



Supplement of

Calibration of the MEMS v1 model over a continental soil inventory: a comparison of MCMC and 4DEnVar methods

Toni Viskari et al.

Correspondence to: Toni Viskari (toni.viskari@ec.europa.eu)

The copyright of individual parts of the supplement might differ from the article licence.

Supplemental tables:

| C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 |
|------|------|------|----|----|------|----|------|----|-----|-----|
| 0.35 | 0.35 | 0.15 | 0 | 0 | 0.15 | 0 | 3000 | 0 | 0 | 0 |

Table S1: MEMS model initial state vector used in the calibration. The values in pools C1, C2, C3 as well as C6 are used to ensure that there are no numerical errors at the start of the simulation and do not impact the steady state at all. For the MAOM pool C9, though, we initialised the model with some carbon already accumulated in order to reduce the number of simulated years required for steady state.

| | 4DnVar | MCMC |
|---------------------|--------------------|--------------------|
| k_5 | 0.00013/0.00016 | 0.00036/0.00055 |
| k_8 | 0.00015/0.00017 | 0.00006 /0.0001 |
| k_9 | 0.0000066/0.000006 | 0.0000003/0.000002 |
| k_{10} | 0.00008/0.00008 | 0.00003/0.00002 |
| SC_{cept} | 1.7/0.35 | 0.3/1.5 |
| SC_{slope} | 0.006/0.01 | 0.03/0.04 |

Table S2: The standard deviations for the parameter distributions produced by the different calibration methods. The first value is for f_{doc} 0.15, the second for f_{doc} 0.35. It is important to note that with the MCMC calibration, some of the parameter values are so close to the set boundary that they cannot be considered normally distributed, which affects the calculated standard deviations.

Supplemental figures:

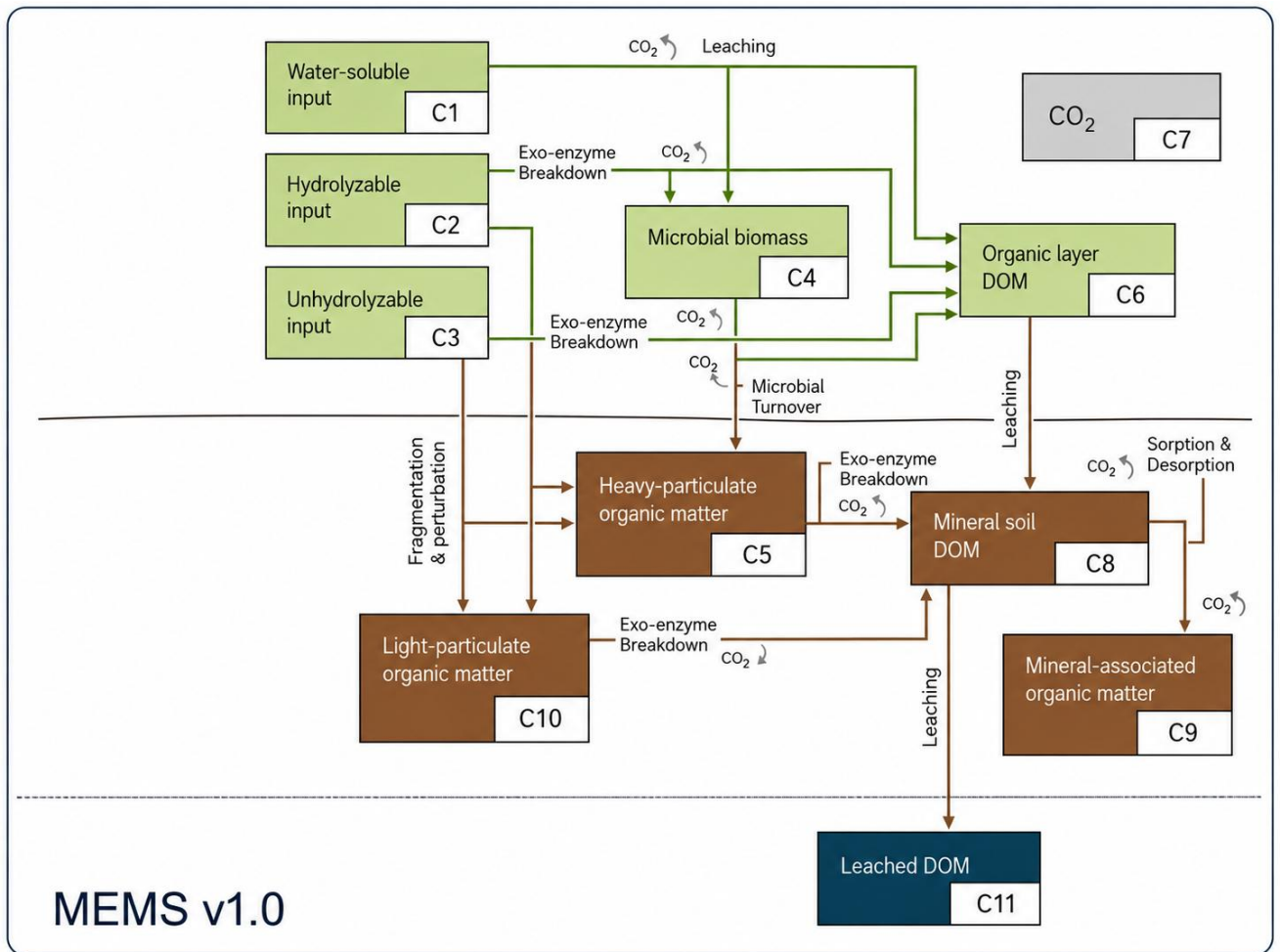


Figure S1: The MEMS model structure based on the work presented in Robertson et al. (2019).

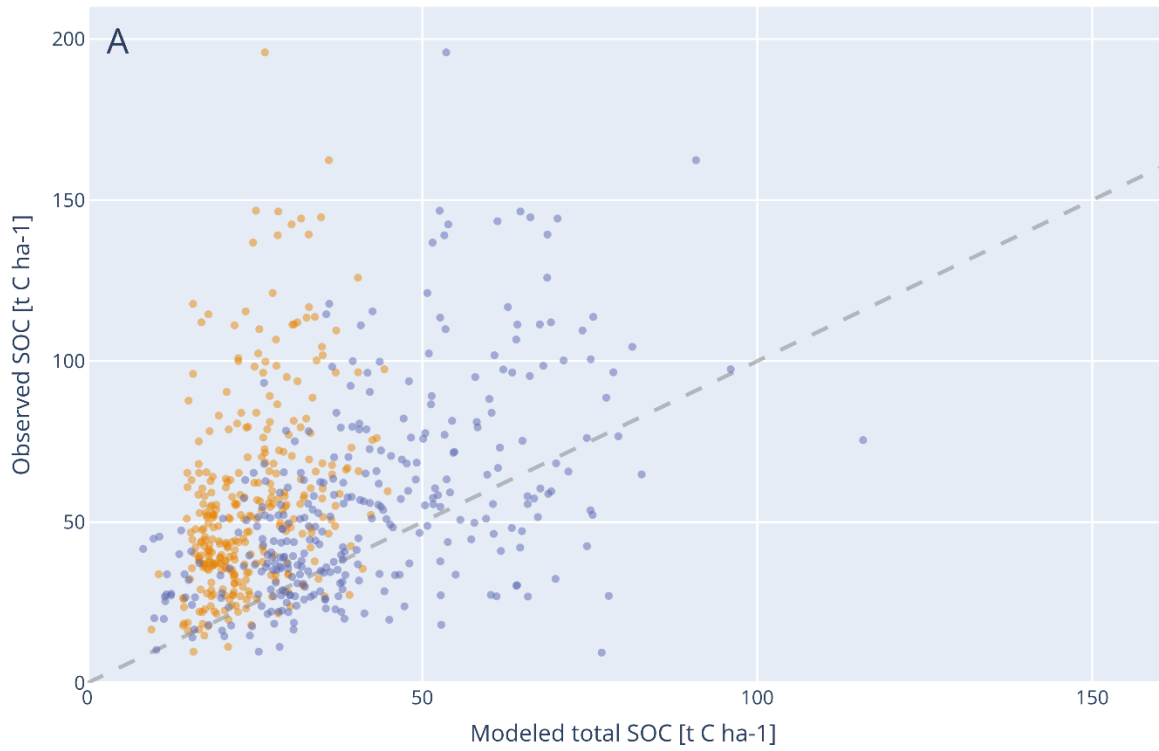


Figure S2: For the calibration dataset, comparison between the modelled and measured a) Total SOC value and b) MAOM:SOC fraction for both the MCMC and 4DENVar calibrations when f_{doc} was set to 0.15.

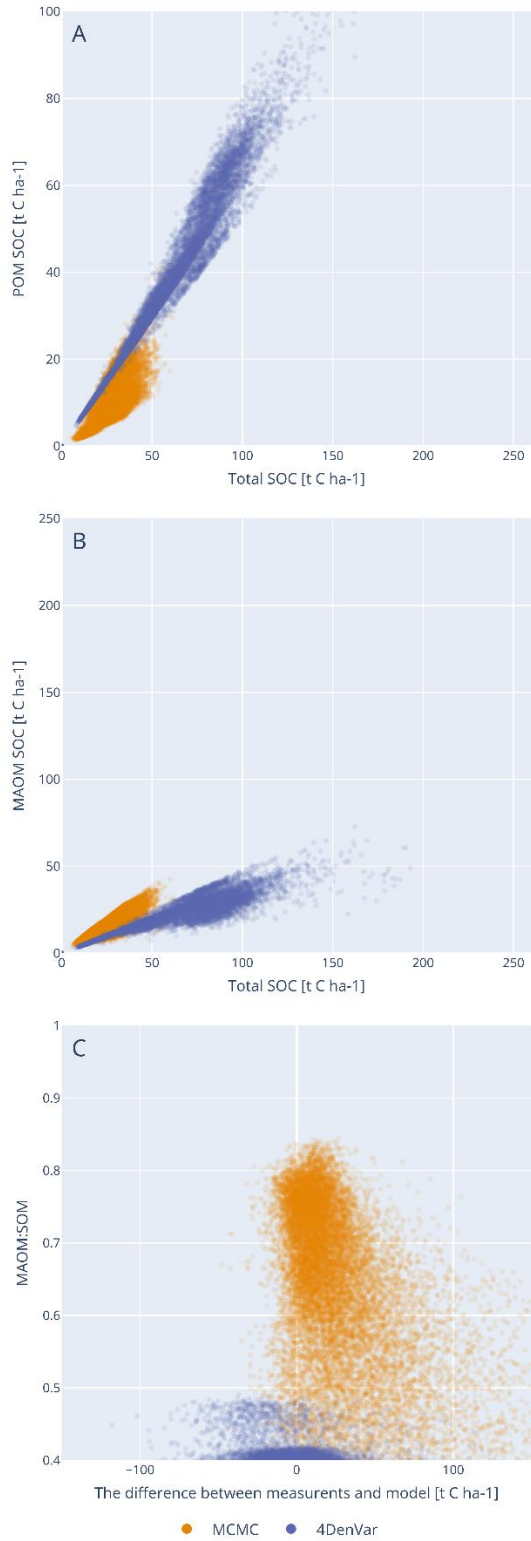


Figure S3: The model projected a) POM, b) MAOM stocks in relation to the total modelled SOC stocks as well as c) The MAOM:SOM ratio in relation to the model error across the LUCAS sites when f_{doc} is 0.35.