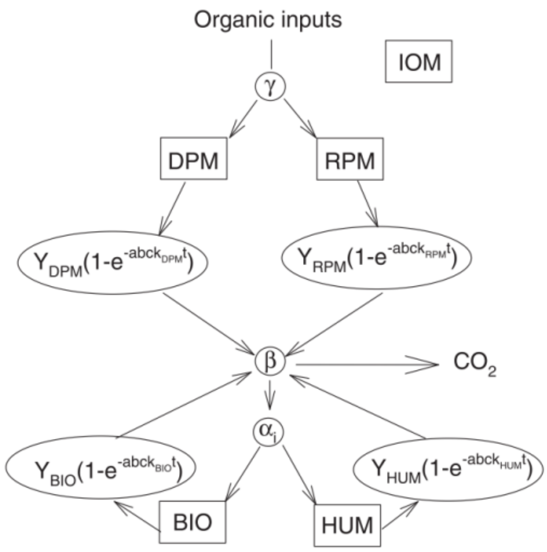
$$\frac{dx(t)}{dt} = \dot{x}(t) = I(t) \cdot b + x(t) \cdot re(t) \cdot A$$



pool concept of RothC (from Heitkamp et al., 2012)

Name

RothC

Important publications

Coleman and Jenkinson, 1996;

Dechow et al., 2019;

Falloon et al., 1998

Special features

- RothC has an inert Carbon Pool
- The Carbon in BIO and HUM gets partially recycled
- It includes a simple soil water model

Input distribution: b

In the manual, plant input is distributed into DPM and RPM with b=$(0.59,041)^T$, Manure additionally into HUM with b=$(0.49, 0.49, 0.02)^T$. (Dechow et al., 2019) developed a more sophisticated approach

Initialisation: $x(t_0)$

There is no official initialisation method besides a 'spin-up run'. IOM is calculated by: $10^{(-1.31\,+\,1.139\,\cdot\,log10(soc\_ini))}$ (Falloon et al., 1998).

Assuming a partition of FOM into DPM and RPM of 0.59 and 0.41 (standard for roots), the partitions of x_0 of the active pools are $(0.0065, 0.1500, 0.0212, 0.8224)^T$. Multiplied by (SOC_ini - IOM), the respective stocks can be derived.

Environmental response: re(t)

re(t) is split in three parts: a, b and c, for temperature, water and soil cover, respectively.

$a: \frac{47.91}{1 + e^{\frac{106}{T+18.27}}}$ with T = average monthly air temperature (°C)

b: is a simple soil moisture model dependent on clay content, building on the monthly difference of precipitation (P) and evapotranspiration (E)

c: is 1 if the soil is bare and 0.6 if it is covered.

Mass Flow Matrix: A

flow rates are in [a^{-1}]. Rows are flows into each pool; columns are flows from each pool. All flow rates are clay dependent. Shown values are for pure sand.

	CO_2	DPM	RPM	BIO	HUM	IOM
CO_2		8.521	0.256	0.562	0.017	
DPM		**-10**				
RPM			**-0.3**			
BIO		0.680	0.020	**-0.615**	0.001	
HUM		0.799	0.024	0.053	**-0.018**	
IOM						

References

Coleman, K., Jenkinson, D.S., 1996. RothC-26.3 - A Model for the turnover of carbon in soil, in: Powlson, D.S., Smith, P., Smith, J.U. (Eds.), Evaluation of Soil Organic Matter Models. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 237–246. https://doi.org/10.1007/978-3-642-61094-3_17

Dechow, R., Franko, U., Kätterer, T., Kolbe, H., 2019. Evaluation of the RothC model as a prognostic tool for the prediction of SOC trends in response to management practices on arable land. Geoderma 337, 463–478. https://doi.org/10.1016/j.geoderma.2018.10.001

Falloon, P., Smith, P., Coleman, K., Marshall, S., 1998. Estimating the size of the inert organic matter pool from total soil organic carbon content for use in the Rothamsted carbon model. Soil Biol. Biochem. 30, 1207–1211. https://doi.org/10.1016/S0038-0717(97)00256-3

Heitkamp, F., Wendland, M., Offenberger, K., Gerold, G., 2012. Implications of input estimation, residue quality and carbon saturation on the predictive power of the Rothamsted Carbon Model. Geoderma 170, 168–175. https://doi.org/10.1016/j.geoderma.2011.11.005

Additional info

	CO_2	DPM	RPM	BIO	HUM	IOM
CO_2		10 * β/(β+1)	0.3 * β/(β+1)	0.66 * β/(β+1)	0.02 * β/(β+1)	
DPM		**-10**				
RPM			**-0.3**			
BIO		10 * α /(β+1)	0.3 * α /(β+1)	**-0.66** + 0.66 * α /(β+1)	0.02 * α /(β+1)	
HUM		10 * (1-α) /(β+1)	0.3 * (1-α) /(β+1)	0.66 * (1-α) /(β+1)	**-0.02** + 0.02 * (1-α) /(β+1)	
IOM						

α: partitioning between BIO and HUM: BIO: 46%, HUM: (1-α).

β: partitioning of C to CO2 and HUM+BIO. Dependent on the clay content:

$\beta = 1.67\ (1.85 + 1.60 \exp(-0.0786\ \%\text{clay}))$

Then β / (β + 1) is evolved as CO2 and 1 / (β + 1) is formed as BIO + HUM.