Supplement of Geosci. Model Dev., 17, 5349–5367, 2024
https://doi.org/10.5194/gmd-17-5349-2024-supplement

Geoscientific Model Development
Open Access
EGU

Supplement of

Modelling boreal forest's mineral soil and peat C dynamics with the Yasso07 model coupled with the Ricker moisture modifier

Boris Ťupek et al.

Correspondence to: Boris Ťupek (boris.tupek@luke.fi)

Table S1. The prior distribution of parameters of Yasso07.ξ_{AR} version of Yasso07 soil carbon model (parameters k_A … δ2) coupled with environmental function ξ_{AR} (Eq. (3), parameters Q_{10}, and a), and parameters of likelihood function (Eq. (5), ε_{aSOC}, ε_{bSOC}, ε_{aCO2}, ε_{bCO2}) used with observations of SOC stocks and CO_2 emissions from forest-mire ecotone sites for Bayesian optimization.

parameters	Prior p(θ)		
	2.50%	50%	97.50%
kA	0.62	0.73	0.84
kW	5	5.8	6.6
kE	0.24	0.29	0.35
kN	0.027	0.031	0.042
kH	0.0014	0.0017	0.0019
αAW	0.41	0.48	0.54
αAE	0	0.01	0.16
αAN	0.6	0.83	0.98
αWA	0.94	0.99	1
αWE	0	0	0.08
αWN	0	0.01	0.21
αEA	0	0	0.004
αEW	0	0	0.003
αEN	0	0.03	0.25
αNA	0	0	0.007
αNW	0	0.01	0.031
αNE	0.79	0.92	0.99
αH	0.0037	0.0045	0.0056
δ1	-1.9	-1.7	-1.5
δ2	0.76	0.86	0.96
r	-0.321	-0.306	-0.29
Q_{10}	1	2	5
a	3	15	30
ε_{aSOC}	0.0001	80	150
ε_{bSOC}	0.0001	1	3
ε_{aCO2}	0.0001	0.15	0.7
ε_{bCO2}	0.0001	0.5	3

Table S2. Chemical A, W, E, N composition of litter components separately for species and species groups and used by the compartment A, W, E, N pools of Yasso07 soil carbon model. Vavrova = Vavrova et al. 2009, CIDET/LIDET = Trofymow et al. 1998, Gholz et al. 2000, eurodeco = Berg et al. 1991a, b, 1993. The table and values were adopted from Liski, J., Tuomi M., Rasinmäki, J., 2009. Yasso07 user-interface manual. https://en.ilmatieteenlaitos.fi/yasso-download-and-support

Litter type	Plant species	A[b]	W	E	N	H	Source
branches.	Pinus sylvestris	0.4763	0.0196	0.0870	0.4170	0.0	vavrova
branches.	Pinus sylvestris	0.4933	0.0105	0.0659	0.4303	0.0	vavrova
branches.	Pinus sylvestris	0.4289	0.0197	0.1309	0.4205	0.0	vavrova
branches.	Pinus sylvestris	0.5068	0.0120	0.0506	0.4306	0.0	vavrova
branches.	Pinus sylvestris	0.4607	0.0107	0.0874	0.4412	0.0	vavrova
branches.	Pinus sylvestris	0.5047	0.0106	0.0519	0.4328	0.0	vavrova
branches.	Pinus sylvestris	0.4642	0.0130	0.0840	0.4388	0.0	vavrova
branches.	Pinus sylvestris	0.5307	0.0126	0.0382	0.4186	0.0	vavrova
branches.	Pinus sylvestris	0.5256	0.0116	0.0394	0.4234	0.0	vavrova
branches.	Pinus sylvestris	0.4661	0.0195	0.0996	0.4148	0.0	vavrova
branches.	Pinus sylvestris	0.5060	0.0180	0.0647	0.4112	0.0	vavrova
branches.	Pinus sylvestris	0.4941	0.0257	0.0905	0.4456	0.0	vavrova
branches.	Pinus sylvestris	0.4848	0.0219	0.0633	0.4300	0.0	vavrova
branches.	Pinus sylvestris	0.4158	0.0295	0.1131	0.4416	0.0	vavrova
branches.	Pinus sylvestris	0.4605	0.0242	0.0874	0.4279	0.0	vavrova
branches.	Pinus sylvestris	0.4423	0.0198	0.1101	0.4278	0.0	vavrova
branches.	Pinus sylvestris	0.4811	0.0242	0.0681	0.4266	0.0	vavrova
branches.	Pinus sylvestris	0.4434	0.0263	0.1108	0.4195	0.0	vavrova
branches.	Pinus sylvestris	0.5141	0.0188	0.0561	0.4110	0.0	vavrova
branches.	Pinus sylvestris	0.4312	0.0218	0.1128	0.4341	0.0	vavrova
branches.	Pinus sylvestris	0.4867	0.0207	0.0452	0.4474	0.0	vavrova
branches.	Pinus sylvestris	0.3997	0.0234	0.1161	0.4608	0.0	vavrova
branches.	Pinus sylvestris	0.4758	0.0176	0.0678	0.4388	0.0	vavrova
branches.	Pinus sylvestris	0.4741	0.0248	0.0698	0.4313	0.0	vavrova
branches.	Pinus sylvestris	0.4996	0.0188	0.0470	0.4346	0.0	vavrova
fine.roots	Drypetes glauca	0.5215	0.1991	0.1062	0.1613	0.0	cidet/lidet
fine.roots	Picea abies	0.5508	0.1331	0.0665	0.2496	0.0	eurodeco
fine.roots	Pinus elliottii	0.3594	0.1965	0.0890	0.3490	0.0	cidet/lidet
fine.roots	Pinus resinosa	0.5634	0.0937	0.0609	0.2820	0.0	cidet/lidet
fine.roots	Pinus sylvestris	0.5791	0.1286	0.0643	0.2280	0.0	eurodeco
foliage	Abies lasiocarpa	0.3065	0.3196	0.1943	0.1796	0.0	cidet/lidet
foliage	Acer saccharum	0.2733	0.4768	0.0818	0.1587	0.0	cidet/lidet
foliage	Alnus incana	0.4430	0.1953	0.0976	0.2641	0.0	eurodeco
foliage	Ammophila breviligulata	0.5690	0.2157	0.0641	0.1440	0.0	cidet/lidet
foliage	Andropogon gerardii	0.5937	0.1474	0.0592	0.1868	0.0	cidet/lidet
foliage	Betula lutea	0.4578	0.1852	0.0793	0.2662	0.0	cidet/lidet
foliage	Betula papyrifera	0.3134	0.3715	0.0674	0.2477	0.0	cidet/lidet
foliage	Betula pubenscens	0.4079	0.1980	0.0990	0.2951	0.0	eurodeco
foliage	Betula pubenscens	0.4600	0.1929	0.0964	0.2507	0.0	eurodeco
foliage	Bouteloua eriopoda	0.6433	0.1852	0.0510	0.1553	0.0	cidet/lidet

foliage	Bouteloua gracilis	0.6858	0.1384	0.0758	0.0796	0.0	cidet/lidet
foliage	Ceanothus greggii	0.2687	0.4911	0.1072	0.1237	0.0	cidet/lidet
foliage	Cornus nuttalii	0.3701	0.5174	0.0912	0.0076	0.0	cidet/lidet
foliage	Drypetes glauca	0.3982	0.4023	0.0802	0.1091	0.0	cidet/lidet
foliage	Fagus grandifolia	0.4847	0.1381	0.0776	0.2996	0.0	cidet/lidet
foliage	Fagus grandifolia	0.4911	0.1625	0.0732	0.2603	0.0	cidet/lidet
foliage	Festuca hallii	0.6391	0.1405	0.0989	0.1219	0.0	cidet/lidet
foliage	Kobresia myosuroides	0.6156	0.2273	0.0535	0.0925	0.0	cidet/lidet
foliage	Larix laricina	0.4283	0.2190	0.0990	0.2537	0.0	cidet/lidet
foliage	Larrea tridentata	0.4046	0.3154	0.1845	0.0795	0.0	cidet/lidet
foliage	Liriodendron tulipifera	0.3127	0.4362	0.1393	0.0870	0.0	cidet/lidet
foliage	Picea abies	0.4826	0.1317	0.0658	0.3199	0.0	eurodeco
foliage	Picea mariana	0.3852	0.2068	0.1137	0.2943	0.0	cidet/lidet
foliage	Pinus banksiana	0.4355	0.1564	0.0715	0.3366	0.0	cidet/lidet
foliage	Pinus elliottii	0.4134	0.1960	0.1734	0.2142	0.0	cidet/lidet
foliage	Pinus nigra	0.4790	0.1633	0.0817	0.2760	0.0	eurodeco
foliage	Pinus pinaster	0.5110	0.0960	0.0480	0.3450	0.0	eurodeco
foliage	Pinus pinea	0.4730	0.1211	0.0605	0.3453	0.0	eurodeco
foliage	Pinus resinosa	0.4458	0.2060	0.1531	0.1918	0.0	cidet/lidet
foliage	Pinus strobus	0.3968	0.2017	0.1875	0.2059	0.0	cidet/lidet
foliage	Pinus sylvestris	0.5180	0.1773	0.0887	0.2160	0.0	eurodeco
foliage	Populus tremuloides	0.3656	0.3839	0.0948	0.1557	0.0	cidet/lidet
foliage	Populus tremuloides	0.4240	0.2307	0.1153	0.2300	0.0	eurodeco
foliage	Pseudotsuga menzesii	0.3727	0.2202	0.0854	0.2735	0.0	cidet/lidet
foliage	Pseudotsuga menziesii	0.4442	0.1225	0.1096	0.3237	0.0	cidet/lidet
foliage	Pteridium aquilinum	0.5263	0.0969	0.0242	0.3526	0.0	cidet/lidet
foliage	Quercus prinus	0.3938	0.2722	0.0935	0.2351	0.0	cidet/lidet
foliage	Rhododendron macrophyll	0.3690	0.3627	0.0895	0.1695	0.0	cidet/lidet
foliage	Robinia pseudoacacia	0.4045	0.3377	0.0719	0.1766	0.0	cidet/lidet
foliage	Spartina alterniflora	0.5877	0.2675	0.0490	0.0712	0.0	cidet/lidet
foliage	Thuja plicata	0.3913	0.1127	0.1149	0.3811	0.0	cidet/lidet
foliage	Thuja plicata	0.3592	0.2231	0.1399	0.2667	0.0	cidet/lidet
foliage	Triticum aestivum	0.7315	0.0672	0.0335	0.1621	0.0	cidet/lidet
stem	Betula pendula	0.6500	0.0300	0.0000	0.3200	0.0	woody
stem	Betula pendula	0.7800	0.0000	0.0000	0.2200	0.0	woody
stem	Picea abies	0.6300	0.0300	0.0000	0.3300	0.0	woody
stem	Picea abies	0.7000	0.0050	0.0050	0.2800	0.0	woody
stem	Pinus sylvestris	0.6600	0.0300	0.0000	0.2900	0.0	woody
stem	Pinus sylvestris	0.6800	0.0150	0.0150	0.2800	0.0	woody

Table S2 References

Berg, B., Booltink, H., Breymeyer, A., Ewertsson, A., Gallardo, A., Holm, B., Johansson, M.-B., Koivuoja, S., Meentemeyer, V., Nyman, P., Olofsson, J., Pettersson, A.-S., Reurslag, A., Staaf, H., Staaf, I., and Uba, L.: Data on needle litter decomposition and soil climate as well as site characteristics for some coniferous forest sites, Part I, Site characteristics. Report 41. Swedish University of Agricultural Sciences, Department of Ecology and Environmental Research, Uppsala, 1991a.

Berg, B., Booltink, H., Breymeyer, A., Ewertsson, A., Gallardo, A., Holm, B., Johansson, M.-B., Koivuoja, S., Meentemeyer, V., Nyman, P., Olofsson, J., Pettersson, A.-S., Reurslag, A., Staaf, H., Staaf, I., and Uba, L.: Data on needle litter decomposition and soil climate as well as site characteristics for some coniferous forest sites, Part II, Decomposition data. Report 42. Swedish University of Agricultural Sciences, Department of Ecology and Environmental Research, Uppsala, 1991b.

Berg, B., Berg, M.P., Bottner, P., Box, E., Breymeyer, A., De Anta, R.C., Couteaux, M., Mälkönen, E., McClaugherty, C., Meentemeyer, V., Munoz, F., Piussi, P., Remacle, J., and De Santo, A.V.: Litter mass loss in pine forests of Europe and Eastern United States: some relationships with climate and litter quality. Biogeochemistry 20, 127–159, https://doi.org/10.1007/BF00000785, 1993.

Gholz, H.L., Wedin, D.A., Smitherman, S.M., Harmon, M.E., and Parton, W.J.: Long-term dynamics of pine and hardwood litter in contrasting environments: toward a global model of decomposition. Global Change Biology 6, 751–765, https://doi.org/10.1046/j.1365-2486.2000.00349.x, 2000.

Trofymow, J.A.: The Canadian Intersite Decomposition ExperimenT (CIDET). Project and site establishment report. Information report BCX-378. Pacific Forestry Centre, Victoria, Canada, 1998.

Vávřová, P., Penttilä, T., and Laiho, R.: Decomposition of Scots pine fine woody debris in boreal conditions: Implications for estimating carbon pools and fluxes. Forest Ecology and Management 257, 401–412, https://doi.org/10.1016/j.foreco.2008.09.017, 2009.

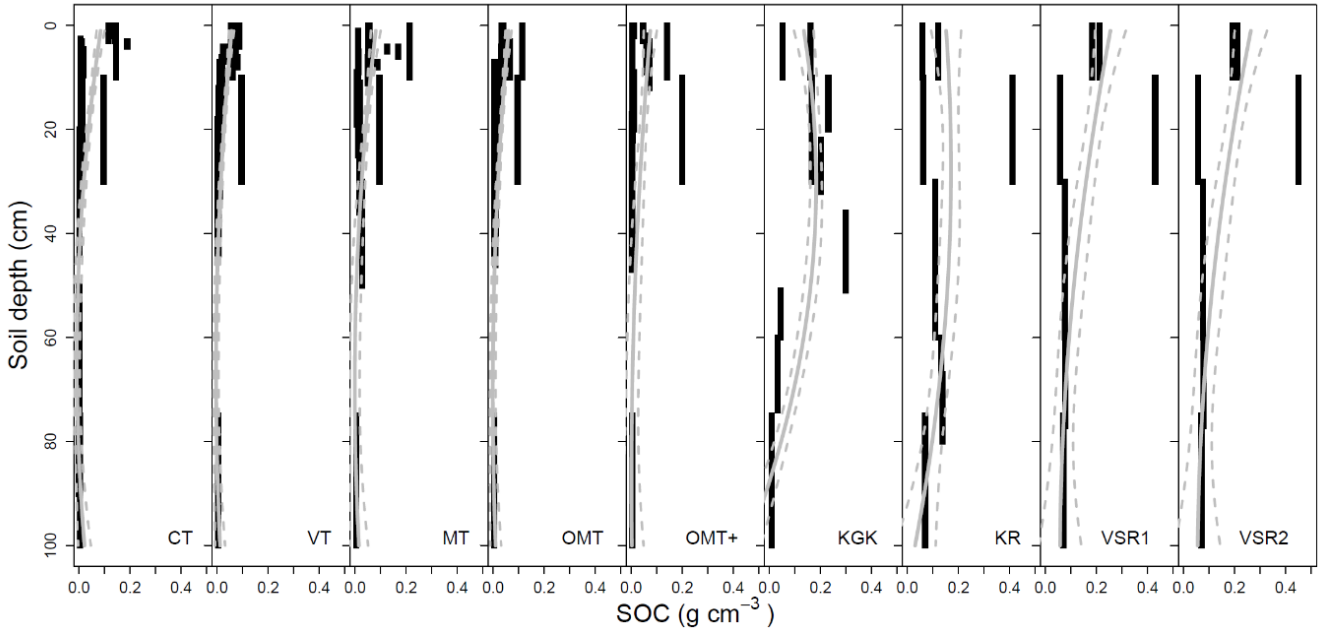

Figure S1. Soil organic carbon content (SOC, g cm^{-3}) for samples soil layers of different depth and the fitted functions used for interpolation of total SOC up to 1m.

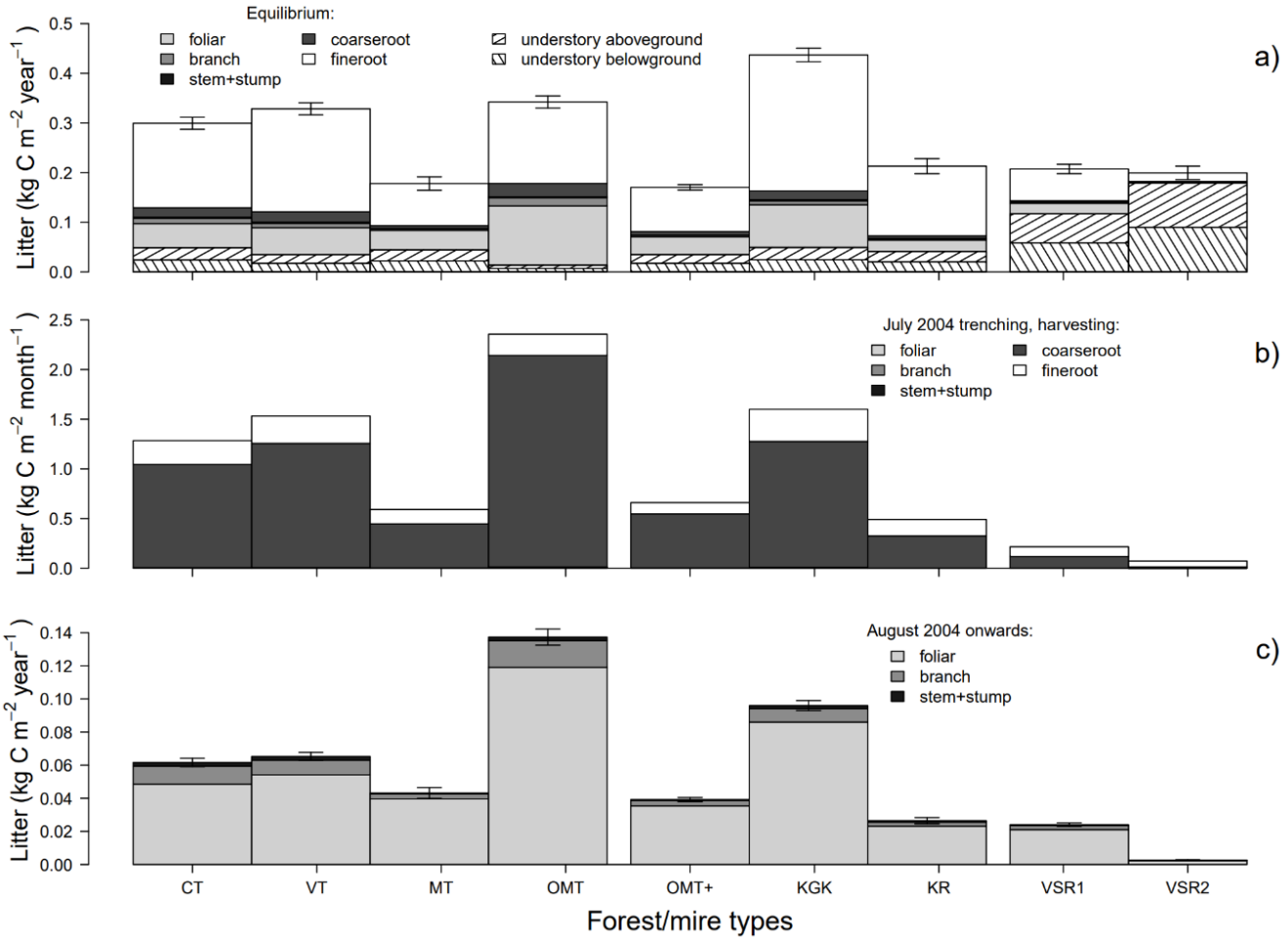

Figure S2. Litter input for nine forest/mire types derived separately from each biomass component (foliage, branchesches, stem and stump, roots, and understory) for assumed equilibrium state forest before trenching (a), during root trenching (b), and after trenching (c).

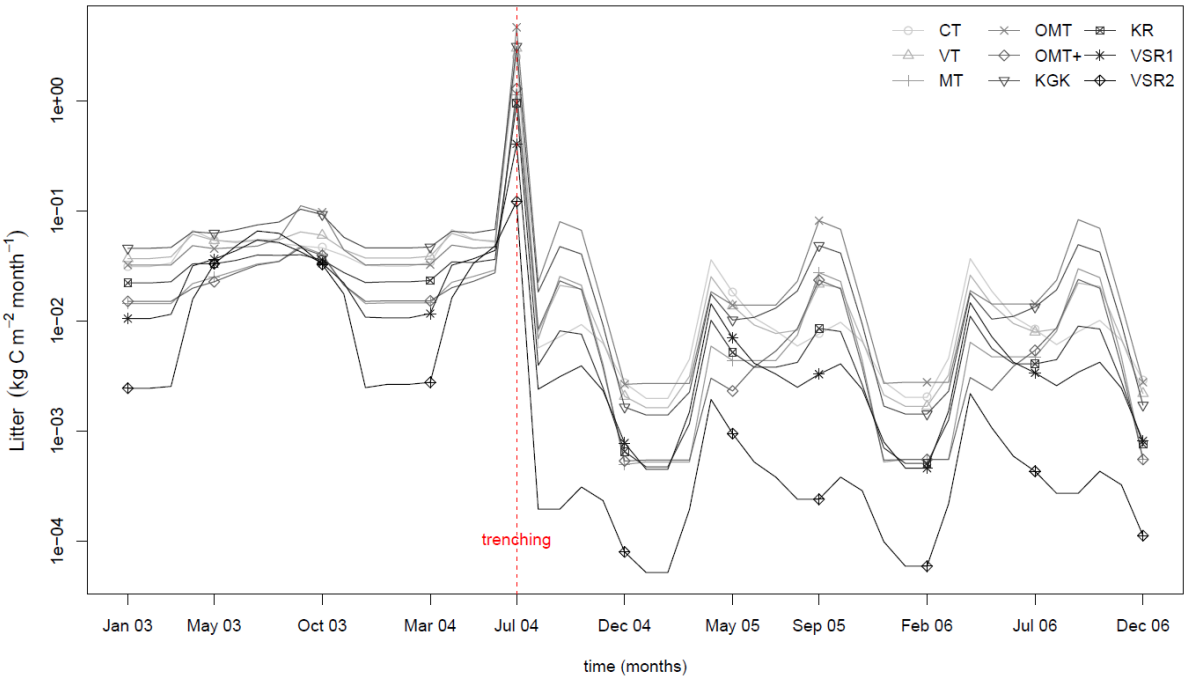

Figure S3. Monthly time series of the total litter input of nine forest/mire types.