.557	41.807
171.912	0.01	352	3.2	0.27	271.2	0.037	40.9	0.388	44140.8	97.0	67.657	169.245	0.01	346.248	3.211	0.275	271.204	0.037	41.059	0.385	44371.381	97.773
176.701	0.00	293	3.6	0.40	260.0	0.069	20.5	0.552	28980.7	50.7	80.060	182.568	0.00	257.411	3.263	0.440	259.969	0.069	19.806	0.547	29125.353	50.306
74.487	0.01	366	4.0	0.25	261.1	0.077	27.3	0.614	21593.8	71.3	53.026	90.413	0.00	326.737	3.881	0.245	260.367	0.078	26.508	0.593	21699.895	63.552
212.030	0.00	594	4.9	0.36	266.3	0.058	28.5	0.464	38867.9	56.5	116.280	223.463	0.00	571.686	4.818	0.358	266.036	0.058	27.917	0.463	39675.699	54.427
20.991	0.34	627	5.0	0.41	297.2	0.008	135.2	0.839	16590.4	255.9	14.243	16.627	0.40	549.418	4.550	0.437	297.599	0.008	137.094	0.836	16615.572	261.611
45.901	0.48	376	1.2	0.64	285.8	0.033	83.9	0.320	19633.4	153.5	20.876	33.163	0.47	326.428	1.203	0.656	286.204	0.032	87.869	0.292	19189.286	163.899
121.274	0.30	135	1.1	0.77	270.9	0.051	39.9	0.464	38627.1	96.8	55.134	139.885	0.17	119.729	1.108	0.756	270.076	0.051	40.137	0.460	37955.796	93.568
41.795	0.55	1358	8.3	0.51	291.2	0.019	111.6	1.107	13877.8	114.8	47.246	36.385	0.56	1254.654	8.030	0.527	291.751	0.018	118.034	1.095	14150.041	118.741
22.802	0.68	489	6.2	0.11	293.1	0.021	131.8	0.693	21132.0	183.4	15.535	21.426	0.71	446.654	6.090	0.111	293.255	0.021	134.179	0.688	21211.356	186.114
26.701	0.00	39	0.4	1.00	282.7	0.032	100.1	0.100	22829.2	253.8	21.018	26.701	0.00	39.498	0.439	1.000	282.726	0.032	100.110	0.100	22829.231	253.809
68.715	0.88	387	7.9	0.04	279.8	0.016	96.6	0.244	33795.1	117.8	28.377	68.715	0.88	385.824	7.849	0.037	279.788	0.016	96.563	0.244	33773.178	117.829
15.659	0.14	134	1.0	0.76	299.7	0.002	82.3	0.798	19105.2	194.4	11.347	15.628	0.14	133.709	0.970	0.765	299.694	0.002	82.188	0.798	19100.269	194.194
30.839	0.00	562	9.0	0.00	285.5	0.013	166.2	0.252	17942.2	315.6		30.839	0.00	560.323	8.980	0.000	285.537	0.013	166.210	0.252	17942.224	315.571
34.445	0.47	743	6.7	0.27	288.0	0.028	106.1	0.639	20781.9	150.1	20.760	29.150	0.58	575.851	5.920	0.307	288.601	0.029	109.384	0.616	21499.356	153.227
70.988	0.30	1166	4.2	0.22	282.4	0.036	45.0	0.949	15458.8	75.0	59.072	57.005	0.46	1042.764	4.074	0.238	282.992	0.036	46.662	0.944	15500.841	79.556
79.057	0.04	298	3.2	0.33	265.5	0.059	43.4	0.382	23499.3	78.9	45.249	108.786	0.01	242.575	2.812	0.386	264.989	0.059	43.512	0.355	24672.325	71.959
116.059	0.00	405	4.9	0.27	268.1	0.050	28.2	0.658	19911.2	77.1	42.437	124.145	0.00	325.706	4.271	0.316	268.627	0.048	29.310	0.649	19751.880	77.327

weighting e-folding distance = 500 km

$\tau_{ecosystem}$¬ yr	τ_{soil}** yr	anthro.‖ fractional	Elevation§ m	Slope§ % rise	floodplain§ fractional	MAT¶ Kelvin	T CV¶ unitless	MAP¶ cm yr^{-1}	P CV¶ unitless	C_{soil}¬ tC km^{-2}	NPP** tC km^{-2} yr^{-1}	$\tau_{ecosystem}$¬ yr	τ_{soil}** yr	anthro.‖ fractional	Soil $\Delta^{14}C$ (0-100cm)^ ‰	Soil age (0-100cm)^ yr	Soil $\Delta^{14}C$ (0-30cm)^ ‰	Soil age (0-30cm)^ yr	Soil $\Delta^{14}C$ (30-100cm)^ ‰	Soil age (30-100cm)^ yr	Elevation§ m	Slope§ % rise
11.670	13.094	0.04	148.272	1.010	0.715	299.426	0.002	186.629	0.492	21716.254	338.873	11.495	12.605	0.04	-112.8	1658	21.8	359	-242.8	2918	246.493	1.275
46.254	34.007	0.23	1720.299	12.349	0.341	288.603	0.017	159.973	0.948	14150.013	171.858	35.945	28.310	0.27	-135.5	1966	-23.1	676	-264.9	3527	1098.093	9.275
10.744	12.931	0.90	504.594	7.997	0.197	297.040	0.005	215.538	0.642	15589.756	267.158	10.721	12.918	0.90	-139.8	1809	-30.2	656	-247.8	2949	478.488	7.729
11.342	15.615	0.14	132.382	0.971	0.766	299.693	0.002	81.912	0.797	19090.205	193.852	11.332	15.589	0.14	-160.9	2172	-12.7	517	-273.9	3427	128.482	0.975
42.100	68.380	0.13	942.308	7.940	0.102	280.563	0.025	67.376	0.483	24082.614	100.739	40.952	67.151	0.14	-149.1	2063	-34.0	648	-261.9	3441	710.710	7.253
124.769	190.535	0.00	496.112	4.497	0.211	262.604	0.055	18.707	0.614	38550.037	48.821	128.284	196.531	0.00	-504.7	16037	-272.3	4104	-690.2	25596	418.594	3.818
11.930	15.170	0.05	514.381	1.670	0.430	297.508	0.003	131.618	0.574	17336.143	261.525	11.774	16.411	0.04	-95.0	1393	21.8	329	-205.8	2410	446.770	2.063
11.870	14.167	0.04	526.030	1.519	0.479	297.682	0.002	138.165	0.516	16844.191	280.203	11.604	14.708	0.03	-92.3	1372	24.4	321	-203.8	2388	477.123	1.693
24.425	27.572	0.03	322.550	4.281	0.055	279.804	0.036	93.700	0.101	26032.884	245.151	24.312	27.542	0.03	-100.5	1337	-16.4	517	-205.4	2384	294.189	3.965
19.794	35.047	0.72	321.791	3.586	0.338	282.849	0.029	53.097	0.306	19486.381	126.149	20.574	37.866	0.75	-184.0	2586	-57.2	805	-300.3	4200	254.816	2.962
12.644	20.172	0.27	250.102	2.527	0.288	282.876	0.033	94.799	0.127	12797.205	199.653	12.628	20.201	0.29	-91.6	1331	6.0	403	-208.1	2449	210.799	2.247
34.927	101.152	0.80	451.198	4.937	0.000	278.481	0.016	101.015	0.217	39385.780	123.162	34.927	101.152	0.81							448.814	4.933
16.286	68.715	0.88	237.584	7.079	0.000	280.923	0.016	92.672	0.227	21816.859	117.829	16.286	68.715	0.89	-161.7	2120	-38.1	647	-278.5	3531	231.765	6.906
25.361	29.645	0.01	737.284	11.609	0.016	283.883	0.014	104.143	0.870	29711.005	225.688	25.281	29.833	0.01	-131.1	1874	-13.8	535	-248.8	3237	707.443	11.535
36.802	46.217	0.01	1213.351	10.441	0.070	275.461	0.030	55.764	0.280	18410.355	107.046	37.621	47.373	0.01	-180.5	2530	-56.1	871	-308.4	4262	1249.612	12.132
43.232	34.427	0.78	698.178	4.579	0.679	295.000	0.019	102.072	1.200	14178.364	91.404	40.354	34.127	0.79	-139.4	1993	-21.3	664	-247.2	3273	447.484	3.180
11.560	15.999	0.90	1091.473	17.533	0.136	295.027	0.012	168.498	0.848	14244.511	241.831	11.560	15.999	0.90	-135.8	1881	-22.6	644	-240.1	3033	1052.460	17.166
22.989	28.865	0.61	380.251	1.907	0.540	300.013	0.012	97.946	1.193	18469.054	122.305	21.608	27.761	0.58	-182.0	2284	-85.6	1150	-263.5	3237	335.710	2.259
79.464	144.696	0.00	203.783	2.543	0.538	258.651	0.071	19.919	0.618	25937.736	41.170	82.017	142.776	0.00	-473.7	13453	-245.7	3999	-674.9	21956	72.754	1.289
67.611	168.093	0.01	336.342	3.218	0.281	271.249	0.037	41.389	0.379	44825.738	99.411	67.516	165.733	0.01	-274.1	4528	-93.6	1208	-428.6	7486	311.462	3.308
81.941	184.927	0.00	202.847	2.741	0.515	259.950	0.068	18.823	0.540	29432.436	49.342	85.799	189.182	0.00	-481.1	13728	-256.5	3987	-667.5	22013	117.087	1.802
54.965	97.563	0.00	284.282	3.873	0.214	259.420	0.078	25.957	0.565	21565.008	52.414	57.966	107.630	0.00	-423.1	10643	-221.6	3328	-631.7	18292	250.827	4.080
118.931	224.774	0.00	532.025	4.695	0.349	265.680	0.059	26.989	0.458	41015.670	51.494	122.932	224.640	0.00	-472.4	13872	-239.8	3332	-643.5	21680	422.715	4.054
13.914	15.797	0.42	456.591	3.973	0.473	298.136	0.007	139.628	0.829	16586.686	270.655	13.524	14.860	0.44	-114.8	1568	-17.4	628	-211.8	2502	378.791	3.361
18.938	29.965	0.45	271.096	1.171	0.667	286.317	0.032	92.187	0.257	18573.492	177.871	16.678	26.048	0.44	-111.1	1674	10.4	417	-234.5	2939	261.456	1.199
55.413	144.524	0.13	112.208	1.246	0.721	268.850	0.051	39.686	0.456	35392.334	85.894	55.370	149.731	0.09	-328.5	6460	-142.7	1851	-494.9	10625	119.833	1.403
43.670	34.687	0.57	1061.577	7.357	0.568	292.732	0.018	129.326	1.077	14677.299	123.668	37.284	32.382	0.59	-137.1	1970	-20.5	660	-253.8	3347	625.849	5.022
15.378	20.954	0.72	381.572	5.984	0.121	293.492	0.021	138.322	0.680	21387.954	190.477	15.190	20.192	0.73	-119.3	1721	7.3	437	-228.8	2820	285.637	5.804
21.018	26.701	0.00	39.498	0.439	1.000	282.726	0.032	100.110	0.100	22829.231	253.809	21.018	26.701	0.00							39.498	0.439
28.352	68.715	0.88	383.247	7.791	0.038	279.788	0.016	96.563	0.244	33729.299	117.829	28.304	68.715	0.88	-243.1	4219	-80.1	1255	-400.7	7093	375.305	7.615
11.342	15.615	0.14	132.382	0.971	0.766	299.693	0.002	81.912	0.797	19090.205	193.852	11.332	15.589	0.14	-160.9	2172	-12.7	517	-273.9	3427	128.482	0.975
	30.839	0.00	557.268	8.973	0.000	285.537	0.013	166.210	0.252	17942.225	315.571		30.839	0.00	-131.0	1919	-9.4	494	-267.8	3517	548.152	8.950
19.744	28.630	0.61	371.406	4.777	0.375	289.200	0.029	113.142	0.586	22568.299	155.088	19.276	29.055	0.66	-114.4	1687	11.9	426	-217.1	2713	173.416	3.184
53.130	52.075	0.51	860.053	3.878	0.277	283.930	0.036	49.285	0.943	15467.478	86.287	43.017	44.321	0.60	-180.8	2578	-35.9	653	-276.7	3812	467.740	2.933
48.069	119.073	0.01	168.471	2.241	0.474	264.344	0.058	43.164	0.320	26139.139	62.249	52.086	131.551	0.00	-377.4	8014	-175.4	2349	-571.4	13521	81.820	1.375
40.290	123.111	0.00	223.696	3.349	0.394	269.587	0.045	31.016	0.635	18998.753	75.714	36.587	116.976	0.00	-376.3	8244	-164.4	2073	-532.0	12918	142.399	2.349

weighting e-folding distance = 250 km										weighting e-folding distance = 100 km											
floodplain§ fractional	MAT¶ Kelvin	T CV¶ unitless	MAP¶ cm yr^{-1}	P CV¶ unitless	C_{soil}¬ tC km^{-2}	NPP** tC km^{-2} yr^{-1}	$\tau_{ecosystem}$¬ yr	τ_{soil}** yr	anthro.‖ fractional	Elevation§ m	Slope§ % rise	floodplain§ fractional	MAT¶ Kelvin	T CV¶ unitless	MAP¶ cm yr^{-1}	P CV¶ unitless	C_{soil}¬ tC km^{-2}	NPP** tC km^{-2} yr^{-1}	$\tau_{ecosystem}$¬ yr	τ_{soil}** yr	anthro.‖ fractional
0.611	298.386	0.002	171.452	0.504	22096.362	341.266	11.443	12.519	0.05	2584.757	5.619	0.173	288.124	0.001	95.227	0.358	22358.196	340.089	11.025	13.051	0.05
0.486	292.180	0.015	188.513	0.975	15079.320	179.664	22.913	22.600	0.39	349.222	3.430	0.773	296.738	0.014	190.465	0.971	14527.087	176.116	15.879	22.589	0.57
0.208	297.065	0.005	214.121	0.648	15635.760	268.804	10.644	12.878	0.90	409.043	6.998	0.230	297.118	0.005	210.767	0.663	15843.120	272.876	10.361	12.779	0.88
0.770	299.692	0.002	81.070	0.797	19059.068	192.830	11.302	15.511	0.14	117.521	1.016	0.772	299.690	0.002	78.475	0.795	18958.075	189.848	11.206	15.285	0.13
0.107	281.454	0.023	88.549	0.558	25408.725	121.195	35.855	60.085	0.17	482.375	7.199	0.106	282.163	0.020	124.360	0.624	25944.797	173.007	25.410	41.515	0.14
0.286	262.948	0.056	18.070	0.617	40739.060	45.852	139.653	218.886	0.00	227.233	2.123	0.495	263.391	0.056	16.628	0.637	45664.360	40.855	172.133	277.883	0.00
0.334	297.345	0.004	118.376	0.689	18348.597	216.319	11.947	20.604	0.05	339.971	2.629	0.170	297.135	0.006	95.065	0.845	20101.889	184.523	12.624	24.289	0.08
0.478	297.819	0.002	138.150	0.533	16657.693	254.650	11.127	16.919	0.02	485.965	2.370	0.376	297.561	0.003	128.837	0.650	15946.666	197.906	10.490	21.517	0.03
0.067	280.153	0.035	94.272	0.094	25821.654	244.343	23.956	27.483	0.04	223.844	3.221	0.095	280.999	0.034	95.121	0.082	25201.952	241.868	22.972	27.532	0.06
0.376	283.163	0.030	47.902	0.307	19812.215	113.721	21.963	44.437	0.79	168.096	2.132	0.484	283.754	0.030	43.455	0.271	19301.896	99.590	23.241	53.216	0.83
0.344	283.239	0.033	95.159	0.127	12972.065	195.794	12.559	20.283	0.34	130.491	1.650	0.485	284.031	0.033	95.579	0.126	13305.168	187.212	12.244	20.467	0.48
0.000	278.481	0.016	101.015	0.217	39385.780	123.162	34.927	101.152	0.81	441.770	4.917	0.000	278.481	0.016	101.015	0.217	39385.780	123.162	34.927	101.152	0.83
0.000	280.923	0.016	92.672	0.227	21816.857	117.829	16.286	68.715	0.89	214.810	6.409	0.000	280.923	0.016	92.672	0.227	21816.859	117.829	16.286	68.715	0.90
0.018	283.831	0.014	104.666	0.870	29547.815	226.191	25.034	30.382	0.01	624.864	11.212	0.025	283.685	0.014	106.129	0.867	29038.308	227.458	24.263	31.765	0.00
0.062	275.600	0.029	55.115	0.300	19249.769	101.712	38.981	49.387	0.01	1277.908	18.066	0.024	276.137	0.027	64.495	0.357	20568.914	96.286	39.079	49.284	0.01
0.769	296.083	0.017	110.390	1.163	14578.208	88.896	30.325	34.492	0.83	79.570	0.726	0.926	297.981	0.016	114.880	1.117	14782.637	84.264	17.230	34.966	0.85
0.147	295.027	0.012	168.498	0.848	14244.510	241.831	11.560	15.999	0.91	940.884	16.060	0.181	295.027	0.012	168.498	0.848	14244.511	241.831	11.560	15.999	0.92
0.491	300.166	0.012	100.717	1.170	17685.439	137.482	18.263	24.720	0.48	242.588	2.835	0.404	300.462	0.011	100.074	1.097	16431.619	166.243	14.198	18.655	0.38
0.669	259.148	0.068	18.536	0.550	26142.911	39.225	87.625	135.338	0.00	26.881	0.663	0.816	259.274	0.067	17.157	0.509	26426.895	37.463	98.734	121.770	0.00
0.297	271.369	0.037	42.380	0.361	46139.822	104.375	67.241	158.417	0.01	264.512	3.706	0.349	271.617	0.036	44.842	0.320	50055.512	116.398	67.258	139.757	0.02
0.672	259.913	0.066	17.315	0.531	30284.542	46.686	95.357	196.744	0.00	50.590	0.899	0.845	259.731	0.064	15.535	0.527	31965.594	41.817	110.124	203.569	0.00
0.128	258.305	0.077	25.861	0.543	20392.227	39.253	65.463	118.611	0.00	218.141	4.229	0.075	257.463	0.076	24.754	0.578	19940.850	30.267	85.765	121.143	0.00
0.354	265.180	0.060	25.622	0.430	44500.247	49.116	131.538	229.072	0.00	211.864	2.227	0.468	264.855	0.062	25.045	0.381	51602.889	51.507	148.728	293.189	0.00
0.516	298.911	0.006	142.095	0.810	16451.619	289.893	13.317	13.717	0.48	703.030	6.544	0.265	300.023	0.005	131.911	0.761	16606.011	284.174	17.139	14.140	0.67
0.649	284.673	0.032	90.918	0.234	18607.853	185.425	15.799	23.847	0.44	321.152	1.417	0.570	281.983	0.035	82.419	0.240	19606.158	173.988	17.545	25.874	0.47
0.687	267.326	0.051	37.329	0.461	30304.227	72.097	54.758	155.394	0.09	129.647	1.395	0.696	266.443	0.051	35.197	0.466	26383.144	64.595	52.040	152.842	0.13
0.700	295.095	0.016	148.854	1.046	15839.043	122.450	25.343	31.373	0.67	106.147	1.012	0.931	298.189	0.014	150.311	0.980	16961.242	98.341	17.210	36.962	0.79
0.139	293.887	0.021	146.684	0.673	21917.292	197.547	15.158	18.989	0.75	210.493	5.312	0.188	294.430	0.020	157.528	0.693	22930.447	200.310	15.756	18.380	0.77
1.000	282.726	0.032	100.110	0.100	22829.231	253.809	21.018	26.701	0.00	39.498	0.439	1.000	282.726	0.032	100.110	0.100	22829.231	253.809	21.018	26.701	0.00
0.042	279.788	0.016	96.563	0.244	33597.963	117.829	28.158	68.715	0.89	349.870	7.090	0.056	279.788	0.016	96.563	0.244	33209.843	117.829	27.727	68.715	0.90
0.770	299.692	0.002	81.070	0.797	19059.068	192.830	11.302	15.511	0.14	117.521	1.016	0.772	299.690	0.002	78.475	0.795	18958.075	189.848	11.206	15.285	0.13
0.000	285.537	0.013	166.210	0.252	17942.225	315.571		30.839	0.00	521.472	8.881	0.000	285.537	0.013	166.210	0.252	17942.224	315.571		30.839	0.00
0.505	289.457	0.030	113.159	0.556	24328.836	146.644	20.514	33.296	0.74	92.986	2.025	0.638	289.104	0.032	101.068	0.551	26175.473	123.246	22.853	41.083	0.81
0.451	285.688	0.035	52.937	0.995	15118.063	90.487	25.956	35.383	0.79	103.570	1.288	0.729	286.565	0.036	54.324	1.123	15401.077	81.436	19.127	38.483	0.92
0.579	263.573	0.056	41.677	0.281	26702.097	51.713	55.249	134.223	0.00	37.866	0.912	0.649	263.145	0.055	40.128	0.262	25256.498	47.336	53.443	114.597	0.00
0.532	270.726	0.040	31.985	0.627	17147.233	69.094	32.294	98.715	0.00	98.244	1.489	0.697	271.020	0.038	31.532	0.619	16284.709	61.076	31.538	78.638	0.00

Table S4. Multiple linear regression (MLR) results and statistics, including correlation coefficients (*r* values) and statistical significance *p* values.

	correlation coefficients, *r*					statistical significance *p* -values*				
	bulk POC		n-alkanoic ("fatty") acids		lignin phenols	bulk POC		n-alkanoic ("fatty") acids		lignin phenols
	$\delta^{13}C$	^{14}C age	$\delta^{13}C$	^{14}C age	^{14}C age	$\delta^{13}C$	^{14}C age	$\delta^{13}C$	^{14}C age	^{14}C age
Sample type†	0.2690	0.1408	0.2432	0.4319	0.6543	8.11E-02	3.68E-01	1.87E-01	3.41E-03	5.96E-03
Runoff	-0.009	-0.091	-0.059	-0.283	-0.586	9.54E-01	5.66E-01	7.56E-01	6.64E-02	1.70E-02
Elevation	0.291	0.142	0.148	-0.226	-0.511	5.86E-02	3.64E-01	4.28E-01	1.40E-01	4.30E-02
log TSS Yield	0.370	0.289	0.231	-0.291	-0.300	1.88E-02	7.06E-02	2.20E-01	6.48E-02	2.60E-01
log POC Yield	0.141	0.398	0.135	-0.138	-0.169	3.85E-01	1.11E-02	4.76E-01	3.90E-01	5.32E-01
MAT	0.393	-0.533	0.091	-0.772	-0.764	9.09E-03	2.32E-04	6.28E-01	8.66E-10	5.66E-04
T CV	-0.229	0.563	0.057	0.759	0.863	1.40E-01	8.59E-05	7.62E-01	2.33E-09	1.70E-05
log MAP	0.177	-0.496	-0.032	-0.727	-0.716	2.57E-01	7.26E-04	8.64E-01	2.32E-08	1.81E-03
P CV	0.588	0.145	0.472	-0.191	-0.353	3.43E-05	3.52E-01	7.34E-03	2.15E-01	1.80E-01
Permafrost (% contin.)	-0.142	0.490	0.141	0.645	0.608	3.63E-01	8.61E-04	4.48E-01	2.30E-06	1.25E-02
Permafrost (% discontin.)	-0.198	0.520	-0.065	0.460	0.418	2.04E-01	3.55E-04	7.29E-01	1.66E-03	1.07E-01
Soil C stock	-0.483	0.297	-0.345	0.580	0.390	1.03E-03	5.32E-02	5.71E-02	3.70E-05	1.36E-01
NPP	-0.049	-0.364	-0.301	-0.451	-0.534	7.54E-01	1.65E-02	9.93E-02	2.12E-03	3.31E-02
$\tau_{ecosystem}$	-0.002	0.767	0.069	0.620	0.362	9.89E-01	3.24E-09	7.11E-01	9.19E-06	1.68E-01
τ_{soil}	-0.300	0.643	-0.140	0.766	0.576	5.09E-02	3.33E-06	4.54E-01	1.39E-09	1.96E-02
Longitude	0.069	-0.107	0.175	0.040	0.037	6.58E-01	4.95E-01	3.45E-01	7.95E-01	8.91E-01
log Area	0.054	0.118	-0.119	0.070	0.175	7.33E-01	4.50E-01	5.23E-01	6.51E-01	5.16E-01
Slope	0.033	0.155	0.096	-0.166	-0.307	8.32E-01	3.22E-01	6.07E-01	2.83E-01	2.47E-01
Floodplain (fractional area)	0.346	-0.162	0.049	-0.027	0.177	2.32E-02	2.99E-01	7.92E-01	8.62E-01	5.12E-01
Anthropogenic (fractional area)	0.074	-0.380	0.179	-0.526	-0.570	6.35E-01	1.21E-02	3.35E-01	2.43E-04	2.11E-02

*All corrlations deemd as significant for the purposes of this study (i.e., $p < 0.05$) are highlighted in red.
†Sample type descriptions have been replaced by a dummy variable: 1 = suspended sediments, 2 = bank and bedload sediments, 3 = estuary/shelf/slope/etc. deposits.

Table S5. Redundancy analysis (RDA) results and statistics, including control variable loadings, response variable loadings, and individual sample scores for each RDA canonical axis.

	Control variable loadings ("biplot scores")*				
	RDA1	**RDA2**	**RDA3**	**RDA4**	**RDA5**
Sample type†	0.263	-0.383	0.565	-0.334	-0.135
Runoff	-0.217	0.078	-0.242	0.177	-0.183
Elevation	-0.230	-0.293	-0.415	0.067	0.330
log TSS Yield	-0.161	-0.440	-0.570	0.147	-0.210
log POC Yield	0.051	-0.299	-0.593	0.247	-0.149
MAT	-0.881	-0.043	-0.279	-0.111	-0.031
T CV	0.836	-0.157	0.267	0.124	-0.102
log MAP	-0.779	0.081	-0.307	0.026	-0.070
P CV	-0.274	-0.598	-0.190	0.029	0.253
Permafrost (% contin.)	0.689	-0.216	0.299	0.134	-0.059
Permafrost (% discontin.)	0.603	-0.098	-0.105	0.086	-0.124
Soil C stock	0.713	0.254	0.052	-0.110	0.339
NPP	-0.503	0.250	-0.313	-0.198	-0.294
$\tau_{ecosystem}$	0.870	-0.276	-0.103	-0.072	0.304
τ_{soil}	0.905	-0.017	0.111	-0.057	0.214
$f_{anthropogenic}$	-0.537	0.097	-0.074	0.411	-0.067

	Response variable loadings*				
	RDA1	**RDA2**	**RDA3**	**RDA4**	**RDA5**
bulk POC $\delta^{13}C$	-0.411	-0.742	0.029	-0.191	-0.018
bulk POC ^{14}C age	0.699	-0.421	-0.348	0.054	-0.014
n-alkanoic ("fatty") acid $\delta^{13}C$	-0.135	-0.499	0.182	0.246	0.053
n-alkanoic ("fatty") acid ^{14}C age	0.819	-0.065	0.262	-0.121	0.066
lignin phenol ^{14}C age	0.305	-0.081	0.215	0.054	-0.146

	Individual sample scores ("site scores")				
	RDA1	**RDA2**	**RDA3**	**RDA4**	**RDA5**
Amazon @ Obidos	-0.631	1.154	-1.453	-1.934	-1.760
Brahmaputra @ Jamuna Bridge	-1.023	-1.507	-0.967	0.058	0.853
Brahmaputra @ Jamuna Bridge	-0.910	-0.742	-1.594	0.407	0.935
Cagayan @ mouth	-1.260	1.043	0.037	0.399	-0.753
Cariaco (composite) @ mouth	-2.029	-0.986	1.247	-1.668	0.535
Columbia @ Portland	-1.009	-0.444	1.145	-1.578	1.549
Colville @ Nuiqsut	3.558	-0.511	-1.343	0.021	1.716
Congo @ Boma	-1.307	0.967	0.071	-0.445	0.909
Congo @ Brazzaville	-1.111	2.094	-0.854	-0.483	0.678
Connecticut @ Lyme	0.465	2.165	-0.871	1.429	0.380
Danube @ Tulcea	-0.519	1.121	-0.024	0.844	-0.590
Danube @ Tulcea	-0.406	1.886	-0.650	1.193	-0.508
Danube @ Tulcea	-0.632	0.356	0.603	0.495	-0.673
Danube @ Tulcea	-0.632	0.356	0.603	0.495	-0.673
Delaware @ state border	-0.479	1.322	0.224	-0.209	-1.268
Dulnain @ Dulnain Bridge	-0.127	3.079	-0.074	1.156	1.234
Earn @ Bridge of Earn	-0.575	2.592	1.332	1.261	0.538
Eel @ mouth	0.279	-0.801	-0.670	-0.435	0.240
Fraser @ Hope	-0.421	0.224	-0.038	-0.208	1.056
Fraser @ Hope	-0.534	-0.541	0.589	-0.557	0.973
Ganga @ Harding Bridge	-1.438	-2.521	-0.506	0.750	1.509
Ganga @ Harding Bridge	-1.551	-3.286	0.121	0.401	1.427
Gaoping @ mouth	-0.706	0.095	-0.699	0.890	-2.360
Godavari @ Rajahmundi	-1.948	-3.745	1.257	0.037	0.365
Indigirka @ mouth	2.625	-1.727	1.675	-0.104	-0.827
Kalix @ mouth	1.469	1.987	1.271	-1.872	2.425
Kolyma @ mouth	3.114	0.014	2.158	-1.266	-0.768
Lena @ mouth	2.190	-1.776	2.039	3.710	-0.568
Mackenzie + Peel @ Tsiigehtchic	3.545	-1.803	-1.870	-0.657	0.408
Mackenzie + Peel @ Tsiigehtchic	3.658	-1.038	-2.497	-0.308	0.490
Mekong @ Phnom Penh	-0.536	1.375	-1.563	-0.064	-0.330
Mississippi @ mouth	-1.188	-0.990	0.492	-2.079	-2.717
Mississippi @ mouth	-1.075	-0.225	-0.135	-1.730	-2.634
Ob @ mouth	1.821	2.003	0.816	-1.401	0.910
Ob @ mouth	1.708	1.237	1.443	-1.750	0.828
Padma @ Mawa	-1.281	-1.922	-0.769	0.874	1.317
Pearl @ Guangzhou	-1.185	-0.006	-0.590	1.443	-0.738
Pettaquamscutt @ Narragansett	0.101	-0.327	0.364	-1.305	-1.482
Tay @ Earn confluence	-0.523	1.999	0.066	2.317	1.031
Unare @ mouth	-2.098	0.266	0.715	-1.724	0.892
Waiapu @ Ruatoria	1.055	-1.470	-0.709	-0.853	-0.926
Yangzte @ Zhenjiang	-0.847	-0.514	-0.188	2.681	-0.049
Yellow @ Binzhou	-0.346	-0.097	-1.682	-1.294	-0.017
Yenisey @ mouth	1.236	-0.595	1.821	1.926	-0.524
Yukon @ mouth	1.504	0.237	-0.341	1.133	-3.031

*Control and response variable loadings are scaled according to "Type-II" scaling (*73*).
†Sample type descriptions have been replaced by a dummy variable: 1 = suspended sediments, 2 = bank and bedload sediments, 3 = estuary/shelf/slope/etc. deposits.