



Supplement of

Mobile evaporite enhances the cycle of physical–chemical erosion in badlands

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Fig. S1. (a) Aerial view of mudstone badlands landscape taken from Guting Bridge (GT) (Figure 1). Badlands cover an area of 4.37 km², which accounts for 2.49% of the total catchment area. (b) the profile of a mudstone hillslope. Mud cracks extend down to the area approximately 10 cm below the mudstone surface.

Table S1 The riverine chemistry and related hydrological characteristics of river in Nanxiong Bridge.

duration	WT	pH	COND	SSC	Cl ⁻	SO ₄ ²⁻	Na ⁺	Ca ²⁺	Sr ²⁺	SAR	D ₅₀	Q
h	°C		μs cm ⁻¹	mg L ⁻¹			μmol L ⁻¹			meq L ⁻¹	μm	m ³ s ⁻¹
0.0	29.1	7.3	340	11	*	1008	2270	1530	5.06	1.44	*	*
5.5	28.7	8.2	420	11	790	890	1933	1407	4.55	1.24	*	2.3
8.5	27.8	8.5	460	95	532	594	1972	1383	4.39	1.29	*	2.7
11.5	28.1	7.2	96	29186	377	572	2753	990	3.24	2.12	4.4	34.0
14.5	26.7	7.8	99	33758	822	1107	3387	679	2.56	3.14	4.7	90.5
17.5	26.9	7.5	99	31407	871	1079	2955	613	2.14	2.86	6.4	115.7
20.5	27.0	7.5	180	12885	1265	1560	2126	837	2.42	1.80	4.1	120.3
26.5	28.9	7.4	260	7762	1461	1662	1486	774	2.31	1.32	4.2	79.3
32.5	27.5	7.5	460	6285	1161	1238	1478	785	2.35	1.30	3.9	20.6
35.5	26.4	7.8	99	5445	528	771	420	351	0.84	0.58	8.1	64.5
38.5	25.7	7.7	99	16900	448	682	1348	560	1.53	1.42	8.2	464.8
41.5	25.5	7.4	99	16247	165	215	1072	486	1.36	1.22	6.0	724.3
44.5	25.2	7.3	99	5201	348	392	1132	457	1.27	1.33	5.5	753.2
47.5	26.3	7.3	99	10184	280	350	960	519	1.37	1.07	6.1	667.3
50.5	25.9	7.7	99	11427	270	356	1107	544	1.44	1.19	6.1	560.2
53.5	26.2	7.8	99	7799	305	418	1007	599	1.61	1.03	5.6	379.8
56.5	26.2	7.6	250	6091	295	429	1000	719	1.92	0.94	6.6	214.7
59.5	25.8	7.7	170	7270	314	478	1189	816	2.31	1.04	4.6	124.6
62.5	26.5	7.6	310	7275	570	813	1593	949	2.59	1.29	4.6	86.9
68.5	26.3	7.6	500	10871	807	1216	2216	1178	3.31	1.58	6.4	101.7
71.5	27.3	7.5	310	10777	609	1009	1899	1036	2.93	1.44	5.6	126.1

* no data; (WT): water temperature; (COND): conductivity; (D₅₀): median of particle sizes; (Q): discharge

Table S2 The riverine chemistry and related hydrological characteristics of river in Guting Bridge.

duration	WT	pH	COND	SSC	Cl ⁻	SO ₄ ²⁻	Na ⁺	Ca ²⁺	Sr ²⁺	SAR	D ₅₀	P _{acc}
h	°C		μs cm ⁻¹	mg L ⁻¹			μmol L ⁻¹			meq L ⁻¹	μm	mm h ⁻¹
0.0	29.0	7.9	930	164	330	655	1163	1135	3.03	0.86	*	0.0
5.5	28.4	8.5	240	17718	803	965	2047	1060	2.89	1.56	6.8	0.0
8.5	27.6	7.7	230	19539	1425	1504	3743	896	2.99	3.05	5.6	55.5
11.5	27.6	7.4	98	12172	1515	1162	3666	597	1.87	3.61	4.5	83.5
14.5	27.0	7.4	143	11082	532	647	1610	734	1.93	1.47	5.5	89.5
17.5	26.6	7.4	99	11257	575	645	2112	731	2.02	1.92	5.7	98.0
20.5	27.0	7.4	260	6845	284	560	1133	778	2.11	1.01	5.8	100.0
26.5	28.7	7.3	140	2857	248	491	1037	761	2.05	0.93	3.6	100.0
32.5	27.2	7.3	350	3659	300	595	1126	905	2.43	0.93	3.6	101.5
35.5	26.6	7.8	99	35921	1390	1004	3515	366	1.06	4.41	3.6	129.5
38.5	26.2	7.4	99	15445	169	287	847	543	1.46	0.92	6.0	239.5
41.5	25.8	7.5	99	12625	196	253	865	443	1.18	1.04	6.7	306.0
44.5	25.2	7.5	99	14029	236	292	985	463	1.19	1.15	5.3	324.0
47.5	26.1	7.5	99	9268	165	282	806	571	1.42	0.85	5.5	378.5
50.5	26.1	7.6	99	5943	139	253	666	574	1.46	0.71	3.8	390.0
53.5	26.3	7.6	99	4150	175	332	710	690	1.71	0.68	5.8	392.0
56.5	26.3	7.5	120	7716	425	607	1456	782	2.13	1.29	8.8	402.5
59.5	26.4	7.6	140	3430	289	551	1090	926	2.34	0.90	3.9	403.0
62.5	26.4	7.6	240	4906	439	705	1442	983	2.57	1.14	4.9	406.5
68.5	26.4	7.6	120	11861	367	589	1614	855	2.26	1.35	5.6	426.0
71.5	26.9	7.6	99	4715	332	625	1225	925	2.39	1.00	5.5	428.0

* no data; (WT): water temperature; (COND): conductivity; (D₅₀): median of particle sizes; (P_{acc}): precipitation accumulation.

Table S3 Chemical weathering rate of Nanxiong Bridge.

	Flux _{rain}	Flux _{evap}	Flux _{sil}	Flux _{carb}
	t km ⁻² yr ⁻¹			
annual average (2014-2016)	10.3	96.9	101.2	135.7
typhoon period (2017)	2.9	10.9	16.8	6.6
ratio (%)	28.2	11.2	16.6	4.9

Table S4 Time series of Molar ratio for Na/(1000·Sr) and Ca/(1000·Sr) in Nanxiong Bridge during the non-typhoon period.

date	Nanxiong Bridge	
	Ca/(1000·Sr)	Na/(1000·Sr)
2014/9/19	0.244	0.211
2014/10/25	0.257	0.191
2014/11/22	0.178	0.095
2014/12/20	0.249	0.096
2015/1/17	0.270	0.219
2015/3/1	0.270	0.232
2015/3/21	0.282	0.232
2015/4/25	0.257	0.218
2015/5/23	0.250	0.254
2015/6/20	0.217	0.202
2015/6/26	0.202	0.113
2015/7/18	0.296	0.263
2015/8/15	0.297	0.349
2015/9/19	0.303	0.269
2015/10/17	0.294	0.190
2015/11/16	0.240	0.175
2015/12/26	0.261	0.201
2016/1/20	0.288	0.227
2016/1/23	0.285	0.218
2016/2/27	0.270	0.205
2016/3/19	0.298	0.183
2016/4/16	0.315	0.345
2016/5/14	0.285	0.443

2016/6/22	0.272	0.266
2016/7/20	0.287	0.326
2016/8/11	0.265	0.375
2016/9/30	0.263	0.257
2016/10/25	0.339	0.216
2016/11/29	0.225	0.171
2016/12/21	0.253	0.283
2014/9/19	0.264	0.166

Table S5 Time series of Molar ratio for Na/(1000·Sr) and Ca/(1000·Sr) in Nanxiong Bridge and Guting Bridge during the 2017 typhoon.

duration	Nanxiong Bridge		Guting Bridge	
	Ca/(1000·Sr)	Na/(1000·Sr)	Ca/(1000·Sr)	Na/(1000·Sr)
0.0	0.305	0.452	0.375	0.384
5.5	0.309	0.424	0.367	0.709
8.5	0.315	0.450	0.300	1.251
11.5	0.306	0.849	0.319	1.958
14.5	0.265	1.321	0.380	0.834
17.5	0.286	1.381	0.361	1.044
20.5	0.346	0.877	0.369	0.537
26.5	0.336	0.645	0.371	0.506
32.5	0.334	0.629	0.373	0.464
35.5	0.415	0.498	0.347	3.325
38.5	0.365	0.879	0.370	0.578
41.5	0.358	0.788	0.376	0.734
44.5	0.359	0.889	0.388	0.826
47.5	0.380	0.703	0.402	0.567
50.5	0.377	0.768	0.394	0.457
53.5	0.371	0.625	0.403	0.415
56.5	0.375	0.522	0.368	0.685
59.5	0.354	0.516	0.396	0.467
62.5	0.367	0.616	0.382	0.561
68.5	0.356	0.669	0.378	0.714
71.5	0.353	0.647	0.387	0.512

Table S6 the sediment chemistry of Guting Bridge.

duration	Ca	Na	Al	Fe	K	Mg	Mn	Ti	Sr
hr	$\mu\text{g g}^{-1}$								
5.5	10914	9981	78214	42084	23413	11294	524	4901	101
41.5	9833	8919	86454	48893	28034	13157	552	5319	99
Total loss, τ (%)	-17	-18	-17	7	10	7	3	-	-10

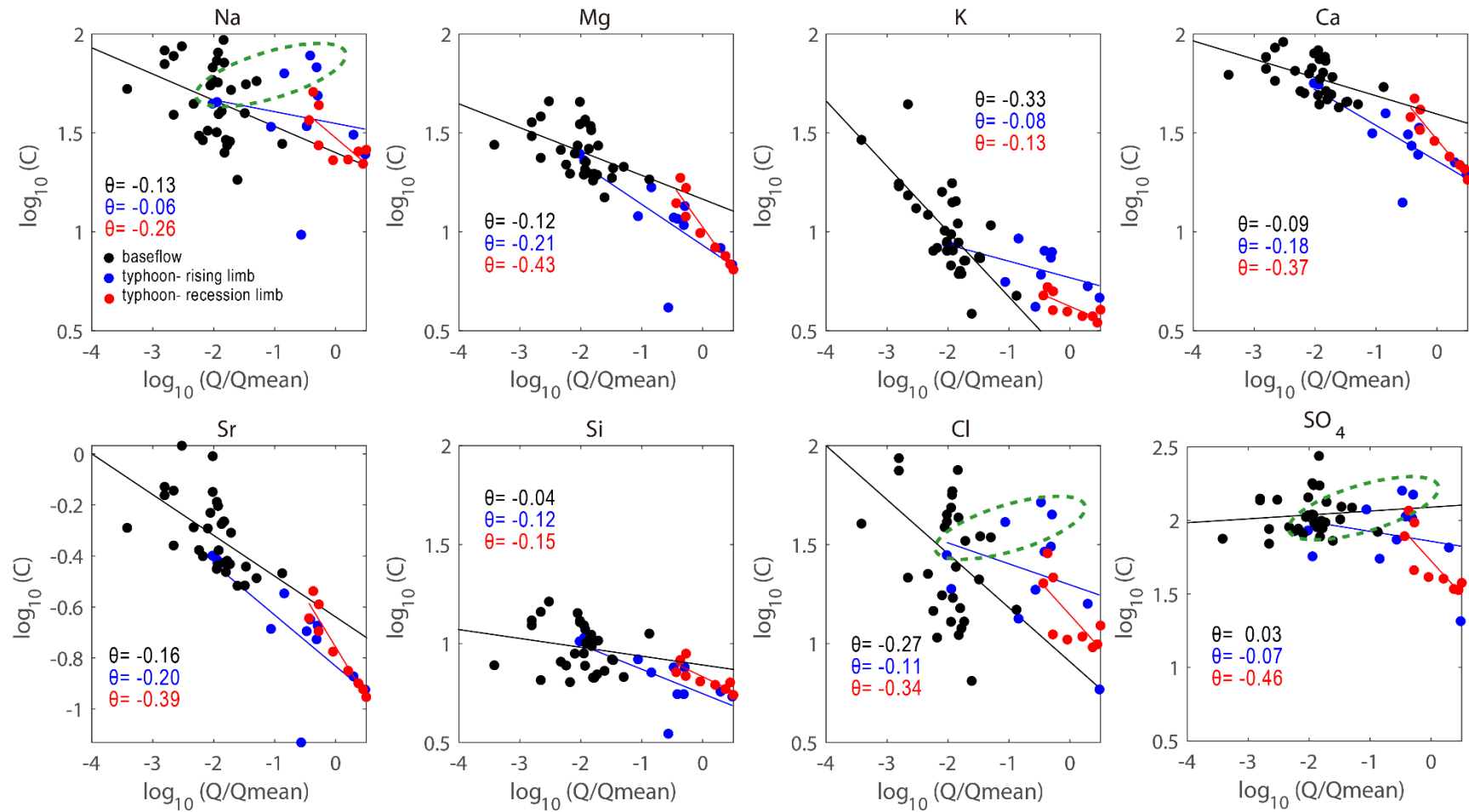


Fig. S2. The cQ relationships at rising and recession limb of the typhoon event, and baseflow at Nanxiong Bridge. Black, blue and red colors denote the sample from baseflow, rising and recession limb, respectively. Green dashed circles denote the sample of Na, Cl, and SO_4 at the certain period of rising limb. Dots, lines and numbers denote samples, trendline and slope respectively.