Supplementary material to: "Modeling the vertical soil organic matter profile using Bayesian parameter estimation"

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List of Figures

List of Tables

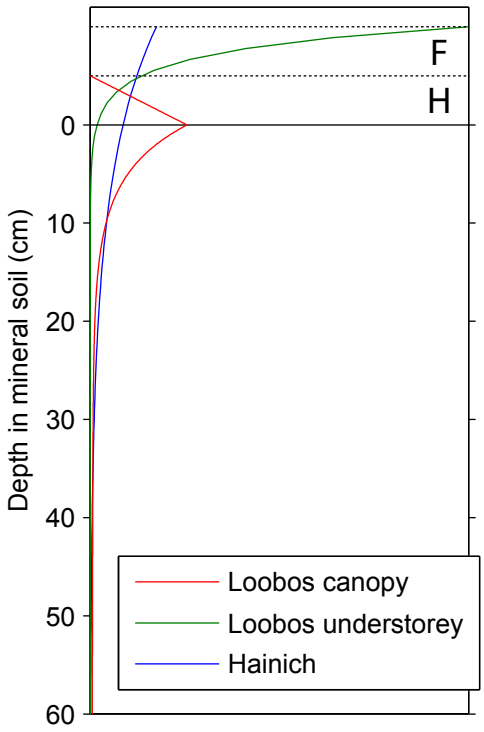

Figure 1: Vertical distribution of the root litter input for Loobos and Hainich used in the simulations. For Loobos different distribution functions were used for the canopy and understorey. The canopy distribution function consists of two parts: a linearly increasing function from zero to 1.0384 from the top to the bottom of H horizon for the organic layer; and a two-term exponential function for the mineral soil: $f(z) = \exp(-20.00\,z) + 0.0384\exp(-0.886\,z)$ (with z the depth in the mineral soil in m). For the understorey at Loobos, and all root input at Hainich, a single-term exponential function starting at the top of the F horizon was used ($f(z) = \exp(-40\,z)$ for Loobos; $f(z) = \exp(-7\,z)$ for Hainich). All curves are normalized so that the integral equals 1.

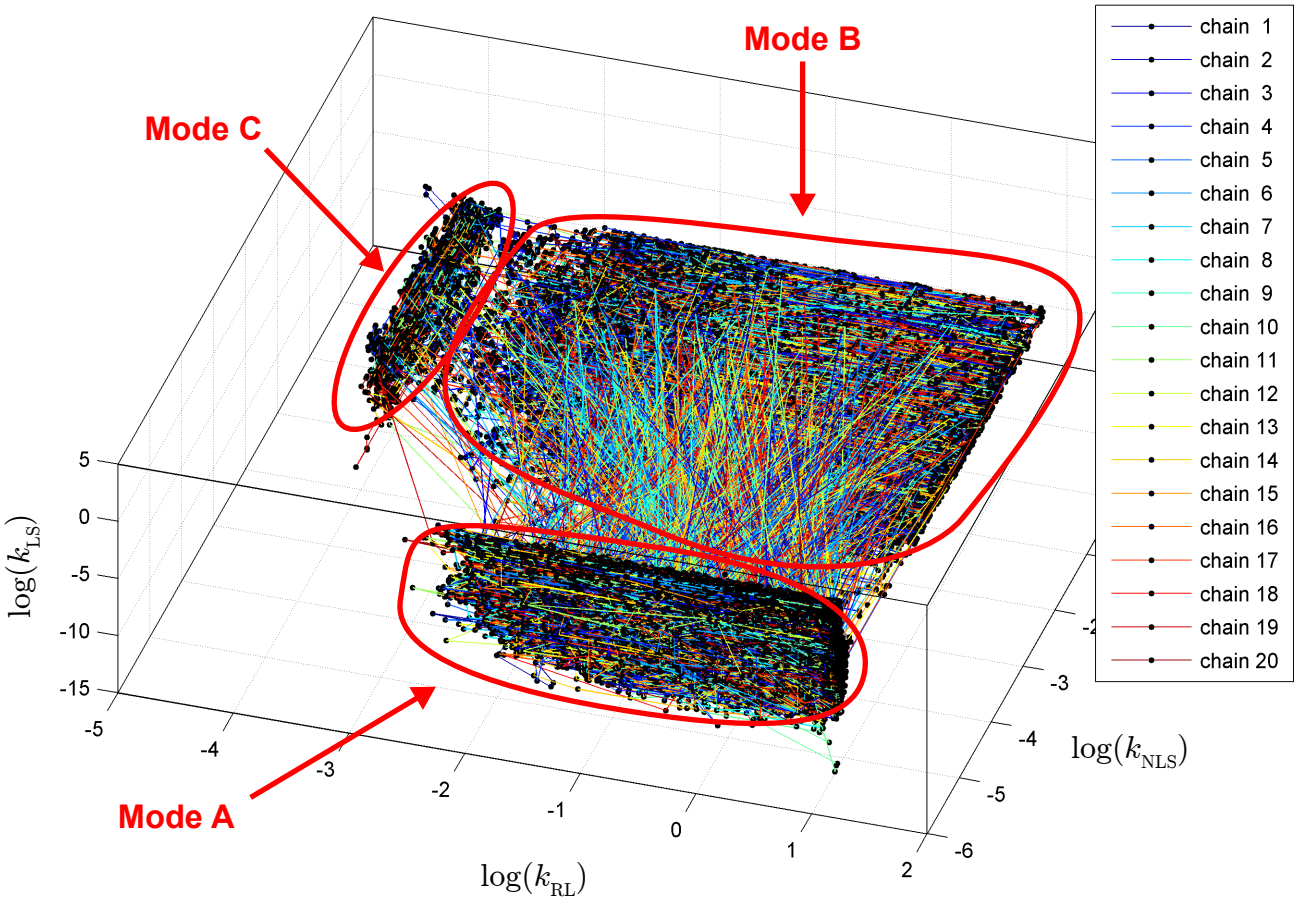

Figure 2: Trace plot of 20 chains sampling the three modes for Hainich for calibration setup 3. The sample was obtained in a supplementary run with the DREAM(ZS) algorithm, estimating only the parameters that differ significantly between the modes: k_{RL}, k_{NLS}, k_{LS} and v (not shown). All other parameters were fixed at the average over the three modes. The variance of the distribution was artificially inflated by a factor 5. The chains were started widely dispersed in the parameter space using Latin hypercube sampling, and were run for 200,000 iterations. The algorithm converged for all parameters (Gelman-Rubin index ≤ 1.01). The many lines between the modes indicate the chains jumping back and forth between them.

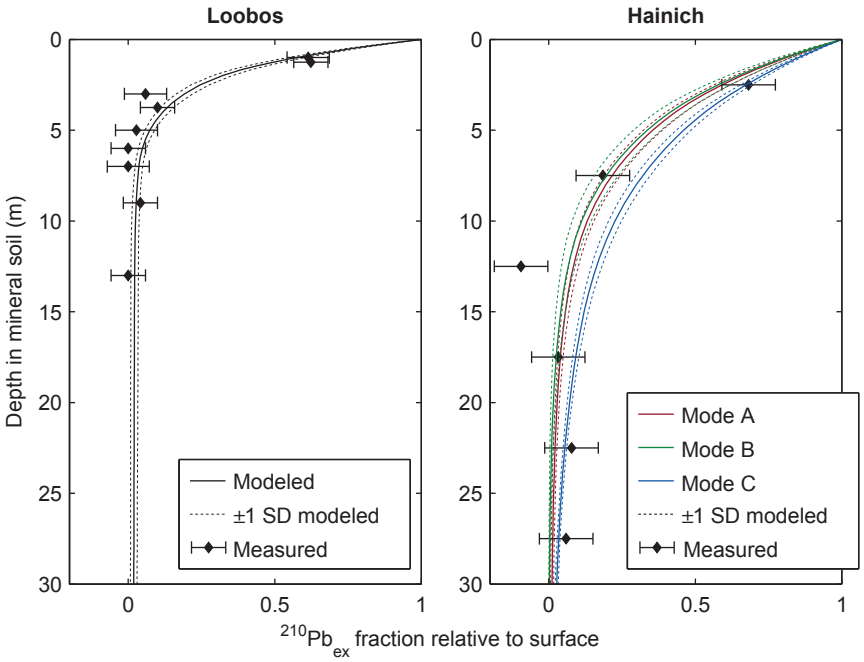

Figure 3: Measured $^{210}Pb_{ex}$fractions relative to surface and corresponding model results for both sites, calibration setup 3. Model results are averages and standard deviations over the Monte Carlo ensemble. Note that the observed $^{210}Pb_{ex}$profile was not measured at Loobos but at an equivalent site.

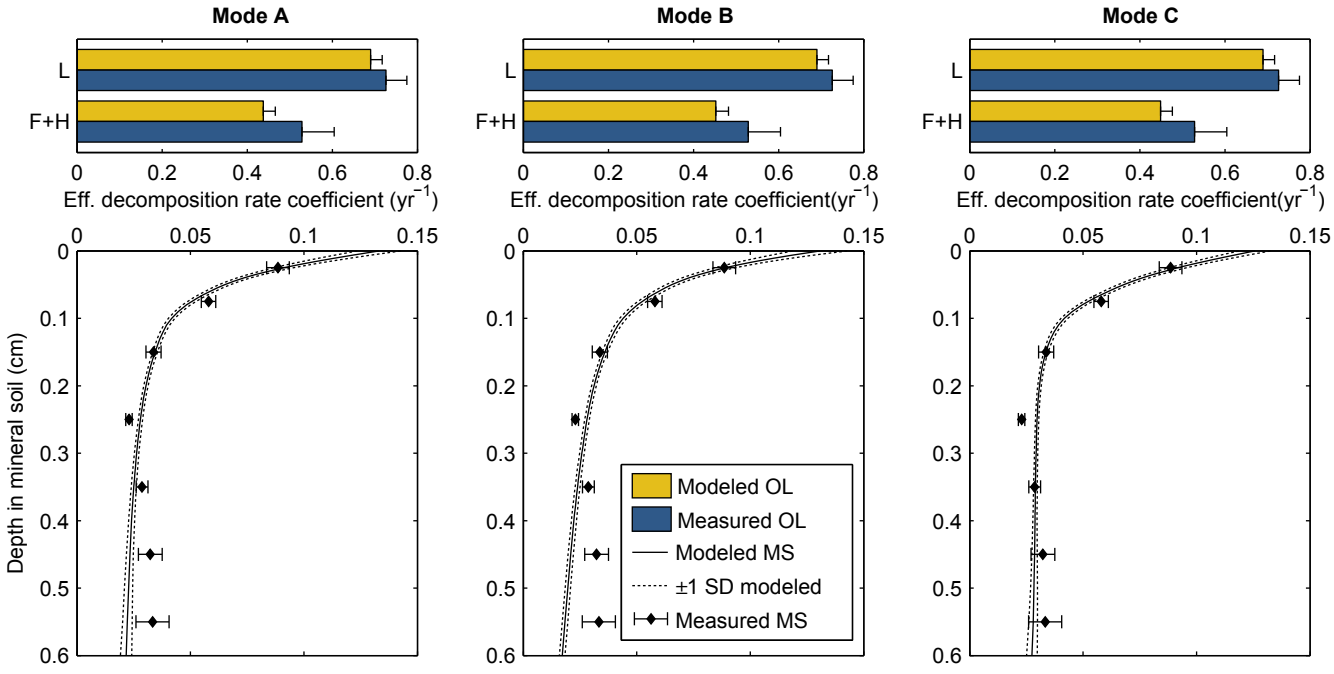

Figure 4: Measured effective decomposition rate coefficients and corresponding model results for Hainich, calibration setup 3. Depicted model results are averages and standard deviations over the Monte Carlo ensemble. Errorbars for the measurements indicate one standard error of the mean.

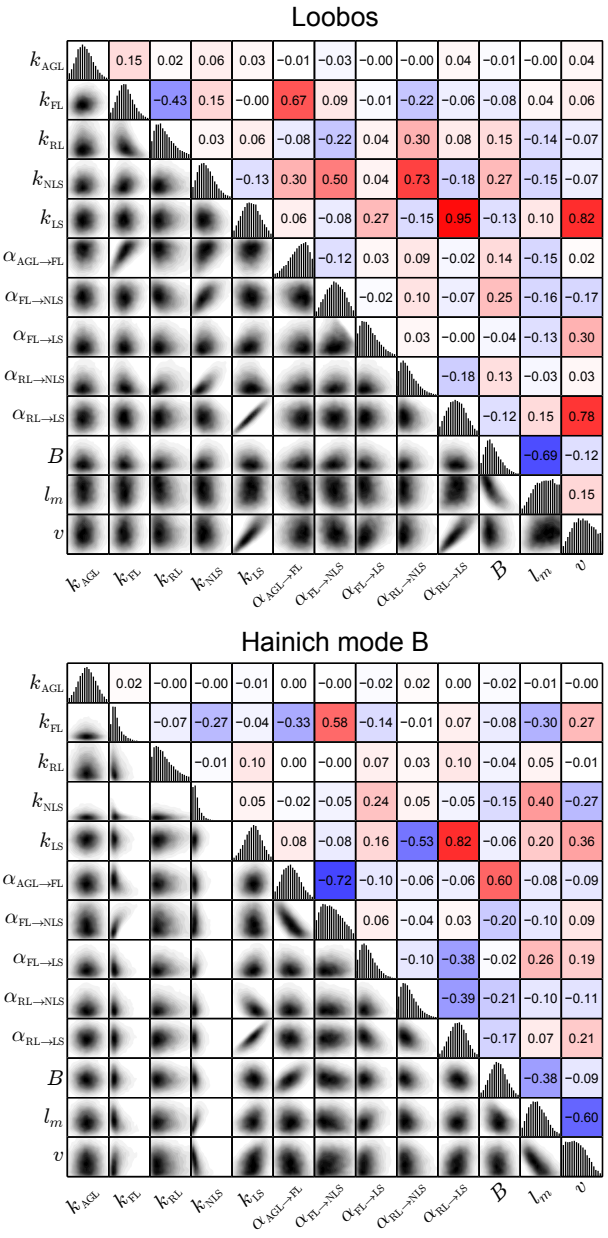

Figure 5: Correlation matrix of the posterior sample for calibration 3 (including $^{210}Pb_{ex}$ and strong priors) for Loobos and mode B for Hainich. The figures shows the correlations for each possible combination of two parameters. In the lower triangle bivariate density probability plots are depicted. In the upper triangle the correlation coefficients are shown, with blue indicating negative correlations and red positive correlations. On the diagonal histograms of the univariate marginal distribution for each parameter are shown.

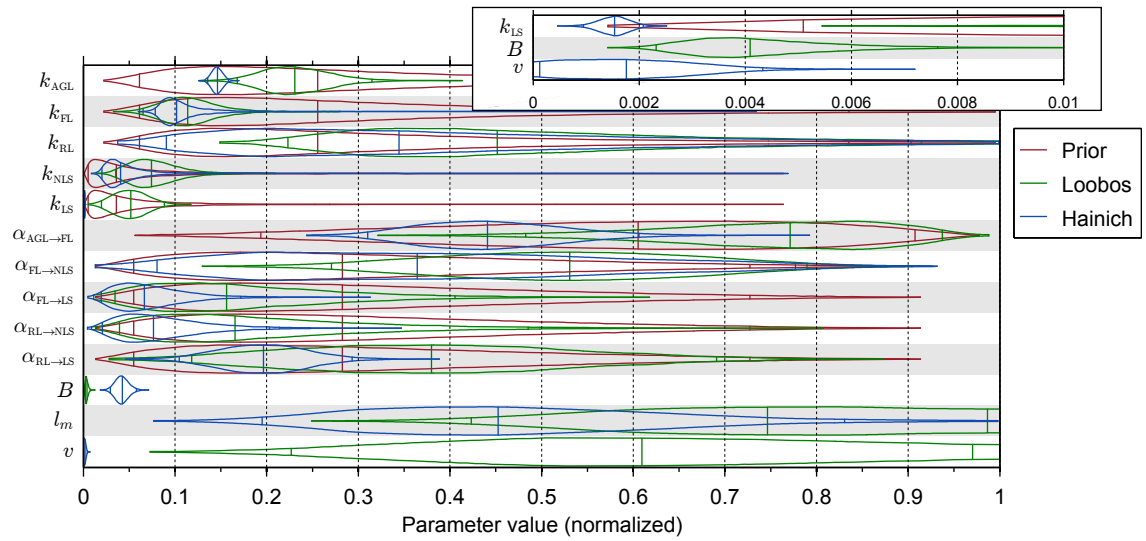

Figure 6: Marginal posterior distributions for Loobos and Hainich, calibration setup 3. The "violins" depict the marginal distribution for each parameter. The three vertical lines inside the violins indicate the median and the 95 % confidence bounds.

Site	Mode	k_{AGL}	k_{FL}	k_{RL}	k_{NLS}	k_{LS}	$\alpha_{AGL\to FL}$	$\alpha_{FL\to NLS}$	$\alpha_{FL\to LS}$	$\alpha_{RL\to NLS}$	$\alpha_{RL\to LS}$	B	l_m	v
		0.504	0.195	0.670	0.106	0.0592	0.483	0.271	0.0347	0.0393	0.118	0.00696	1.27	0.0227
Loobos	**n.a.**	0.692	0.342	1.35	0.223	0.155	0.771	0.531	0.156	0.165	0.380	0.0123	2.24	0.0609
		0.944	0.545	2.74	0.417	0.265	0.937	0.790	0.406	0.485	0.691	0.0229	2.96	0.0970
		0.407	0.229	0.285	0.00253	0.0134	0.468	0.0228	0.0304	0.0622	0.0290	0.118	1.06	0.00402
	A	0.439	0.265	1.09	0.00430	0.0495	0.593	0.0674	0.119	0.161	0.121	0.178	1.53	0.0804
		0.474	0.306	2.75	0.00598	0.257	0.729	0.142	0.340	0.270	0.369	0.230	2.31	0.0992
		0.407	0.235	0.271	0.0604	0.00284	0.310	0.0803	0.0195	0.0207	0.105	0.0881	0.585	1.22e-005
Hainich	**B**	0.439	0.305	1.03	0.122	0.00461	0.441	0.364	0.0665	0.0766	0.196	0.128	1.36	0.000176
		0.474	0.572	2.71	0.428	0.00623	0.606	0.777	0.172	0.203	0.293	0.174	2.49	0.000433
		0.406	0.267	0.0174	0.0985	0.00319	0.495	0.0279	0.0391	0.00936	0.0322	0.205	1.85	0.0416
	C	0.439	0.308	0.0184	0.275	0.0113	0.676	0.159	0.165	0.0294	0.157	0.249	2.49	0.0843
		0.474	0.357	0.0196	0.846	0.0381	0.828	0.584	0.453	0.0713	0.490	0.297	2.96	0.0993

Table 1: Properties of the marginal posterior distributions for both sites for calibration setup 3 (with $^{210}Pb_{ex}$ and strong priors.) For each site/mode the 2.5 % quantile (upper), the median (middle), and the 97.5 % quantile (lower) are shown.