Supplement of

Improving Yasso15 soil carbon model estimates with ensemble adjustment Kalman filter state data assimilation

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| parameter | 2.5 % | mean | 97.5 % |
|-----------|-------|------|--------|
| α_A       | 0.44  | 0.49 | 0.54   |
| α_W       | 4.5   | 4.9  | 5.4    |
| α_E       | 0.22  | 0.24 | 0.27   |
| α_N       | 0.075 | 0.095| 0.12   |
| β_WA      | 0.4   | 0.44 | 0.48   |
| β_EA      | 0.044 | 0.25 | 0.46   |
| β_NA      | 0.84  | 0.92 | 0.98   |
| β_AW      | 0.99  | 0.99 | 1.00   |
| β_EW      | 0.0027| 0.084| 0.26   |
| β_NW      | 0.00029| 0.011| 0.041  |
| β_AE      | 1.60E-05| 0.00061| 0.0022|
| β_WE      | 1.20E-05| 0.00048| 0.0018|
| β_NE      | 0.0074| 0.066| 0.14   |
| β_AN      | 2.00E-05| 0.00077| 0.0028|
| β_WN      | 0.086 | 0.1  | 0.12   |
| β_EN      | 0.47  | 0.65 | 0.82   |
| β_1       | 0.084 | 0.091| 0.1    |
| β_2       | -0.00054| -0.00021| -1.20E-05|
| β_N1      | 0.039 | 0.049| 0.059  |
| β_N2      | -0.00029| -7.90E-05| -1.90E-06|
| β_H1      | 0.028 | 0.035| 0.047  |
| β_H2      | -0.0006| -0.00021| -8.60E-06|
| γ_N       | -1.9  | -1.8 | -1.7   |
| γ_H       | -1.5  | -1.2 | -0.91  |
| γ_H       | -20   | -13  | -6.4   |
| δ_W       | 0.0038| 0.0046| 0.0054 |
| δ_N       | 0.0011| 0.0013| 0.0015 |

**Supplemental Table S1:** The calibrated parameter values for Yasso15 used in this manuscript as well as the 95 percentile uncertainty boundaries.
Supplemental Figure S1: Observed and modelled SOC with and without data assimilation (SDA) of all previous measurements using inflation factor of 1.5. The coloured area around the two different SDA estimates are the 95% confidence interval.
Supplemental Figure S2: The mean of prior and posterior distribution SOC pools at Askov B3 before and after each assimilated observation.
Supplemental Figure S3: The mean of prior and posterior distribution SOC pools at Grignon before and after each assimilated observation.
Supplemental Figure S4: The mean of prior and posterior distribution SOC pools at Rothamsted before and after each assimilated observation.
Supplemental Figure S5: The mean of prior and posterior distribution SOC pools at Ultuna before and after each assimilated observation.
Supplemental Figure S6: The mean of prior and posterior distribution SOC pools at Versailles before and after each assimilated observation.