Corrigendum to Geosci. Model Dev., 17, 931–956, 2024
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Corrigendum to "SAMM version 1.0: a numerical model for microbial-mediated soil aggregate formation" published in Geosci. Model Dev., 17, 931–956, 2024

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There was a unit error in one of the equations of the Soil Aggregation through Microbial Mediation (SAMM) model. Specifically, the equation that calculated the maximum amount of mineral-associated organic carbon ($MAO_{C_{max}}$) was taken from Abramoff et al. (2022) without considering that they used a different unit ($g\,m^{-2}$ instead of $kg\,ha^{-1}$ for SAMM). This led to an underestimation of $MAO_{C_{max}}$ in SAMM by a factor of 10 and consequently reduced the capacity of the minerals to directly sorb low-molecular-weight carbon and nitrogen. With this corrigendum, the equation to calculate $MAO_{C_{max}}$ has been corrected, and both versions of SAMM have been recalibrated. The results for both the normal version of SAMM and the version without aggregate protection (SAMMnoAgg) were recalculated, based on a new calibration. The corrected equation for ($MAO_{C_{max}}$) is as follows:

$$MAO_{C_{max}} = \text{Depth (m)} \cdot 10\,000\,m^2 \cdot \text{BD } (kg\,m^{-3}) \cdot \text{SiCl } (kg\,\text{SiCl}\,kg^{-1}) \cdot c_{SORP}\ (kg\,C\,kg^{-1}\,\text{SiCl}) \quad (1)$$

Here, depth is the depth of the simulated soil (m), BD is the bulk density ($kg\,m^{-3}$), SiCl is the fraction of silt and clay of the soil ($kg\,kg^{-1}$), and c_{SORP} is the maximum sorption capacity of silt and clay ($kg\,kg^{-1}$ silt and clay). In the published version of the paper we did not consider the highly weathered state of the soils in Khon Kaen. Therefore, we had used the c_{SORP} value for soils dominated by 2 : 1 clay minerals ($0.083\,kg\,C\,kg^{-1}$ silt + clay). To correct this, we replaced the previous value with the most recent estimate by Georgiou et al. (2025) for soils dominated by 1 : 1 clay minerals ($0.049\,kg\,C\,kg^{-1}$ silt + clay). In the previous version of SAMM, $MAO_{C_{max}}$ was only $3292\,kg\,C\,ha^{-1}$ in the 0–15 cm depth layer. With the correction, it is now $18\,757\,kg\,C\,ha^{-1}$.

The previous underestimation of $MAO_{C_{max}}$ mainly affected the turnover rate of the mineral-associated organic matter pool. It was too slow in the previous version, balancing out the lower protection capacity of minerals, and is now faster. Other than that, not much has changed in the results with the new calibration. The evaluation statistics of the recalibration of SAMM with and without aggregate simulation did not change substantially, and the overall interpretation remains identical. Specifically, SAMM still captures differences between treatments in soil organic carbon (Nash–Sutcliffe modeling efficiency (EF) of 0.65), microbial nitrogen (EF of 0.13), and litter carbon (EF of 0.81). The amount of carbon within aggregates was simulated worse compared

to the previous version of SAMM (EF of 0.21 instead of 0.60), while the amount of carbon in the free silt and clay fraction was simulated significantly better compared to the previous version of SAMM (EF of 0.67 instead of 0.24).

The recalibrated version of SAMMnoAgg still had a significantly lower turnover rate of mineral-associated carbon decomposition, but due to a higher amount of mineral protection it was faster by only about 30 % compared to the previous version of SAMM. Still, model performance of SAMMnoAgg was slightly worse compared to SAMM (EF of 0.49, 0.75, and 0.34 for SOC, litter carbon, and microbial nitrogen, respectively). The Akaike information criterion of SAMM was still slightly better (5519 vs. 5765); therefore the main messages of the differences between both models were maintained. The main goal of this corrigendum was thus to provide the corrected equations to calculate $MAO_{C_{max}}$ and to provide updated model parameters and an updated version of the initial evaluation figures with the corrected calibration value. Without this correction, SAMM may fail to represent the carbon dynamics in soils with a high silt and clay content and consequently underestimate the level of direct attachment of low-molecular-weight carbon and nitrogen to the mineral fraction.

We have published an updated version of the SAMM model code on Zenodo (https://doi.org/10.5281/zenodo.15648425, mol4ub, 2025). Furthermore, we have updated the following tables and figures:

- Table 4
- Table 5
- Figure 5
- Figure A1.

1 Updated tables and figures

1.1 Updated parameter sets of SAMM

Table 4. Overview of all SAMM model parameters (top), further computed helper variables (middle), and external model drivers and site conditions (bottom). The calibrated values are the best parameter set from the independent Bayesian calibration for the SAMM model and the recalibrated non aggregate model (SAMMnoAgg). (These values refer to the recalibrated version of SAMM v1.1 after including the corrected calculation of $MAO_{C_{max}}$ and represent an update of Table 4 in the published article.)

Variable	Description	Units	Calibrated	SAMM[a]	SAMMnoAgg[b]
k_{STR}	Turnover rate of structural litter pool	$g\,g^{-1}\,d^{-1}$	Yes	0.0031	0.0032
k_{LAB}	Turnover rate of metabolic litter pool	$g\,g^{-1}\,d^{-1}$	Yes	0.0366	0.0378
k_{MIC}	Death rate of microbial biomass pool	$g\,g^{-1}\,d^{-1}$	Yes	0.0070	0.0068
k_{MAO}	Turnover rate of mineral-associated carbon pool	$g\,g^{-1}\,d^{-1}$	Yes	0.00041	0.00028
μ_{max}	Maximum uptake rate of LMW by microbes	$g\,g^{-1}\,d^{-1}$	Yes	0.337	0.29
k_{Agg}	Turnover rate of aggregate pools	$g\,g^{-1}\,d^{-1}$	Yes	0.0323	1[e]
$K_{M_{MIC}}$	Half-saturation constant of the microbial activity factor	-	Yes	66.8	49.6
m_{MIC}	Maintenance respiration of microbes	$g\,g^{-1}\,d^{-1}$	Yes	0.00064	0.0023
K_{LMWMAO}	Specific adsorption rate of LMW to MAOM	$g\,g^{-1}\,d^{-1}$	Yes	0.018	0.067
c_{SORP}	Maximum sorption capacity coefficient	$kg\,kg^{-1}$	No[c]	0.049	0.049
CUE_{STR}	Carbon use efficiency of structural litter pool	$g\,g^{-1}$	Yes	0.57	0.66
CUE_{LAB}	Carbon use efficiency of metabolic litter pool	$g\,g^{-1}$	Yes	0.51	0.72
CUE_{LMW}	Maximum carbon use efficiency of low-molecular-weight pool	$g\,g^{-1}$	No[d]	0.6	0.6
$CN_{min(MIC)}$	Minimum C/N ratio of microbial biomass pool	$g\,g^{-1}$	Yes	5.72	5.63
$CN_{max(MIC)}$	Maximum C/N ratio of microbial biomass pool	$g\,g^{-1}$	Yes	7.77	7.31
$f_{MICMAOM}$	Fraction of MIC directed to MAOM upon microbial death	$g\,g^{-1}$	Yes	0.21	0.17
$pc_{STR_{LAB}}$	Protection capacity of STR_C for $LAB_{C\&N}$	$g\,g^{-1}$	Yes	2.54	3.94
$aggfactSTR_C$	Protection of STR_C inside aggregates per microbial growth	$g\,g^{-1}$	Yes	1.16	0[e]
$aggfactMAO_C$	Protection of MAO_C inside aggregates per microbial growth	$g\,g^{-1}$	Yes	1.57	0[e]
NonMicAgg	Physicochemical aggregate formation	$kg\,MIC\,C\,eq\,ha^{-1}\,d^{-1}$	Yes	32.5	0[e]
$Daily_{Litter_C}$	Daily root carbon inputs (from unavoidable plant growth)	$kg\,C\,ha^{-1}\,d^{-1}$	Yes	2.28	3.82
$Daily_{Litter_{C/N}}$	C/N ratio of daily root inputs	$g\,g^{-1}$	Yes	142.9	58.1
$Daily_{Litter_{STRC(\%)}}$	Percent of structural litter in daily root inputs	$g\,g^{-1}$	Yes	0.16	0.18
Computed helper variables (rate modifiers etc.)					
$CUE_{CN(LMW)}$	Dynamic C/N-based carbon use efficiency of LMW_C pool	$g\,g^{-1}$	–	–	–
s_t	Temperature scalar	–	–	–	–
s_w	Water scalar	–	–	–	–
pLAB	Fraction of metabolic litter protected by structural litter	$g\,g^{-1}$	–	–	–
a_{MIC}	Michaelis–Menten microbial activity factor	–	–	–	–
$MAO_{C_{max}}$	Maximum adsorption capacity to MAO_C	$t\,ha^{-1}$	–	–	–
w_{leach}	Share of soil water leached (HYDRUS calculation)	$g\,g^{-1}\,d^{-1}$	–	–	–
Site condition and other model driving variables					
depth	Soil depth to be simulated	m	–	–	–
BD	Bulk density	$kg\,m^{-3}$	–	–	–
SiCl	Silt and Clay fraction	$kg\,kg^{-1}$ soil	–	–	–

[a] Model version including soil aggregates. [b] Recalibrated model version without soil aggregates. [c] From Georgiou et al. (2025). [d] Established maximum (Sinsabaugh et al., 2013; Manzoni et al., 2012). [e] Set to 0/1 in model version without soil aggregates to deactivate them.

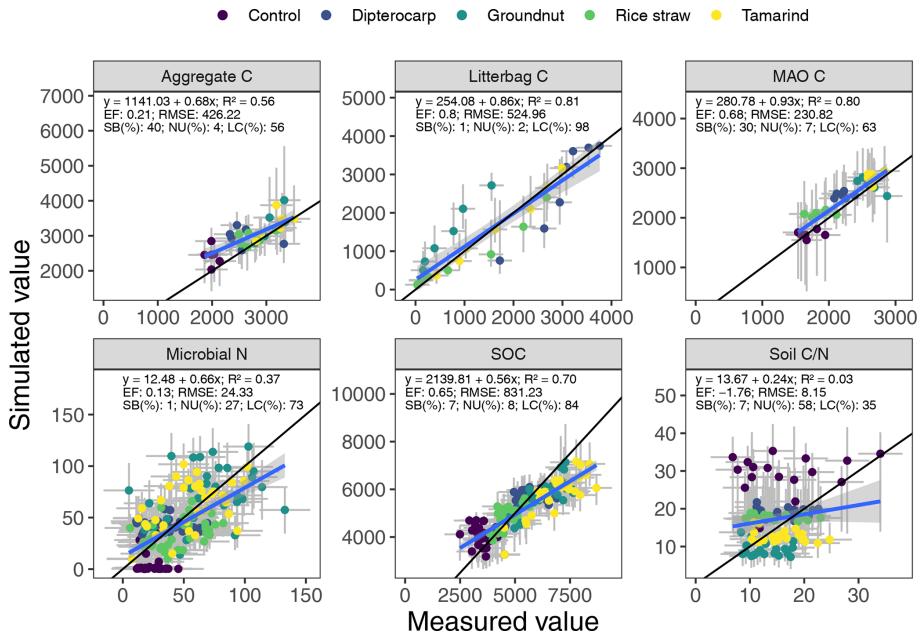

Figure 5. Simulated versus measured values of aggregate carbon, litter carbon, mineral-associated organic carbon (MAOC), microbial biomass nitrogen, soil organic carbon (SOC), and soil C/N ratio. The grey bars indicate the 95 % credibility interval. The black line marks the 1 : 1 line, the blue line the regression of simulated on measured values. (This figure represents an update of Fig. 5 in the published article.)

1.2 Comparison of SAMM separately calibrated with and without the aggregate protection mechanism

Table 5. Model evaluation statistics of **(a)** the default SAMM model (with aggregate protection) and **(b)** the recalibrated SAMM model without aggregate protection (SAMMnoAgg). The RMSE and the width 95 % credibility intervals (w95 % CI) are in $kg\,C\,ha^{-1}$. Evaluation statistics are from the Bayesian calibration. Abbreviations: EF, Nash-Sutcliffe modelling efficiency; (R)MSE, (root) mean squared error; LC, lack of correlation; NU, nonunity slope; SB, squared bias; AIC, Akaike information criterion. Data rows in brackets were not used in the calculation of the overall model AIC. (These values refer to the recalibrated version of SAMM v1.1 after including the corrected calculation of $MAO_{C_{max}}$ and represent an update of Table 5 in the published article.)

	dataset	EF	RMSE	R^2	LC	NU	SB	MSE	AIC	% in 95 % CI	w95 % CI[a]	
	(a) Default SAMM model								5519[b]			
	Litterbag C	0.81	525.0	0.81	98	2	1	275 588	846	71	952	
	Microbial N	0.13	24.3	0.37	73	27	1	592	2158	53	36	
	SOC	0.65	831.2	0.70	84	8	7	690 948	2607	63	1322	
(	Aggregate C	0.21	426.2	0.56	56	4	40	181 661	637	87	1206	)
(	Free MAO C	0.68	230.8	0.80	63	7	30	53 277	503	97	1152	)
(	Soil C/N[c]	−1.76	8.2	0.03	35	58	7	66	1828	57	12	)
	(b) Recalibrated SAMMnoAgg								5765[b]			
	Litterbag C	0.75	596.8	0.82	72	3	26	356 118	986	71	1225	
	Microbial N	0.34	21.3	0.43	87	13	1	454	1939	55	41	
	SOC	0.49	1000.5	0.67	66	25	9	1 001 037	2931	72	2374	
(	Soil C/N[c]	−0.54	6.1	0.02	64	21	15	37	1179	62	13)	

[a] 95 % width of the credibility interval from the Bayesian calibration posterior. [b] Overall model AIC. For comparability of model versions this was computed without Aggregate and MAO C and soil C/N. [c] Not used in calibration.

Appendix A

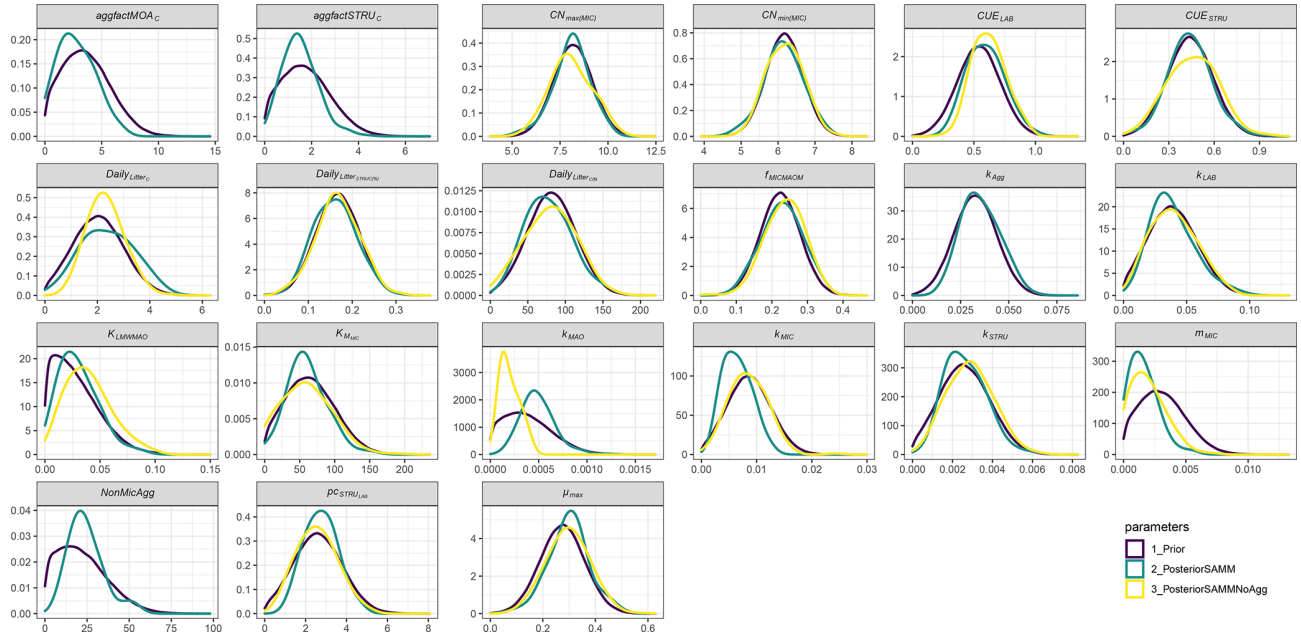

Figure A1. Prior and posterior parameter distributions of SAMM and the version without aggregates (SAMMnoAgg) for all model parameters that were calibrated. Priors were the mean of SAMM and SAMMnoAgg from an initial calibration of both model versions with a genetic algorithm. The width of the distribution was manually chosen and based on the range given by the genetic algorithm. Negative values were excluded. (This figure represents an update of Fig. A1 in the published article.)

Code and data availability. The full dataset used for this study, as well as the R code of SAMM version 1.1, is provided on GitHub via Zenodo (https://doi.org/10.5281/zenodo.15648425, mol4ub, 2025). It may be adapted for further uses or integrated into full ecosystem models that allow for interchanging of the SOM part of the model.

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