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Supplement of

Groundwater data improve modelling of headwater stream CO₂ outgassing with a stable DIC isotope approach

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Table S1: Analytical results of stream water. Samples were taken at the V-notch weir located at the catchment outlet for discharge measurements.
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Sample ID	Collection date dd-mmm-yyyy	O ₂ /mg/L	O ₂ /%-sat.	T /°C	pH	EC /μS cm ⁻¹	Eh /mV	TA /mg L ⁻¹ CaCO ₃	δ ¹³ C-DIC /‰ VPDB	δ ¹³ C-POC /‰ VPDB	DIC /μmol L ⁻¹	pCO2 /ppmV	Discharge /L s ⁻¹
1-UHL	24-Sep-2014	9.3	93	10.9	5.76	37	342	1.2	-20.9	-29.3	89	1419	50.8
2-UHL	29-Oct-2014	9.7	89	7.7	6.20	53	301	8.9	-21.6	-29.8	196	2217	21.5
3-UHL	12-Dec-2014	10.8	91	3.0	6.48	70	198	11.5	-15.6	-29.1	198	1523	27.0
4-UHL	20-Jan-2015	11.3	40	1.9	6.02	51	122	9.0	-20.0	-29.5	143	1530	25.6
4.1 UHL	16-Feb-2015			4.0	6.30	55			-16.7	-29.7	137	1290	17.5
5-UHL	18-Feb-2015	10.5	86	4.3	6.16	54	89	7.0	-16.5	-29.8	261	2763	16.3
5.1 UHL	28-Feb-2015			4.4	5.90	56			-15.7	-29.7	134	1647	14.9
5.2 UHL	7-Mar-2015			2.5	5.89	53			-14.7	-29.1	120	1392	16.0
5.3 UHL	12-Mar-2015			3.8	5.23	31			-21.2	-29.7	49	694	40.1
5.4 UHL	16-Mar-2015			3.8	5.88	46			-18.2	-29.1	100	1216	36.3
6-UHL	17-Mar-2015	11.2	91	3.2	4.97	36	95	3.2	-21.3	-29.3	65	920	125.8
6.1 UHL	22-Mar-2015			3.5	5.38	40			-20.2	-29.1	86	1182	34.5
6.2 UHL	29-Mar-2015			4.5	4.46	34			-21.5	-28.9	58	878	107.2
7-UHL	31-Mar-2015	11.8	94	0.9	4.87	38	197	2.6	-17.5	-29.9	141	1838	138.4
7.1 UHL	1-Apr-2015			2.0	4.50	36			-23.7	-30.2	57	785	109.3
7.2 UHL	10-Apr-2015			4.0	4.50	33			-18.4	-28.9	46	683	111.8
7.3 UHL	12-Apr-2015			2.0	4.40	36			-24.1	-29.4	40	552	137.3
7.4 UHL	18-Apr-2015			2.0	5.01	37			-22.1	-29.6	88	1188	47.7
8-UHL	22-Apr-2015	11.3	96	5.1	6.12	46	91	6.3	-18.5	-30.2	136	1514	29.7
8.1. UHL	22-Apr-2015			3.0	5.87	45			-18.5	-28.8	92	1094	29.7
8.2. UHL	30-Apr-2015			3.0	5.71	41			-18.5	-29.0	107	1345	40.3
8.3. UHL	7-May-2015			6.5	5.42	35			-21.3	-29.0	94	1424	34.5
8.4 UHL	17-May-2015			6.0	5.76	55			-16.7	-29.2	156	2134	16.5
8.5. UHL	21-May-2015			7.0	6.02	50			-16.7	-29.6	209	2619	16.2
9-UHL	26-May-2015	9.9	96	8.1	6.46	62	90	8.5	-15.2	-29.4	175	1562	15.0
9.1. UHL	1-Jun-2015			8.9	6.11	60			-15.9	-29.9	175	2180	13.7
9.2. UHL	4-Jun-2015			10.2	6.08	60			-16.5	-29.9	182	2407	12.6
9.3. UHL	15-Jun-2015			11.3	6.25	62			-15.9	-29.9	184	2194	12.1
10-UHL	17-Jun-2015	10.4	99	9.2	6.29	63	92	10.9	-15.0	-28.8	195	2120	12.0
10.3 UHL	1-Jul-2015			10.0	6.14	11			-18.5	-29.1	167	2105	12.3
10.4 UHL	9-Jul-2015			10.0	5.80	10			-15.7	-29.2	193	2948	12.0
10.5 UHL	13-Jul-2015			11.2	5.97				-15.3	-29.1	197	2869	12.7
11-UHL	14-Jul-2015	9.2	96	11.9	6.44	62	82	9.8	-15.2	-29.5	192	1910	13.0
11.1 UHL	23-Jul-2015			12.0	6.45				-16.2	-29.4	225	2223	10.5
11.2 UHL	1-Aug-2015			11.4	6.52				-15.3	-29.6	222	1990	9.9
11.3 UHL	6-Aug-2015			12.2	6.25				-15.6	-29.3	233	2841	9.6
11.4 UHL	13-Aug-2015			13.8	6.37				-14.6	-29.3	214	2409	9.3
12-UHL	19-Aug-2015	9.0	95	13.0	5.86	67	98	2.7	-22.4	-28.4	95	1538	47.0
12.1 UHL	18-Aug-2015			12.0	6.08				-17.7	-28.3	270	3749	32.0
12.2 UHL	26-Aug-2015			11.5	6.64				-15.2	-28.4	184	1410	9.7
12.3 UHL	31-Aug-2015			11.0	6.59				-13.5	-28.9	244	1981	9.0

12.4 UHL	7-Sep-2015			9.7	6.06					-16.6	-28.0	85	1123	28.3
12.5 UHL	16-Sep-2015			11.5	6.02					-14.4	-29.0	199	2836	9.8
13-UHL	24-Sep-2015	10.0	97	8.9	7.09	66	99	13.5		-14.0	-29.1	210	733	10.9
13.1 UHL	25-Sep-2015			8.6	6.64					-15.3	-28.5	483	3485	9.8
13.2 UHL	30-Sep-2015			5.0	6.33					-14.1	-28.5	172	1621	9.0
13.3UHL	6-Oct-2015			8.4	6.57					-14.2	-28.3	172	1355	9.0
13.4 UHL	16-Oct-2015			8.0	6.34					-16.9	-28.0	90	908	27.8
13.5 UHL	17-Oct-2015			8.0	5.43					-21.7	-27.5	64	1020	36.7
14-UHL	21-Oct-2015	10.7	95	6.4	5.88	66	158	25.0		-20.3	-29.9	77	2774	37.2
14.5 UHL	1-Nov-2015			8.0	6.35	70				-14.1	-30.2	176	1759	9.7
14.6 UHL	11-Nov-2015			6.5	5.48	62				-25.2	-28.8	96	1440	30.3
14.7 UHL	16-Nov-2015			6.0	3.92	62				-23.9	-28.2	38	612	528.8
14.8 UHL	23-Nov-2015			5.0	4.99	55				-22.3	-29.4	74	1118	25.6
15-UHL	25-Nov-2015	11.1	92	2.8	5.89	71	187	7.5		-19.4	-29.2	133	1558	17.6
15.1 UHL	30-Nov-2015			5.0	4.62	57				-22.8	-28.4	58	891	117.1
15.2 UHL	7-Dec-2015			5.6	5.20	54				-19.7	-30.0	84	1274	26.8
15.3 UHL	15-Dec-2015			5.8	5.97	56				-18.8	-29.2	108	1341	23.5
16-UHL	17-Dec-2015	11.3	93	4.0	6.10	57	179	0.2		-18.4	-29.9	133	1448	27.9
16.1 UHL	21-Dec-2015			5.2	5.61	54				-19.1	-29.7	73	1017	30.7
16.2 UHL	28-Dec-2015			5.1	6.12	59				-17.8	-30.2	128	1425	26.2
16.3 UHL	30-Dec-2015			3.3	5.65	58				-17.6	-29.5	105	1356	23.5
16.4 UHL	6-Jan-2016			2.0	6.30	64				-16.5	-30.2	167	1487	16.8
16.5 UHL	11-Jan-2016			3.0	6.36	61				-10.1	-29.9	94	817	24.1
16.6 UHL	18-Jan-2016			0.8	6.26	64				-16.3	-30.2	162	1438	16.6
17-UHL	21-Jan-2016	12.6	94	-0.1	6.57	54	135	8.5		-16.7	-30.4	202	1305	15.8
17.1 UHL	26-Jan-2016			1.8	4.28	52				-23.1	-28.9	58	795	173.5
17.2 UHL	2-Feb-2016			2.5	4.19	48				-23.0	-29.2	50	705	197.4
17.3 UHL	9-Feb-2016			3.0	4.80	45				-21.3	-30.1	66	928	76.7
17.4 UHL	16-Feb-2016			2.5	5.72	51				-22.2	-30.5	121	1484	31.0
18-UHL	17-Feb-2016	12.6	97	1.2	6.33	52	157	1.8		-18.6	-30.1	128	1087	27.5
18.2 UHL	24-Feb-2016			2.0	4.84	40				-24.1		45	613	67.2
18.3 UHL	1-Mar-2016			2.5	5.86	52				-19.5	-29.3	74	869	32.5
18.4 UHL	6-Mar-2016			2.8	5.56	52				-19.0	-28.9	92	1193	30.6
18.5 UHL	14-Mar-2016			2.5	6.29	55				-16.8		103	938	22.8
18.6 UHL	22-Mar-2016			3.0	5.92	52				-17.5	-29.3	98	1141	26.9
18.7 UHL	29-Mar-2016				4.52	42				-23.7	-29.1	48	682	135.1
19-UHL	30-Mar-2016	11.6	95	2.8	5.53	51	222	1.2		-22.3	-29.4	74	966	86.4
19.4 UHL	3-Apr-2016				4.69	39				-24.1	-28.9	31		104.6
19.5 UHL	8-Apr-2016			4.5	4.90	35				-22.6	-29.5	57	850	74.1
19.6 UHL	10-Apr-2016			3.5	4.45	39				-22.6	-29.6	46	671	140.0
19.7 UHL	15-Apr-2016			3.0	4.89	38				-22.6		58	819	72.5
19.8 UHL	20-Apr-2016			4.3	5.83	53				-19.5	-29.3	121	1526	31.5
20-UHL	27-Apr-2016	11.5	96	2.9	6.65	45	154	4.8		-18.8	-29.8	103	648	35.5

Table S2: Analytical results of groundwater at sites P84, HST, and DST. For additional site information see Table S3.
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Sample ID	Collection date	O ₂	O ₂	T	pH	EC	Eh	TA	δ ¹³ C-DIC	δ ¹³ C-POC	DIC	pCO ₂
	dd-mmm-yyyy	/mg/L	/%-sat.	/°C		/μS cm ⁻¹	/mV	/mg L ⁻¹ CaCO ₃	/‰ VPDB	/‰ VPDB	/μmol L ⁻¹	/ppmV
<u>Site P84</u>												
1-P84	25-Sep-2014	7.9	74	8.5	5.90	78	277	8.0	-23.8	-29.1	500	6981
2-P84	30-Oct-2014	8.3	73	6.4	6.04	81	237	11.1	-23.8	-29.2	523	6362
3-P84	13-Dec-2014	8.7	77	5.9	6.09	79	238	8.7	-22.1	-28.3	332	3859
4-P84	21-Jan-2015	8.4	79	6.9	5.73	75	133	6.8	-24.0	-29.4	458	6518
5-P84	19-Feb-2015	8.0	72	6.5	5.82	92	148	8.2	-24.3	-29.4	523	7109
6-P84	18-Mar-2015	8.1	73	7.3	5.62	0	150	7.0	-24.3	-29.9	449	6694
7-P84	1-Apr-2015	8.0	72	5.7	5.71	82	143	8.6	-24.1	-29.3	446	6143
8-P84	21-Apr-2015	8.2	75	7.0	5.04	76	52	9.5	-24.8	-29.5	443	7162
9-P84	27-May-2015	8.5	75	6.2	5.76	77	118	6.5	-24.3	-29.8	434	5976
10-P84	17-Jun-2015	8.0	72	6.6	6.74	78	91	7.8	-24.2	-28.5	458	2753
11-P84	15-Jul-2015	7.5	72	8.4	5.95	77	144	7.7	-25.0	-28.4	461	6258
12-P84	19-Aug-2015	6.6	65	9.6	5.89	78	112	9.5	-24.4	-29.2	540	7829
13-P84	25-Sep-2015	8.2	78	8.7	7.28	78	91	11.0	-23.2	-28.1	406	979
14-P84	22-Oct-2015	7.8	72	7.9	5.92	86	160	10.3	-23.7	-28.4	299	4060
15-P84	26-Nov-2015	6.2	56	6.9	5.74	87	142	6.0	-24.6		449	6368
16-P84	18-Dec-2015	7.9	72	7.6	5.77	75	111	6.0	-23.5		458	6572
17-P84	22-Jan-2016	9.8	79	3.3	5.88	81	87	8.0	-23.5		404	4831
18-P84	18-Feb-2016	8.6	75	5.6	5.75	81	172	7.5	-24.3	-29.7	455	6165
19-P84	31-Mar-2016	7.9	72	6.3	6.32	74	115	6.1	-24.9		423	4163
20-P84	27-Apr-2016	8.4	73	5.3	6.23	71	173	5.5	-24.7		409	4229
<u>Site HST</u>												
1-HST	25-Sep-2014	6.9	65	8.8	5.85	83	356	8.5	-24.5	-28.2	478	6885
2-HST	30-Oct-2014	7.2	66	7.6	5.90	86	232	13.0	-25.0	-28.5	500	6793
3-HST	13-Dec-2014	6.7	52	6.2	5.99	84	268	8.9	-23.7	-27.5	414	5150
4-HST	21-Jan-2015	7.6	66	4.6	5.90	82	142	6.0	-24.1	-28.4	383	4737
<u>HST</u>												
6-HST	18-Mar-2015	5.6	49	6.5	5.83	84	146	17.5	-24.6	-28.9	446	6038
7-HST	1-Apr-2015	6.7	58	4.3	5.78	85	109	11.9	-24.6	-29.0	435	5587
8-HST	21-Apr-2015	7.0	64	6.5	5.66	81	51	10.3	-24.8	-29.0	453	6504
9-HST	27-May-2015	7.6	67	5.8	5.88	94	82	6.7	-24.3	-28.5	415	5380
10-HST	17-Jun-2015	6.4	61	8.5	6.40	81	86	15.0	-24.8	-29.1	380	3655
11-HST	15-Jul-2015	5.5	54	9.8	6.03	92	111	8.0	-24.9	-28.6	509	6874
12-HST	19-Aug-2015	5.9	58	11.3	5.80	134	136	9.0	-24.4	-29.3	495	7860
13-HST	25-Sep-2015	6.4	65	10.1	5.55	83	101	9.0	-24.0	-28.1	436	7246
14-HST	22-Oct-2015	6.4	59	7.9	5.97	86	141	11.1	-24.4	-25.6	391	5174
15-HST	26-Nov-2015	5.0	45	5.4	5.91	87	117	10.1	-27.0		349	4408
16-HST	18-Dec-2015	6.1	54	6.4	5.95	83	140	9.0	-23.6		481	6147
17-HST	22-Jan-2016	7.0	60	4.9	5.92	84	102	12.0	-24.0		420	5197
18-HST	18-Feb-2016	8.2	72	5.9	5.80	86	178	8.0	-24.3	-29.8	424	5698

19-HST	31-Mar-2016	7.8	67	4.9	6.10	81	116	8.0	-25.4		410	4597
20-HST	27-Apr-2016	9.0	78	4.8	6.03	78	236	8.2	-25.0		378	4407
<u>Site DST</u>												
2-DST	30-Oct-2014								-24.2	-28.3	475	
3-DST	13-Dec-2014								-22.9	-28.3	322	
4-DST	21-Jan-2015	7.8	68	4.8	5.87	89	120		-22.8	-29.1	340	4288
5-DST	19-Feb-2015	8.2	67	3.1	5.85	82	179		-22.9	-29.5	447	5375
6-DST	18-Mar-2015	7.2	64	6.6	5.84	83	140	7.5	-22.6		322	4355
7-DST	1-Apr-2015	7.3	64	5.0	5.72	77	131	7.8	-22.1	-29.2	284	3810
8-DST	23-Apr-2015	7.0	71	10.4	5.71	76	83	8.0	-24.0	-29.1	435	6959
9-DST	27-May-2015	7.5	66	5.8	5.65	80	102	8.3	-23.4	-29.3	425	5979
10-DST	17-Jun-2015	7.5	69	7.2	6.38	82	80	12.2	-23.5	-28.5	428	4069
11-DST	15-Jul-2015	6.7	63	8.0	5.77	80	145	8.2	-23.9	-28.0	477	6931
12-DST	19-Aug-2015	6.4	65	10.8	6.13	79	145	6.5	-22.4	-28.7	391	5073
13-DST	25-Sep-2015	6.1	59	9.1	7.32	78	95	11.0	-23.6	-27.7	482	1079
14-DST	22-Oct-2015	7.3	67	7.7	5.71	81	139	8.9	-22.8	-27.6	392	5762
15-DST	26-Nov-2015	7.7	68	6.3	5.92	81	159	4.1	-23.2		343	4435
16-DST	18-Dec-2015	7.7	69	5.9	6.50	81	139	8.0	-22.8		401	3249
17-DST	22-Jan-2016	7.7	63	4.1	5.99	81	127	6.0	-22.9		399	4651
18-DST	18-Feb-2016	7.5	65	5.2	6.13	80	190	9.0	-23.1	-29.8	455	5047
19-DST	31-Mar-2016	7.1	62	5.6	6.37	78	145	7.1	-24.0		386	3561
20-DST	27-Apr-2016	8.0	70	4.9	6.19	76	203	7.5	-23.9		393	4145

Table S3: Sampling site information at the Uhlirska catchment. Total catchment area is 1.78 km².

Sample site ID	type	well depth /m	Altitude / masl	Latitude (°N)	Longitude (°E)	comment
UHL	stream water	-	777	50.824079	15.147292	weir at catchment outlet
HST	groundwater	2.7	797	50.832283	15.149773	well
DST	groundwater	3.7	803	50.832301	15.150270	well
P84	groundwater	5.2	803	50.832292	15.150270	well

Table S4: Model input file with annual mean POC as Delta13POC for data from September 2014 to April 2016.

<i>Input file</i>											
Temperatureriver	K600	Riverheight	ProportionSilicates	DICSiCa	pCO2	Delta13DIC	Delta13POC	ProportionAcid	ProportionRespRiver	d13CDIC*	
10.9	1	1	1	0.024	1419	-20.91	-29.5	0	0.1	-25.14	
7.7	1	1	1	0.178	2217	-21.62	-29.5	0	0.1	-25.34	
3.0	1	1	1	0.230	1523	-15.59	-29.5	0	0.1	-23.92	
1.9	1	1	1	0.180	1530	-20.02	-29.5	0	0.1	-24.60	
4.0	1	1	1	0.145	1290	-16.71	-29.5	0	0.1	-24.60	
4.3	1	1	1	0.140	2763	-16.46	-29.5	0	0.1	-24.60	
4.4	1	1	1	0.112	1647	-15.69	-29.5	0	0.1	-24.69	
2.5	1	1	1	0.092	1392	-14.68	-29.5	0	0.1	-24.76	
3.8	1	1	1	0.078	694	-21.22	-29.5	0	0.1	-24.80	
3.8	1	1	1	0.067	1216	-18.17	-29.5	0	0.1	-24.84	
3.2	1	1	1	0.064	920	-21.34	-29.5	0	0.1	-24.85	
3.5	1	1	1	0.060	1182	-20.15	-29.5	0	0.1	-24.76	
4.5	1	1	1	0.054	878	-21.47	-29.5	0	0.1	-24.64	
0.9	1	1	1	0.052	1838	-17.50	-29.5	0	0.1	-24.61	
2.0	1	1	1	0.055	785	-23.74	-29.5	0	0.1	-24.65	
4.0	1	1	1	0.086	683	-18.38	-29.5	0	0.1	-25.03	
2.0	1	1	1	0.092	552	-24.09	-29.5	0	0.1	-25.12	
2.0	1	1	1	0.113	1188	-22.08	-29.5	0	0.1	-25.37	
5.1	1	1	1	0.126	1514	-18.53	-29.5	0	0.1	-25.54	
3.0	1	1	1	0.126	1094	-18.51	-29.5	0	0.1	-25.54	
3.0	1	1	1	0.136	1345	-18.50	-29.5	0	0.1	-25.42	
6.5	1	1	1	0.145	1424	-21.26	-29.5	0	0.1	-25.31	
6.0	1	1	1	0.158	2134	-16.74	-29.5	0	0.1	-25.16	
7.0	1	1	1	0.164	2619	-16.71	-29.5	0	0.1	-25.10	
8.1	1	1	1	0.170	1562	-15.15	-29.5	0	0.1	-25.02	
8.9	1	1	1	0.183	2180	-15.88	-29.5	0	0.1	-25.07	
10.2	1	1	1	0.190	2407	-16.49	-29.5	0	0.1	-25.09	

11.3	1	1	1	0.214	2194	-15.90	-29.5	0	0.1	-25.18
9.2	1	1	1	0.218	2120	-15.01	-29.5	0	0.1	-25.20
10.0	1	1	1	0.207	2105	-18.45	-29.5	0	0.1	-25.40
10.0	1	1	1	0.200	2948	-15.70	-29.5	0	0.1	-25.51
11.2	1	1	1	0.197	2869	-15.33	-29.5	0	0.1	-25.57
11.9	1	1	1	0.196	1910	-15.16	-29.5	0	0.1	-25.59
12.0	1	1	1	0.161	2223	-16.16	-29.5	0	0.1	-25.38
11.4	1	1	1	0.125	1990	-15.34	-29.5	0	0.1	-25.16
12.2	1	1	1	0.105	2841	-15.59	-29.5	0	0.1	-25.05
13.8	1	1	1	0.078	2409	-14.56	-29.5	0	0.1	-24.88
13.0	1	1	1	0.054	1538	-22.36	-29.5	0	0.1	-24.74
12.0	1	1	1	0.058	3749	-17.71	-29.5	0	0.1	-24.76
11.5	1	1	1	0.096	1410	-15.15	-29.5	0	0.1	-24.71
11.0	1	1	1	0.126	1981	-13.46	-29.5	0	0.1	-24.69
9.7	1	1	1	0.168	1123	-16.56	-29.5	0	0.1	-24.67
11.5	1	1	1	0.222	2836	-14.39	-29.5	0	0.1	-24.63
8.9	1	1	1	0.270	732.7	-13.98	-29.5	0	0.1	-24.60
8.6	1	1	1	0.279	3485	-15.26	-29.5	0	0.1	-24.60
5.0	1	1	1	0.321	1621	-14.10	-29.5	0	0.1	-24.60
8.4	1	1	1	0.372	1355	-14.18	-29.5	0	0.1	-24.61
8.0	1	1	1	0.458	908.1	-16.87	-29.5	0	0.1	-24.61
8.0	1	1	1	0.466	1020	-21.74	-29.5	0	0.1	-24.61
6.4	1	1	1	0.500	2774	-20.31	-29.5	0	0.1	-24.61
8.0	1	1	1	0.390	1759	-14.07	-29.5	0	0.1	-25.03
6.5	1	1	1	0.290	1440	-25.16	-29.5	0	0.1	-25.41
6.0	1	1	1	0.240	611.8	-23.93	-29.5	0	0.1	-25.60
5.0	1	1	1	0.170	1118	-22.31	-29.5	0	0.1	-25.86
2.8	1	1	1	0.150	1558	-19.40	-29.5	0	0.1	-25.94
5.0	1	1	1	0.143	891.1	-22.80	-29.5	0	0.1	-25.56
5.6	1	1	1	0.134	1274	-19.71	-29.5	0	0.1	-25.04
5.8	1	1	1	0.123	1341	-18.81	-29.5	0	0.1	-24.43

4.0	1	1	1	0.120	1448	-18.42	-29.5	0	0.1	-24.28
5.2	1	1	1	0.126	1017	-19.14	-29.5	0	0.1	-24.31
5.1	1	1	1	0.136	1425	-17.78	-29.5	0	0.1	-24.34
3.3	1	1	1	0.139	1356	-17.64	-29.5	0	0.1	-24.36
2.0	1	1	1	0.149	1487	-16.46	-29.5	0	0.1	-24.39
3.0	1	1	1	0.156	816.8	-10.05	-29.5	0	0.1	-24.42
0.8	1	1	1	0.166	1438	-16.26	-29.5	0	0.1	-24.46
-0.1	1	1	1	0.170	1305	-16.71	-29.5	0	0.1	-24.48
1.8	1	1	1	0.145	794.9	-23.06	-29.5	0	0.1	-24.55
2.5	1	1	1	0.110	704.7	-23.03	-29.5	0	0.1	-24.66
3.0	1	1	1	0.076	928.3	-21.32	-29.5	0	0.1	-24.77
2.5	1	1	1	0.041	1484	-22.21	-29.5	0	0.1	-24.87
1.2	1	1	1	0.036	1087	-18.62	-29.5	0	0.1	-24.89
2.0	1	1	1	0.034	613	-24.14	-29.5	0	0.1	-25.04
2.5	1	1	1	0.032	868.7	-19.54	-29.5	0	0.1	-25.17
2.8	1	1	1	0.031	1193	-18.99	-29.5	0	0.1	-25.28
2.5	1	1	1	0.029	938.1	-16.77	-29.5	0	0.1	-25.45
3.0	1	1	1	0.026	1141	-17.49	-29.5	0	0.1	-25.63
2.8	1	1	1	0.024	682	-23.71	-29.5	0	0.1	-25.78
2.8	1	1	1	0.024	965.9	-22.29	-29.5	0	0.1	-25.80
3.6	1	1	1	0.034	450.5	-24.12	-29.5	0	0.1	-25.76
4.5	1	1	1	0.047	850.2	-22.62	-29.5	0	0.1	-25.72
3.5	1	1	1	0.052	671	-22.57	-29.5	0	0.1	-25.70
3.0	1	1	1	0.065	818.7	-22.58	-29.5	0	0.1	-25.66
4.3	1	1	1	0.078	1526	-19.50	-29.5	0	0.1	-25.62
2.9	1	1	1	0.096	648.1	-18.79	-29.5	0	0.1	-25.55
10.9	1	1	1	0.024	1717	-20.91	-29.5	0	0.1	-25.14
7.7	1	1	1	0.178	2683	-21.62	-29.5	0	0.1	-25.34
3.0	1	1	1	0.230	1843	-15.59	-29.5	0	0.1	-23.92
1.9	1	1	1	0.180	1852	-20.02	-29.5	0	0.1	-24.60
4.0	1	1	1	0.145	1561	-16.71	-29.5	0	0.1	-24.60

4.3	1	1	1	0.140	3343	-16.46	-29.5	0	0.1	-24.60
4.4	1	1	1	0.112	1993	-15.69	-29.5	0	0.1	-24.69
2.5	1	1	1	0.092	1684	-14.68	-29.5	0	0.1	-24.76
3.8	1	1	1	0.078	839.9	-21.22	-29.5	0	0.1	-24.80
3.8	1	1	1	0.067	1471	-18.17	-29.5	0	0.1	-24.84
3.2	1	1	1	0.064	1114	-21.34	-29.5	0	0.1	-24.85
3.5	1	1	1	0.060	1430	-20.15	-29.5	0	0.1	-24.76
4.5	1	1	1	0.054	1063	-21.47	-29.5	0	0.1	-24.64
0.9	1	1	1	0.052	2224	-17.50	-29.5	0	0.1	-24.61
2.0	1	1	1	0.055	949.3	-23.74	-29.5	0	0.1	-24.65
4.0	1	1	1	0.086	826.5	-18.38	-29.5	0	0.1	-25.03
2.0	1	1	1	0.092	667.4	-24.09	-29.5	0	0.1	-25.12
2.0	1	1	1	0.113	1437	-22.08	-29.5	0	0.1	-25.37
5.1	1	1	1	0.126	1832	-18.53	-29.5	0	0.1	-25.54
3.0	1	1	1	0.126	1324	-18.51	-29.5	0	0.1	-25.54
3.0	1	1	1	0.136	1628	-18.50	-29.5	0	0.1	-25.42
6.5	1	1	1	0.145	1723	-21.26	-29.5	0	0.1	-25.31
6.0	1	1	1	0.158	2582	-16.74	-29.5	0	0.1	-25.16
7.0	1	1	1	0.164	3168	-16.71	-29.5	0	0.1	-25.10
8.1	1	1	1	0.170	1890	-15.15	-29.5	0	0.1	-25.02
8.9	1	1	1	0.183	2638	-15.88	-29.5	0	0.1	-25.07
10.2	1	1	1	0.190	2912	-16.49	-29.5	0	0.1	-25.09
11.3	1	1	1	0.214	2654	-15.90	-29.5	0	0.1	-25.18
9.2	1	1	1	0.218	2566	-15.01	-29.5	0	0.1	-25.20
10.0	1	1	1	0.207	2547	-18.45	-29.5	0	0.1	-25.40
10.0	1	1	1	0.200	3567	-15.70	-29.5	0	0.1	-25.51
11.2	1	1	1	0.197	3471	-15.33	-29.5	0	0.1	-25.57
11.9	1	1	1	0.196	2311	-15.16	-29.5	0	0.1	-25.59
12.0	1	1	1	0.161	2690	-16.16	-29.5	0	0.1	-25.38
11.4	1	1	1	0.125	2407	-15.34	-29.5	0	0.1	-25.16
12.2	1	1	1	0.105	3438	-15.59	-29.5	0	0.1	-25.05

13.8	1	1	1	0.078	2915	-14.56	-29.5	0	0.1	-24.88
13.0	1	1	1	0.054	1861	-22.36	-29.5	0	0.1	-24.74
12.0	1	1	1	0.058	4537	-17.71	-29.5	0	0.1	-24.76
11.5	1	1	1	0.096	1706	-15.15	-29.5	0	0.1	-24.71
11.0	1	1	1	0.126	2397	-13.46	-29.5	0	0.1	-24.69
9.7	1	1	1	0.168	1359	-16.56	-29.5	0	0.1	-24.67
11.5	1	1	1	0.222	3432	-14.39	-29.5	0	0.1	-24.63
8.9	1	1	1	0.270	886.5	-13.98	-29.5	0	0.1	-24.60
8.6	1	1	1	0.279	4217	-15.26	-29.5	0	0.1	-24.60
5.0	1	1	1	0.321	1961	-14.10	-29.5	0	0.1	-24.60
8.4	1	1	1	0.372	1640	-14.18	-29.5	0	0.1	-24.61
8.0	1	1	1	0.458	1099	-16.87	-29.5	0	0.1	-24.61
8.0	1	1	1	0.466	1234	-21.74	-29.5	0	0.1	-24.61
6.4	1	1	1	0.500	3357	-20.31	-29.5	0	0.1	-24.61
8.0	1	1	1	0.390	2128	-14.07	-29.5	0	0.1	-25.03
6.5	1	1	1	0.290	1743	-25.16	-29.5	0	0.1	-25.41
6.0	1	1	1	0.240	740.2	-23.93	-29.5	0	0.1	-25.60
5.0	1	1	1	0.170	1353	-22.31	-29.5	0	0.1	-25.86
2.8	1	1	1	0.150	1885	-19.40	-29.5	0	0.1	-25.94
5.0	1	1	1	0.143	1078	-22.80	-29.5	0	0.1	-25.56
5.6	1	1	1	0.134	1541	-19.71	-29.5	0	0.1	-25.04
5.8	1	1	1	0.123	1623	-18.81	-29.5	0	0.1	-24.43
4.0	1	1	1	0.120	1752	-18.42	-29.5	0	0.1	-24.28
5.2	1	1	1	0.126	1231	-19.14	-29.5	0	0.1	-24.31
5.1	1	1	1	0.136	1724	-17.78	-29.5	0	0.1	-24.34
3.3	1	1	1	0.139	1641	-17.64	-29.5	0	0.1	-24.36
2.0	1	1	1	0.149	1800	-16.46	-29.5	0	0.1	-24.39
3.0	1	1	1	0.156	988.4	-10.05	-29.5	0	0.1	-24.42
0.8	1	1	1	0.166	1740	-16.26	-29.5	0	0.1	-24.46
-0.1	1	1	1	0.170	1580	-16.71	-29.5	0	0.1	-24.48
1.8	1	1	1	0.145	961.8	-23.06	-29.5	0	0.1	-24.55

2.5	1	1	1	0.110	852.7	-23.03	-29.5	0	0.1	-24.66
3.0	1	1	1	0.076	1123	-21.32	-29.5	0	0.1	-24.77
2.5	1	1	1	0.041	1796	-22.21	-29.5	0	0.1	-24.87
1.2	1	1	1	0.036	1315	-18.62	-29.5	0	0.1	-24.89
2.0	1	1	1	0.034	741.7	-24.14	-29.5	0	0.1	-25.04
2.5	1	1	1	0.032	1051	-19.54	-29.5	0	0.1	-25.17
2.8	1	1	1	0.031	1444	-18.99	-29.5	0	0.1	-25.28
2.5	1	1	1	0.029	1135	-16.77	-29.5	0	0.1	-25.45
3.0	1	1	1	0.026	1380	-17.49	-29.5	0	0.1	-25.63
2.8	1	1	1	0.024	825.2	-23.71	-29.5	0	0.1	-25.78
2.8	1	1	1	0.024	1169	-22.29	-29.5	0	0.1	-25.80
3.6	1	1	1	0.034	545.1	-24.12	-29.5	0	0.1	-25.76
4.5	1	1	1	0.047	1029	-22.62	-29.5	0	0.1	-25.72
3.5	1	1	1	0.052	812	-22.57	-29.5	0	0.1	-25.70
3.0	1	1	1	0.065	990.6	-22.58	-29.5	0	0.1	-25.66
4.3	1	1	1	0.078	1846	-19.50	-29.5	0	0.1	-25.62
2.9	1	1	1	0.096	784.2	-18.79	-29.5	0	0.1	-25.55
10.9	1	1	1	0.024	1121	-20.91	-29.5	0	0.1	-25.14
7.7	1	1	1	0.178	1751	-21.62	-29.5	0	0.1	-25.34
3.0	1	1	1	0.230	1203	-15.59	-29.5	0	0.1	-23.92
1.9	1	1	1	0.180	1209	-20.02	-29.5	0	0.1	-24.60
4.0	1	1	1	0.145	1019	-16.71	-29.5	0	0.1	-24.60
4.3	1	1	1	0.140	2182	-16.46	-29.5	0	0.1	-24.60
4.4	1	1	1	0.112	1301	-15.69	-29.5	0	0.1	-24.69
2.5	1	1	1	0.092	1099	-14.68	-29.5	0	0.1	-24.76
3.8	1	1	1	0.078	548.4	-21.22	-29.5	0	0.1	-24.80
3.8	1	1	1	0.067	960.4	-18.17	-29.5	0	0.1	-24.84
3.2	1	1	1	0.064	727	-21.34	-29.5	0	0.1	-24.85
3.5	1	1	1	0.060	933.8	-20.15	-29.5	0	0.1	-24.76
4.5	1	1	1	0.054	693.8	-21.47	-29.5	0	0.1	-24.64
0.9	1	1	1	0.052	1452	-17.50	-29.5	0	0.1	-24.61

2.0	1	1	1	0.055	619.8	-23.74	-29.5	0	0.1	-24.65
4.0	1	1	1	0.086	539.6	-18.38	-29.5	0	0.1	-25.03
2.0	1	1	1	0.092	435.7	-24.09	-29.5	0	0.1	-25.12
2.0	1	1	1	0.113	938.4	-22.08	-29.5	0	0.1	-25.37
5.1	1	1	1	0.126	1196	-18.53	-29.5	0	0.1	-25.54
3.0	1	1	1	0.126	864.1	-18.51	-29.5	0	0.1	-25.54
3.0	1	1	1	0.136	1063	-18.50	-29.5	0	0.1	-25.42
6.5	1	1	1	0.145	1125	-21.26	-29.5	0	0.1	-25.31
6.0	1	1	1	0.158	1686	-16.74	-29.5	0	0.1	-25.16
7.0	1	1	1	0.164	2069	-16.71	-29.5	0	0.1	-25.10
8.1	1	1	1	0.170	1234	-15.15	-29.5	0	0.1	-25.02
8.9	1	1	1	0.183	1723	-15.88	-29.5	0	0.1	-25.07
10.2	1	1	1	0.190	1901	-16.49	-29.5	0	0.1	-25.09
11.3	1	1	1	0.214	1733	-15.90	-29.5	0	0.1	-25.18
9.2	1	1	1	0.218	1675	-15.01	-29.5	0	0.1	-25.20
10.0	1	1	1	0.207	1663	-18.45	-29.5	0	0.1	-25.40
10.0	1	1	1	0.200	2329	-15.70	-29.5	0	0.1	-25.51
11.2	1	1	1	0.197	2266	-15.33	-29.5	0	0.1	-25.57
11.9	1	1	1	0.196	1509	-15.16	-29.5	0	0.1	-25.59
12.0	1	1	1	0.161	1756	-16.16	-29.5	0	0.1	-25.38
11.4	1	1	1	0.125	1572	-15.34	-29.5	0	0.1	-25.16
12.2	1	1	1	0.105	2244	-15.59	-29.5	0	0.1	-25.05
13.8	1	1	1	0.078	1903	-14.56	-29.5	0	0.1	-24.88
13.0	1	1	1	0.054	1215	-22.36	-29.5	0	0.1	-24.74
12.0	1	1	1	0.058	2962	-17.71	-29.5	0	0.1	-24.76
11.5	1	1	1	0.096	1114	-15.15	-29.5	0	0.1	-24.71
11.0	1	1	1	0.126	1565	-13.46	-29.5	0	0.1	-24.69
9.7	1	1	1	0.168	887.3	-16.56	-29.5	0	0.1	-24.67
11.5	1	1	1	0.222	2240	-14.39	-29.5	0	0.1	-24.63
8.9	1	1	1	0.270	578.8	-13.98	-29.5	0	0.1	-24.60
8.6	1	1	1	0.279	2753	-15.26	-29.5	0	0.1	-24.60

5.0	1	1	1	0.321	1280	-14.10	-29.5	0	0.1	-24.60
8.4	1	1	1	0.372	1071	-14.18	-29.5	0	0.1	-24.61
8.0	1	1	1	0.458	717.4	-16.87	-29.5	0	0.1	-24.61
8.0	1	1	1	0.466	805.6	-21.74	-29.5	0	0.1	-24.61
6.4	1	1	1	0.500	2192	-20.31	-29.5	0	0.1	-24.61
8.0	1	1	1	0.390	1389	-14.07	-29.5	0	0.1	-25.03
6.5	1	1	1	0.290	1138	-25.16	-29.5	0	0.1	-25.41
6.0	1	1	1	0.240	483.3	-23.93	-29.5	0	0.1	-25.60
5.0	1	1	1	0.170	883.3	-22.31	-29.5	0	0.1	-25.86
2.8	1	1	1	0.150	1231	-19.40	-29.5	0	0.1	-25.94
5.0	1	1	1	0.143	704	-22.80	-29.5	0	0.1	-25.56
5.6	1	1	1	0.134	1006	-19.71	-29.5	0	0.1	-25.04
5.8	1	1	1	0.123	1060	-18.81	-29.5	0	0.1	-24.43
4.0	1	1	1	0.120	1144	-18.42	-29.5	0	0.1	-24.28
5.2	1	1	1	0.126	803.7	-19.14	-29.5	0	0.1	-24.31
5.1	1	1	1	0.136	1126	-17.78	-29.5	0	0.1	-24.34
3.3	1	1	1	0.139	1072	-17.64	-29.5	0	0.1	-24.36
2.0	1	1	1	0.149	1175	-16.46	-29.5	0	0.1	-24.39
3.0	1	1	1	0.156	645.3	-10.05	-29.5	0	0.1	-24.42
0.8	1	1	1	0.166	1136	-16.26	-29.5	0	0.1	-24.46
-0.1	1	1	1	0.170	1031	-16.71	-29.5	0	0.1	-24.48
1.8	1	1	1	0.145	628	-23.06	-29.5	0	0.1	-24.55
2.5	1	1	1	0.110	556.7	-23.03	-29.5	0	0.1	-24.66
3.0	1	1	1	0.076	733.4	-21.32	-29.5	0	0.1	-24.77
2.5	1	1	1	0.041	1173	-22.21	-29.5	0	0.1	-24.87
1.2	1	1	1	0.036	858.5	-18.62	-29.5	0	0.1	-24.89
2.0	1	1	1	0.034	484.2	-24.14	-29.5	0	0.1	-25.04
2.5	1	1	1	0.032	686.3	-19.54	-29.5	0	0.1	-25.17
2.8	1	1	1	0.031	942.7	-18.99	-29.5	0	0.1	-25.28
2.5	1	1	1	0.029	741.1	-16.77	-29.5	0	0.1	-25.45
3.0	1	1	1	0.026	901.1	-17.49	-29.5	0	0.1	-25.63

2.8	1	1	1	0.024	538.8	-23.71	-29.5	0	0.1	-25.78
2.8	1	1	1	0.024	763.1	-22.29	-29.5	0	0.1	-25.80
3.6	1	1	1	0.034	355.9	-24.12	-29.5	0	0.1	-25.76
4.5	1	1	1	0.047	671.7	-22.62	-29.5	0	0.1	-25.72
3.5	1	1	1	0.052	530.1	-22.57	-29.5	0	0.1	-25.70
3.0	1	1	1	0.065	646.7	-22.58	-29.5	0	0.1	-25.66
4.3	1	1	1	0.078	1205	-19.50	-29.5	0	0.1	-25.62
2.9	1	1	1	0.096	512	-18.79	-29.5	0	0.1	-25.55

* Groundwater input as mean DST, HST, and P84 including fractionation (O'Leary 1984) for modified modelling.

Table S5: Modelled pCO₂init. versus modelled CO₂ loss (per catchment area) for results computed with R = 10 and 19 % and with groundwater contribution.

date dd-mmm-yyyy	pCO ₂ init.*	CO ₂ loss*	pCO ₂ init.*	CO ₂ loss*	pCO ₂ init.#	CO ₂ loss#
	10% /ppmV	10% /mg C m ⁻² d ⁻¹	19% /ppmV	19% /mg C m ⁻² d ⁻¹	Groundwater /ppmV	Groundwater /mg C m ⁻² d ⁻¹
24-Sep-2014	4248	4.36	4884	5.34	2799	2.13
29-Oct-2014	5376	2.30	5900	2.68	4049	1.33
12-Dec-2014	15389	15.07	18581	18.53	6270	5.16
20-Jan-2015	3713	2.34	3985	2.64	2651	1.20
16-Feb-2015	5992	3.18	6674	3.65	3747	1.66
18-Feb-2015	(5563) [†]	(2.73)	(6189)	(3.13)	(6141)	(3.00)
28-Feb-2015	(3416)	(1.40)	(3764)	(1.60)	18109	9.39
7-Mar-2015	(1914)	(0.68)	(2066)	(0.78)	26439	16.48
12-Mar-2015	840	0.23	853	0.25	783	0.14
16-Mar-2015	4202	4.23	4657	4.88	2833	2.29
17-Mar-2015	1295	1.89	1335	2.08	1137	1.09
22-Mar-2015	2454	1.73	2611	1.94	1879	0.95
29-Mar-2015	1198	1.30	1231	1.44	1049	0.70
31-Mar-2015	(991)	(0.95)	(1012)	(1.07)	(892)	(0.41)
1-Apr-2015	887	0.47	902	0.54	813	0.13
10-Apr-2015	955	1.18	973	1.26	884	0.87
12-Apr-2015	574	0.13	578	0.15	560	0.05
18-Apr-2015	1757	1.13	1828	1.28	1547	0.72
22-Apr-2015	5743	4.67	6400	5.39	4346	3.12
22-Apr-2015	2465	1.64	2602	1.80	2121	1.23
30-Apr-2015	4066	4.41	4412	4.97	3204	3.01
7-May-2015	2637	1.48	2790	1.67	2195	0.94
17-May-2015	(24822)	(12.91)	(46164)	(24.71)	25322	13.81
21-May-2015	(33696)	(17.39)	(63514)	(33.5)	(20178)	(10.43)
26-May-2015	44788	21.66	85201	41.91	13748	6.11

1-Jun-2015	(39624)	(17.37)	(73729)	(33.01)	50967	21.78
4-Jun-2015	(37042)	(14.76)	(67993)	(27.74)	44357	16.38
15-Jun-2015	(27575)	(10.22)	(46961)	(18.02)	40046	13.71
17-Jun-2015	(25854)	(9.42)	(43137)	(16.31)	131046	49.74
1-Jul-2015	13805	4.51	16370	5.50	8818	2.59
9-Jul-2015	(11996)	(3.74)	(14174)	(4.56)	(47478)	(16.09)
13-Jul-2015	(11092)	(3.62)	(13076)	(4.41)	(66808)	(24.22)
14-Jul-2015	(10866)	(3.61)	(12802)	(4.40)	71641	26.60
23-Jul-2015	(8831)	(2.28)	(10332)	(2.77)	113082	34.13
1-Aug-2015	(6796)	(1.54)	(7861)	(1.87)	(76069)	(21.48)
6-Aug-2015	(5666)	(1.17)	(6489)	(1.41)	(55506)	(15.08)
13-Aug-2015	(4084)	(0.69)	(4568)	(0.82)	(26718)	(6.78)
19-Aug-2015	2727	1.58	2921	1.84	2043	0.67
18-Aug-2015	(2953)	(1.29)	(3195)	(1.52)	(6155)	(4.28)
26-Aug-2015	(3221)	(0.54)	(3465)	(0.61)	12464	3.19
31-Aug-2015	(3573)	(0.64)	(3853)	(0.72)	(8468)	(1.94)
7-Sep-2015	4067	2.63	4397	2.93	2873	1.57
16-Sep-2015	(2844)	(0.60)	(3037)	(0.66)	(2119)	(0.38)
24-Sep-2015	1757	0.36	1828	0.39	1449	0.25
25-Sep-2015	(10988)	(3.64)	(17265)	(5.93)	(3934)	(1.08)
30-Sep-2015	57145	18.66	94454	31.20	16358	4.95
6-Oct-2015	19080	5.27	22455	6.28	9692	2.48
16-Oct-2015	2101	1.11	2205	1.21	1669	0.71
17-Oct-2015	1439	0.52	1487	0.57	1230	0.26
21-Oct-2015	11317	11.27	12661	13.05	6653	5.12
1-Nov-2015	106773	34.19	(6924)	(1.67)	28514	8.71
11-Nov-2015	1648	0.22	1709	0.29	1471	0.03
16-Nov-2015	648	0.68	653	0.78	633	0.39
23-Nov-2015	1554	0.42	1608	0.47	1447	0.31
25-Nov-2015	4584	2.16	5001	2.46	3912	1.68
30-Nov-2015	1086	0.85	1110	0.96	1021	0.57

7-Dec-2015	2786	1.48	2960	1.65	2220	0.93
15-Dec-2015	3831	2.12	4143	2.38	2609	1.08
17-Dec-2015	5297	4.16	5878	4.79	3185	1.88
21-Dec-2015	1914	1.02	1998	1.12	1515	0.57
28-Dec-2015	5949	4.41	6631	5.08	3537	2.06
30-Dec-2015	5269	3.66	5819	4.17	3262	1.78
6-Jan-2016	12031	7.41	14649	9.25	5520	2.83
11-Jan-2016	11725	10.56	14126	12.88	5568	4.60
18-Jan-2016	10398	6.52	12276	7.88	5255	2.78
21-Jan-2016	5836	3.25	6469	3.70	3625	1.66
26-Jan-2016	920	0.91	936	1.03	842	0.34
2-Feb-2016	792	0.70	803	0.79	741	0.29
9-Feb-2016	1305	1.16	1344	1.28	1140	0.66
16-Feb-2016	2857	1.75	3100	2.05	2084	0.76
17-Feb-2016	3447	2.80	3829	3.25	2347	1.50
24-Feb-2016	651	0.11	658	0.13	626	0.04
1-Mar-2016	1518	0.86	1581	0.95	1309	0.59
6-Mar-2016	4766	4.44	5571	5.44	3109	2.38
14-Mar-2016	4185	3.04	4807	3.62	2952	1.89
22-Mar-2016	19446	19.83	53831	57.07	6995	6.34
29-Mar-2016	755	0.40	766	0.46	730	0.26
30-Mar-2016	1369	1.41	1421	1.59	1259	1.03
3-Apr-2016	458	0.03	459	0.03	455	0.02
8-Apr-2016	1053	0.57	1078	0.64	996	0.41
10-Apr-2016	763	0.51	773	0.57	738	0.37
15-Apr-2016	994	0.51	1015	0.57	942	0.36
20-Apr-2016	5247	4.49	5921	5.30	3958	2.93
27-Apr-2016	844	0.28	857	0.30	809	0.23

*Calculation with annual mean d13C-POC.

#Calculation with mean groundwater d13C-DIC as d13C-CO2init +1‰ fractionation (O'Oleary, 1984).

†(*italic*): Convergence criteria not fulfilled / interpolated data

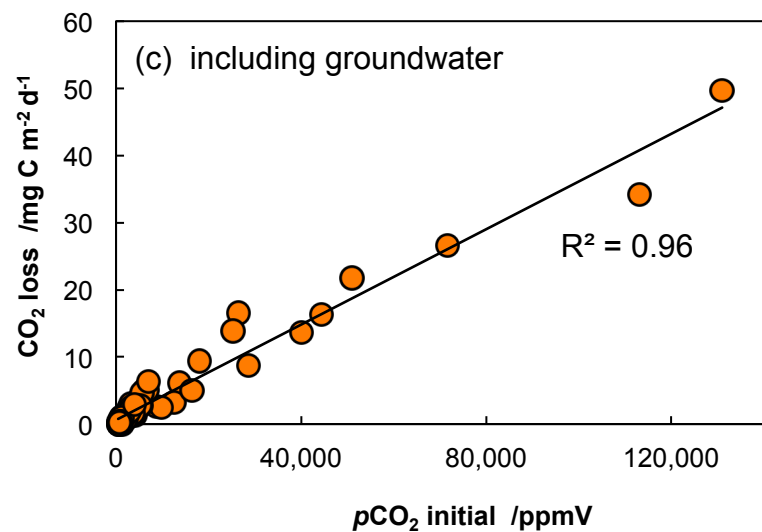
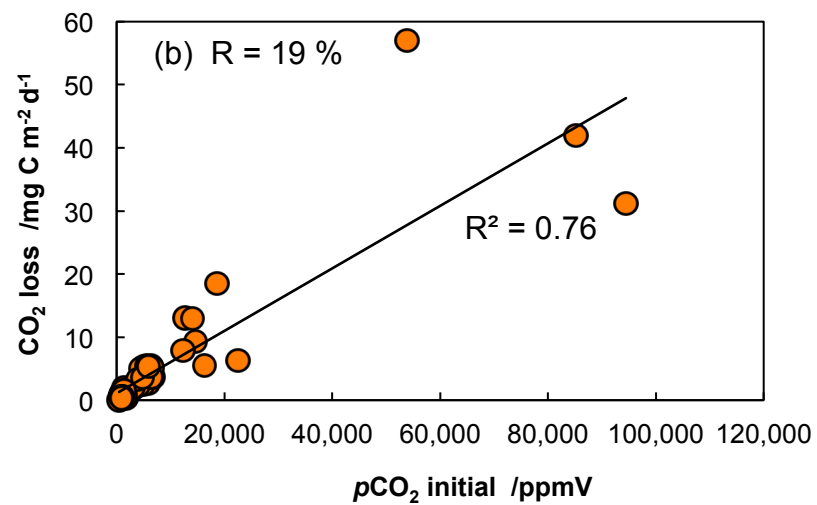
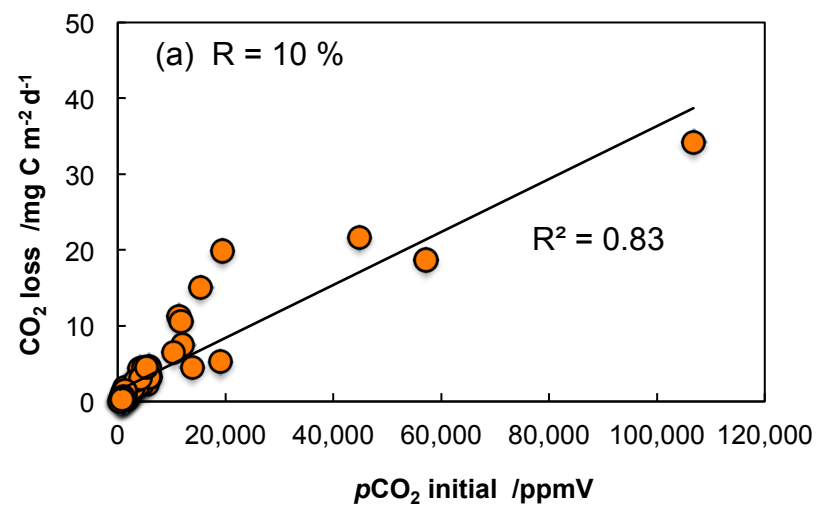


Figure S1
 Modelled CO₂ loss per catchment area over modelled pCO₂ initial for results computed with (a) R = 10 %, (b) R = 19 %, and (c) including groundwater.