

**Table S1.** Respiration rates in calcareous and red soils

	Calcareous soil				Red Soil			
	KP1	KP2	KP3	Average	NKP1	NKP2	NKP3	Average
Soil respiration rate (mg C m <sup>-3</sup> h <sup>-1</sup> )	107.40 ± 75.64 <sup>b</sup>	171.61 ± 141.97 a	138.78 ± 96.71 ab	134.84 ± 106.45 A	147.44 ± 82.07 ab	131.67 ± 89.84 ab	130.15 ± 53.50 ab	137.93 ± 76.88 A
Annual soil emission (t C km <sup>-2</sup> a <sup>-1</sup> )	926.08	1645.45	1342.40	1304.64	1313.02	1083.24	1104.47	1166.91

Data are means ± SD; different lowercase letters indicate differences between soil profiles and uppercase letters indicate population mean differences at  $p = 0.05$ . N=33 in KP1 and NKP1, N=23 in remaining profiles.

**Table S2.** CO<sub>2</sub> Concentrations in different layers in calcareous and red soils

Depth (cm)	Calcareous Soil (%)				Red Soil (%)			
	KP1	KP2	KP3	Average	NKP1	NKP2	NKP3	Average
-10	0.33 ± 0.30	1.15 ± 1.04	0.59 ± 0.49	0.65 ± 0.73 b	0.44 ± 0.26	0.51 ± 0.32	0.60 ± 0.44	0.51 ± 0.34 d
	0.50 ± 0.46	1.17 ± 1.07	0.58 ± 0.42	0.72 ± 0.74 ab	0.58 ± 0.27	0.65 ± 0.41	0.71 ± 0.44	0.64 ± 0.37 c
-20	0.55 ± 0.47	1.38 ± 1.30	0.64 ± 0.52	0.82 ± 0.88 ab	0.76 ± 0.32	0.73 ± 0.47	0.68 ± 0.26	0.73 ± 0.35 bc
	0.66 ± 0.57	1.11 ± 0.89	0.76 ± 0.54	0.82 ± 0.69 ab	0.78 ± 0.31	0.87 ± 0.46	0.78 ± 0.42	0.80 ± 0.39 ab
-30	0.75 ± 0.56	1.29 ± 0.94	0.88 ± 0.54	0.95 ± 0.72 a	1.03 ± 0.52	0.83 ± 0.43	0.93 ± 0.44	0.94 ± 0.47 a
	0.72 ± 0.54	1.30 ± 0.90	0.94 ± 0.59	0.96 ± 0.71 a	0.78 ± 0.34	0.95 ± 0.65	0.92 ± 0.36	0.87 ± 0.46 a
-40	0.77 ± 0.63	1.17 ± 1.02	0.86 ± 0.54	0.91 ± 0.75 a	0.78 ± 0.30	0.86 ± 0.43	0.82 ± 0.34	0.81 ± 0.35 ab
	0.74 ± 0.49	1.07 ± 0.83	0.58 ± 0.38	0.79 ± 0.61 ab	0.67 ± 0.45	0.69 ± 0.33	0.69 ± 0.31	0.68 ± 0.38 bc
-50	0.63 ± 0.16 c	1.20 ± 0.11 a	0.73 ± 0.15 bc		0.73 ± 0.17 bc	0.76 ± 0.14 b	0.77 ± 0.12 b	
	Average	0.83 ± 0.73 a			0.75 ± 0.41 b			

Data are means ± SD. Different letters within a row indicate differences between profiles; different letters in a column indicate differences among layers at  $p = 0.05$ . N=33 in every layer of KP1 and NKP1, N=23 in different layer of remaining profiles.

**Table S3.**  $\delta^{13}\text{C}$ -CO<sub>2</sub> values at different depths of calcareous and red soils

Depth (cm)	Calcareous Soil (‰)			Average	Red Soil (‰)			Average
	KP1	KP2	KP3		NKP1	NKP2	NKP3	
-10	-22.18 ± 0.80	-26.27	-24.45	-23.45 ± 1.94 a	-23.53 ± 0.64	-25.46	-24.8	-24.17 ± 1.02 a
-20	-23.75 ± 0.87	-25.83	-23.21	-24.06 ± 1.19 ab	-25.45 ± 0.52	-25.98	-24.04	-25.28 ± 0.81 b
-30	-22.08 ± 0.09	-26.04	-24.34	-23.64 ± 1.92 a	-26.27 ± 0.71	-25.51	-24.92	-25.74 ± 0.77 b
-40	-24.41 ± 0.86	-26.03	-24.9	-24.94 ± 0.91 ab	-25.42 ± 0.54	-24.9	-25.84	-25.40 ± 0.51 b
-50	-25.28 ± 0.51	--	-25.27	-25.28 ± 0.41 ab	-26.39 ± 0.85	-25.51	-26.12	-26.16 ± 0.71 b
-60	-25.98 ± 1.19	-26.42	-25.28	-25.93 ± 0.93 b	-25.94 ± 0.88	-25.44	-26.32	-25.91 ± 0.69 b
-80	-25.35 ± 0.71	-26.69	-24.42	-25.43 ± 0.95 ab	-26.11 ± 1.48	-25.41	-26.26	-26.00 ± 1.10 b
-100	-24.23 ± 0.69	-26.7	-24.71	-24.97 ± 1.24 ab	-26.09 ± 1.01	-25.5	-26.2	-25.99 ± 0.77 b
Average	-24.24 ± 1.53 a	-26.28 ± 0.34 b	-24.57 ± 0.66 a		-25.62 ± 1.15 ab	-25.46 ± 0.29 ab	-25.56 ± 0.86 ab	
	-24.71 ± 1.44 a				-25.58 ± 0.96b			

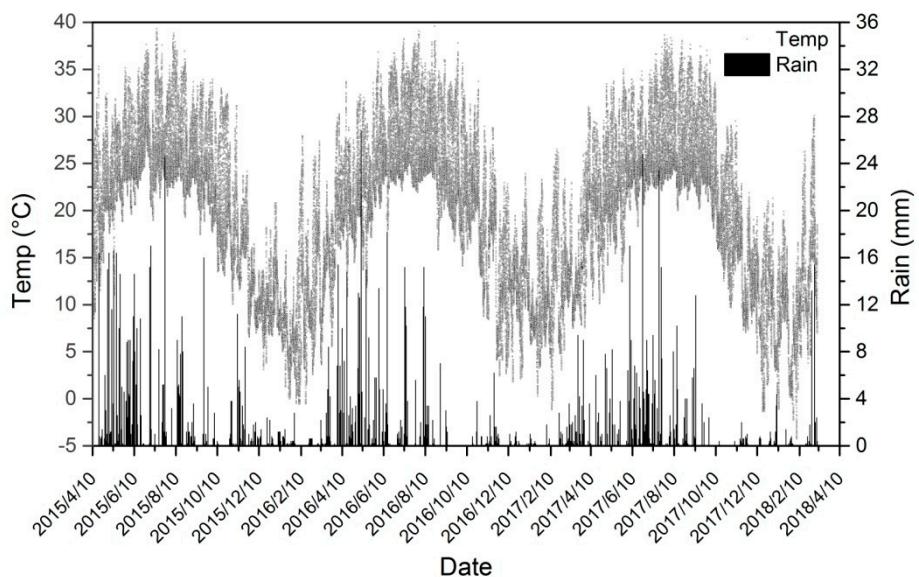
--Represents no data. Data are means ± SD. Different letters within a row indicate differences among profiles; different letters in a column indicate differences among layers at  $p = 0.05$ . N=5 in every layer of calcareous and red soil.

**Table S4** Seasonal carbonate dissolution rates in calcareous and red soils.

Height/De pth (cm)	Calcareous Soil (mg/cm <sup>2</sup> a)					Red Soil (mg/cm <sup>2</sup> a)				
	Summ er	Autu mn	Wint er	Spri ng	Avera ge	Summ er	Autu mn	Wint er	Spri ng	Avera ge
150 (air)	2.80 ± 0.74	2.17 ± 0.27	2.07 ±	1.79 ±	2.21 ± 0.60 c	1.58 ± 0.53	1.23 ± 0.03	1.43 ±	1.59 ±	1.46 ± 0.39 c
			0.58	0.45				0.21	0.62	
0 (air)	4.22 ± 0.52	2.74 ± 0.75	2.58 ±	1.59 ±	2.78 ± 1.10 c	2.56 ± 0.50	1.84 ± 0.49	4.40 ±	1.61 ±	2.60 ± 1.23 c
			0.54	0.44				0.83	0.08	
20 (soil)	6.55 ± 0.77	8.50 ± 1.46	7.79 ±	3.18 ±	6.50 ± 2.26 b	18.44 ± 3.94	16.56 ± 1.32	13.47 ±	6.48 ±	13.74 ± 5.29
			0.31	0.53				3.46	0.68	b
50 (soil)	5.74 ± 1.84	5.90 ± 0.60	6.97 ±	9.31 ±	6.98 ± 1.83	22.39 ± 3.53	16.79 ± 2.82	10.47 ±	18.08 ±	16.94 ± 5.09

			0.30	1.54	ab			3.06	1.86	a
100 (soil)	10.90 ± 1.65	6.19 ± 0.91	7.48 ± 0.73	7.90 ± 1.06	8.12 ± 2.05 a	16.07 ± 2.35	12.81 ± 0.71	10.05 ± 1.64	4.89 ± 0.85	10.96 ± 4.47 b
Average in the air (mg cm <sup>-2</sup> a <sup>-1</sup> )			2.50 ± 0.91 a					2.03 ± 1.07 a		
Average in the soil (mg cm <sup>-2</sup> a <sup>-1</sup> ) <sup>1)</sup>			7.20 ± 2.11 b					13.88 ± 5.42 a		

Data are means ± SD. Different letters within a row indicate differences among profiles; different letters in a column indicate differences among layers at  $p = 0.05$ . N=12 in every layer of calcareous and red soil profiles.



**Figure S1.** Temperature and rainfall in Maocun village