

1 **Supplementary material**

2 **A) Comparison of curve fits to describe the ¹³C dynamics in the continuous labelling** 3 **experiment**

4 **Table 1.** Logarithmic versus logistic curve fit of the ¹³C dynamics. Coefficients of
5 determination (R²) and root-mean-square-deviation (RMSD) of the logarithmic and logistic
6 curve fit (non linear least squares) on the ¹³C mass excess data assessed for the plant-soil
7 compartments during the continuous labelling experiment.

Plant-soil compartment	Logarithmic fit		Logistic fit	
	R ²	RMSD	R ²	RMSD
Leaves	0.91	4.08	0.94	3.08
Petioles	0.88	0.52	0.92	0.39
Stems	0.84	2.20	0.87	1.79
Cuttings	0.85	0.40	0.87	0.35
Roots	0.73	0.36	0.79	0.29
MB	0.53	0.04	0.57	0.03
SOM	0.68	0.21	0.69	0.19
SR	0.67	0.12	0.70	0.11

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9 **B) Comparison two formulas to calculate the rate constant for the mean residence time** 10 **estimation**

11 Simple functions (steady state assumption):

$$12 \quad y = a \cdot e^{-k(t-b)} \quad (1a)$$

13 where a is the amount of ¹³C at the peak measured, k is the rate constant of the tracer loss
14 after the label peak (Fig. 1a, export phase), t is the time after labelling and b is time when the
15 peak was detected.

$$16 \quad y = \frac{a}{1 + e^{-k(t-b)}} \quad (1b)$$

17 where a is the amount of ¹³C at the stationary level (Fig. 1b), k is the rate constant of the ¹³C
18 accumulation, t is the time of labelling and b is the time at the inflection point.

19 Functions extended for non-steady state:

$$20 \quad y = (a - c) \cdot e^{-k(t-b)} + c \quad (2a)$$

21 where c is the non-zero asymptote

$$22 \quad y = \frac{a + c \cdot t}{1 + e^{-k(t-b)}} \quad (2b)$$

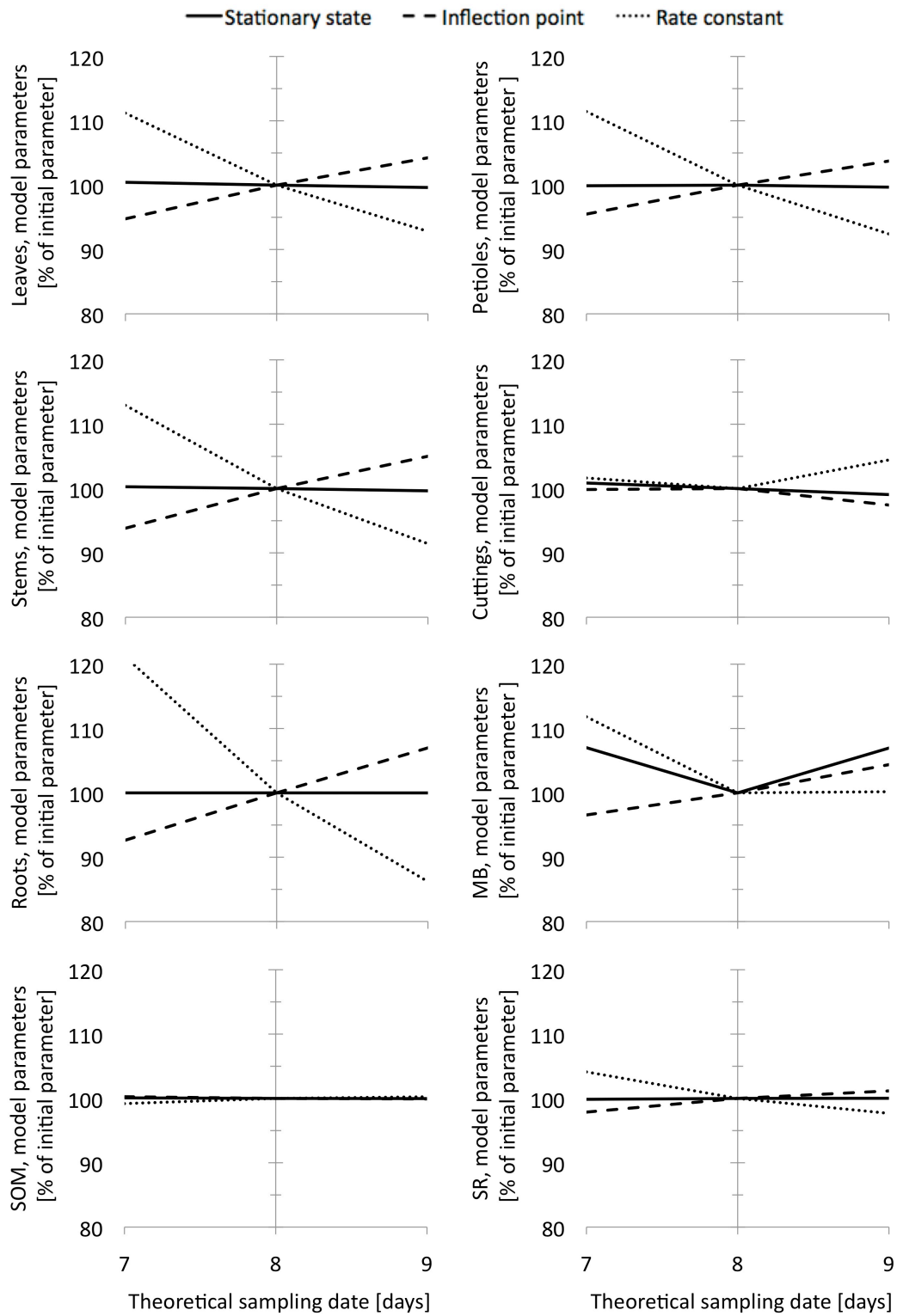
23 where c is the accumulation factor of the accumulation phase II (Manuscript Fig. 1b).

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25 **Table 2.** Mean residence times [MRT] estimated by the exponential decay (pulse labelling) or
 26 logistic growth (continuous labelling) model under the assumption of steady state (simple
 27 exponential/logistic functions, Eq. 1a/b) or non-steady state (non-zero asymptote /
 28 accumulation phase II, Eq. 2a/b). As indicators of the model accuracy the coefficients of
 29 determination (R^2) and root-mean-square-deviation (RMSD) are given.

	MRT [days]		R^2		RMSD [mg]	
	Steady state	Non-steady state	Steady state	Non-steady state	Steady state	Non-steady state
a) Pulse labelling						
Leaves	3.5	1.0	0.90	0.97	2.6	1.5
Petioles	21.1	1.8	0.93	0.94	0.1	0.1
Stems	13.0	0.5	0.92	0.93	0.7	0.7
Cuttings	8.5		0.92		0.2	
Roots	34.0		0.62		0.2	
MB	5.6		0.73		0.01	
SOM						
SR	1.9	1.7	0.84	0.84	0.1	0.1
a) Continuous labelling						
Leaves	1.2	1.4	0.94	0.94	3.1	3.1
Petioles	0.9	1.2	0.92	0.93	0.4	0.4
Stems	1.1	1.4	0.87	0.88	1.8	1.8
Cuttings	1.3	1.1	0.87	0.87	0.3	0.3
Roots	0.8		0.79		0.3	
MB	0.9	1.2	0.57	0.60	0.03	0.03
SOM	0.8	0.7	0.69	0.69	0.2	0.2
SR	1.4	1.4	0.84	0.84	0.1	0.1

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32 **Fig. 1. Sensitivity analysis of the logistic model.** The change in the model parameters
 33 stationary state, inflection point and rate constant are illustrated relative to the initial
 34 parameter at sampling date eight (given in %). The sensitivity analysis is based on the shift of
 35 the data point at day eight (see Figure 2) to day seven or nine and recalibration of the model.