Supplemental Material for *Dynamic intermediate soil carbon cycling pools may drive future responsiveness to environmental change*

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This supplementary material contains the main results from the optimization of a three pool model using two different sources of data: time-series of CO_2 fluxes from incubations, and density fractions measured after land use conversion.

Optimization of the parameters was obtained using the SoilR and FME package in R. The optimization method varied for different datasets depending on the complexity of the optimization problem. The most common methods used here were the Nelder-Mead method and a pseudo-random-search method. After this initial optimization a second optimization was performed using Bayesian methods to obtain the uncertainty of the obtained parameter values.

For each optimization, we provide here the *best* parameter value from the first optimization as well as the *mean* and standard deviation *sd* from the Bayesian optimization.

Units for the decomposition rates are $days^{-1}$, while other parameters are unitless proportions that range between 0 and 1.

Incubation experiments

Bare treatment

Results of the optimization of the soil incubation data for the bare treatment are summarized in the table below

Year	Temperature	Parameter	k1	k2	k3	gamma1	gamma2
2010	21	best	0.3346711	0.0375202	1.70e-05	0.0010193	0.0077894
2010	21	mean	0.4492046	0.0457797	2.77e-05	0.0010637	0.0065595
2010	21	sd	0.2075540	0.0111931	9.20e-06	0.0005361	0.0013664
2010	26	best	0.0072104	0.0221406	2.02e-05	0.0016207	0.0064512
2010	26	mean	0.0084518	0.0231511	2.45e-05	0.0010830	0.0061696
2010	26	sd	0.0050354	0.0035456	5.90e-06	0.0006100	0.0010639
2011	21	best	0.3891537	0.0181287	1.35e-05	0.0010207	0.0069917
2011	21	mean	0.5067455	0.0278821	1.64e-05	0.0007648	0.0061440
2011	21	sd	0.1294170	0.0080082	8.70e-06	0.0001952	0.0014110
2011	26	best	0.4258636	0.0198604	1.00e-07	0.0010479	0.0111690
2011	26	mean	0.5799988	0.0219686	3.00e-07	0.0009092	0.0112585
2011	26	sd	0.2355954	0.0059503	1.00e-07	0.0003631	0.0016059
2012	21	best	0.1755709	0.0000063	3.94e-05	0.0012129	0.0113689
2012	21	mean	0.1754341	0.0000072	4.00e-05	0.0012448	0.0339610
2012	21	sd	0.0350623	0.0000053	4.60e-06	0.0002247	0.0090427
2012	26	best	0.0072104	0.0221406	2.02e-05	0.0016207	0.0064512
2012	26	mean	0.0084518	0.0231511	2.45e-05	0.0010830	0.0061696
2012	26	sd	0.0050354	0.0035456	5.90e-06	0.0006100	0.0010639

Planted treatment

Results of the optimization of the soil incubation data for the planted treatment are summarized in the table below

Year	Temperature	Parameter	k1	k2	k3	gamma1	gamma2

Year	Temperature	Parameter	k1	k2	k3	gamma1	gamma2
2010	21	best	0.2905071	0.0381767	2.63e-05	0.0008904	0.0053405
2010	21	mean	0.6053222	0.0499559	2.95e-05	0.0004307	0.0053213
2010	21	sd	0.1786242	0.0086827	4.20e-06	0.0002279	0.0005147
2010	26	best	0.4266786	0.0195196	2.00e-07	0.0010353	0.0171394
2010	26	mean	0.2406651	0.0162566	2.00e-07	0.0020175	0.0172479
2010	26	sd	0.1052774	0.0035704	1.00e-07	0.0007419	0.0013141
2011	21	best	0.0117278	0.0521569	0.00e+00	0.0014096	0.0080270
2011	21	mean	0.0134527	0.0918721	0.00e+00	0.0052610	0.0050043
2011	21	sd	0.0030384	0.0264728	0.00e+00	0.0018507	0.0015364
2011	26	best	0.6214562	0.0223096	0.00e+00	0.0010013	0.0148507
2011	26	mean	0.6208181	0.0224218	0.00e+00	0.0010336	0.0148482
2011	26	sd	0.1863969	0.0021673	0.00e+00	0.0002206	0.0006236
2012	21	best	0.3945262	0.0242010	1.97e-05	0.0008560	0.0096934
2012	21	mean	0.5043276	0.0254798	1.75e-05	0.0007158	0.0101319
2012	21	sd	0.1304547	0.0047257	1.01e-05	0.0001837	0.0015443
2012	26	best	0.4266786	0.0195196	2.00e-07	0.0010353	0.0171394
2012	26	mean	0.2406651	0.0162566	2.00e-07	0.0020175	0.0172479
2012	26	sd	0.1052774	0.0035704	1.00e-07	0.0007419	0.0013141

The proportional increase in decomposition rates caused by warming, i.e. the ratios $k_{T=26}/k_{T=21}$ are

Year	k1	k2	k3
2010	1.8697355	0.8114545	2.1161845
2011	1.0943328	1.0955236	0.0080893
2012	0.0410682	3534.3217327	0.5129078

Density fractions

Results of the optimization of the density fractions for the bare and planted treatments is summarized in the tables below

Bare treatment

Parameter	k1	k2	k3	alpha21	alpha12	alpha32	alpha23
best	0.2993515	0.3058314	0.0576284	0.0047331	0.0083660	0.5012347	0.0364322
mean	0.4148573	0.4323157	0.0780966	0.0051315	0.0157096	0.6266762	0.0315585
sd	0.1443087	0.1886016	0.0331011	0.0039404	0.0072214	0.3012679	0.0244486

Planted treatment

Parameter	k1	k2	k3	alpha21	alpha32	alpha31
best	0.2481443	0.0887812	0.0001238	0.4848304	0.8899123	0.9850180
mean	0.3104005	0.1015744	0.0005441	0.5099009	0.5010660	0.5638171
sd	0.1946637	0.0619154	0.0001736	0.2900641	0.2783551	0.2855737

Table 1

Here's an automatically generated version of Table 1

Sample	Temperature	k1	sd.k1	k2	sd.k2	k3	sd.k3	gamma1	sd.gamma1	gamma2	sd.gamma2	gamma3	sd.gamma3
Initial soil 2010	21	0.335	0.208	0.03752	0.01119	1.70e-05	9.20e-06	0.0010	5e-04	0.008	0.001	0.991	0.008
Initial soil 2010	26	0.626	0.216	0.03045	0.00559	3.60e-05	5.20e-06	0.0010	4e-04	0.011	0.001	0.988	0.01
Unplanted 2011	21	0.389	0.129	0.01813	0.00801	1.35e-05	8.70e-06	0.0010	2e-04	0.007	0.001	0.992	0.007
Unplanted 2012	21	0.176	0.035	0.00001	0.00001	3.94e-05	4.60e-06	0.0012	2e-04	0.011	0.009	0.987	0.01
Planted 2012	21	0.395	0.130	0.02420	0.00473	1.97e-05	1.01e-05	0.0009	2e-04	0.010	0.002	0.989	0.010