



## Multi-metric evaluation of an ensemble of biogeochemical models for the estimation of organic carbon content in long-term bare fallow soils

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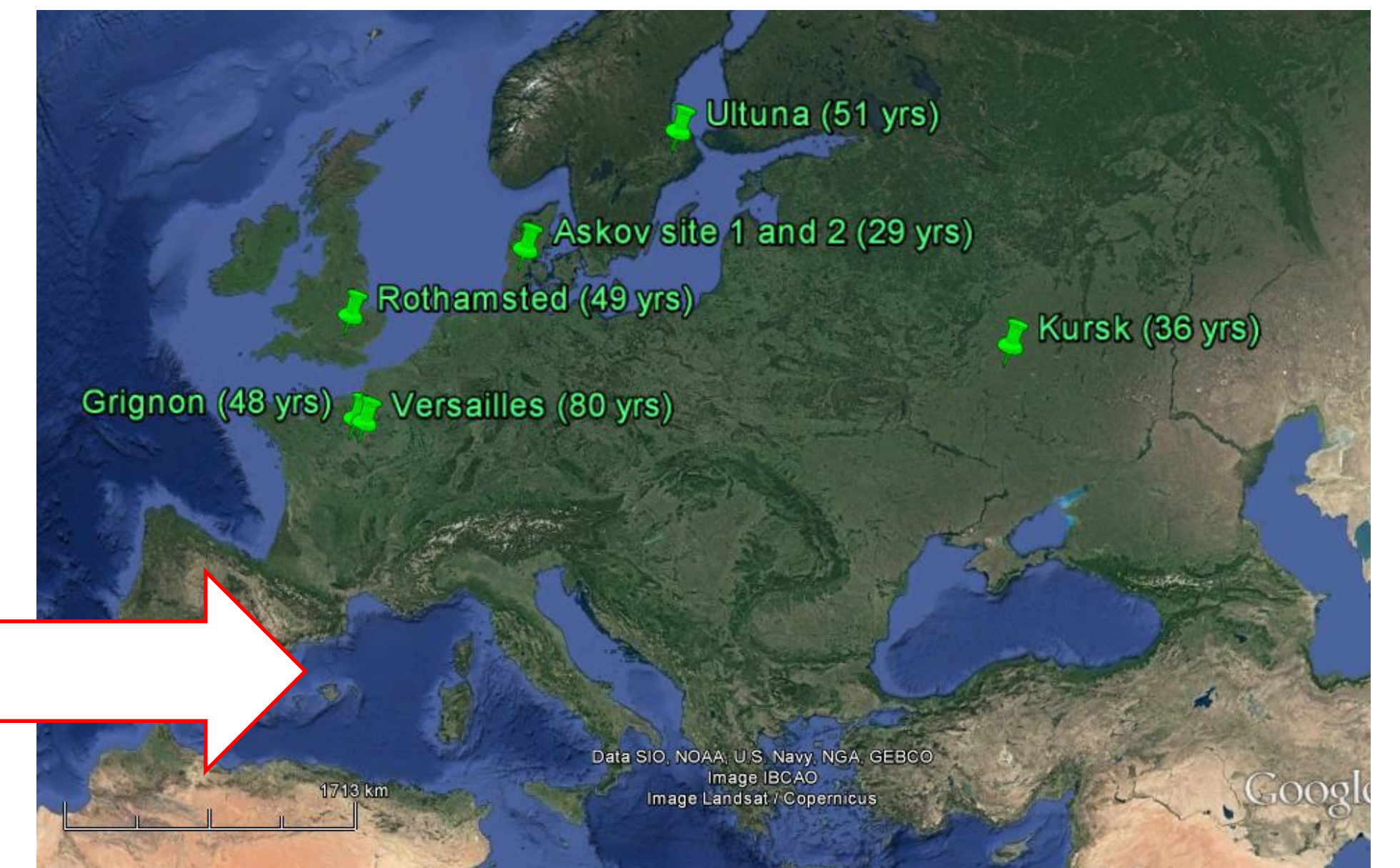
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# Multi-metric evaluation of an ensemble of biogeochemical models for the estimation of organic carbon content in long-term bare fallow soils

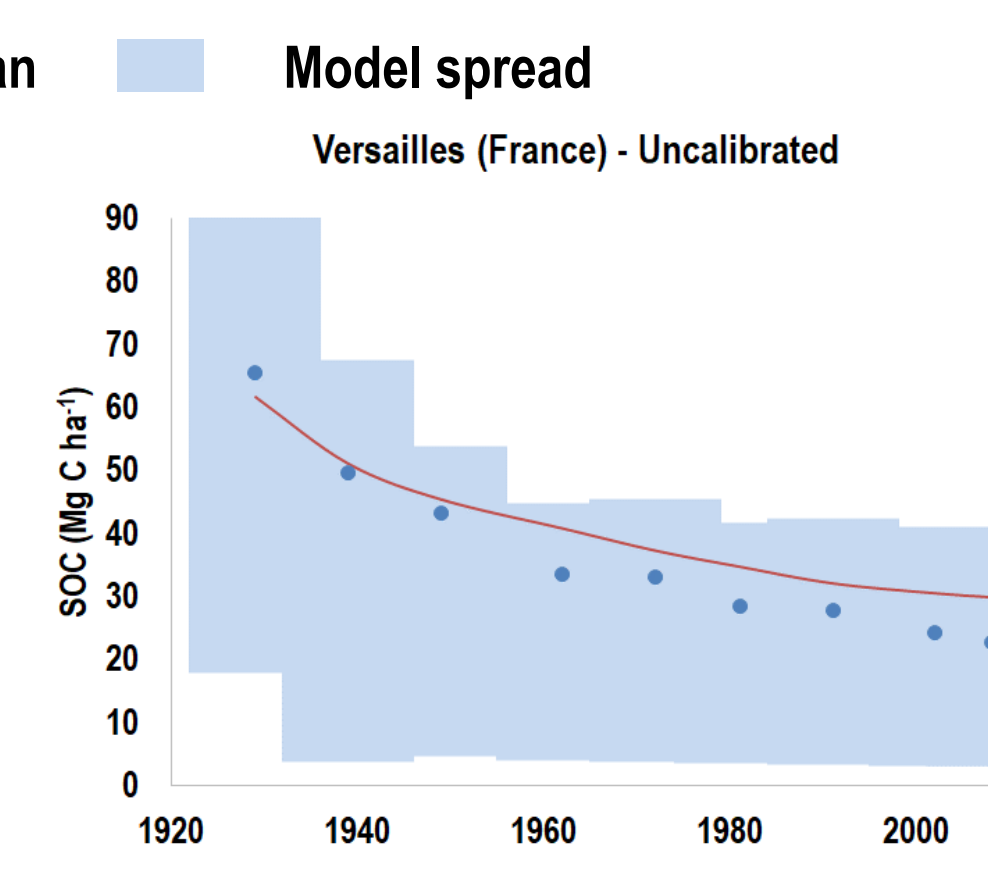
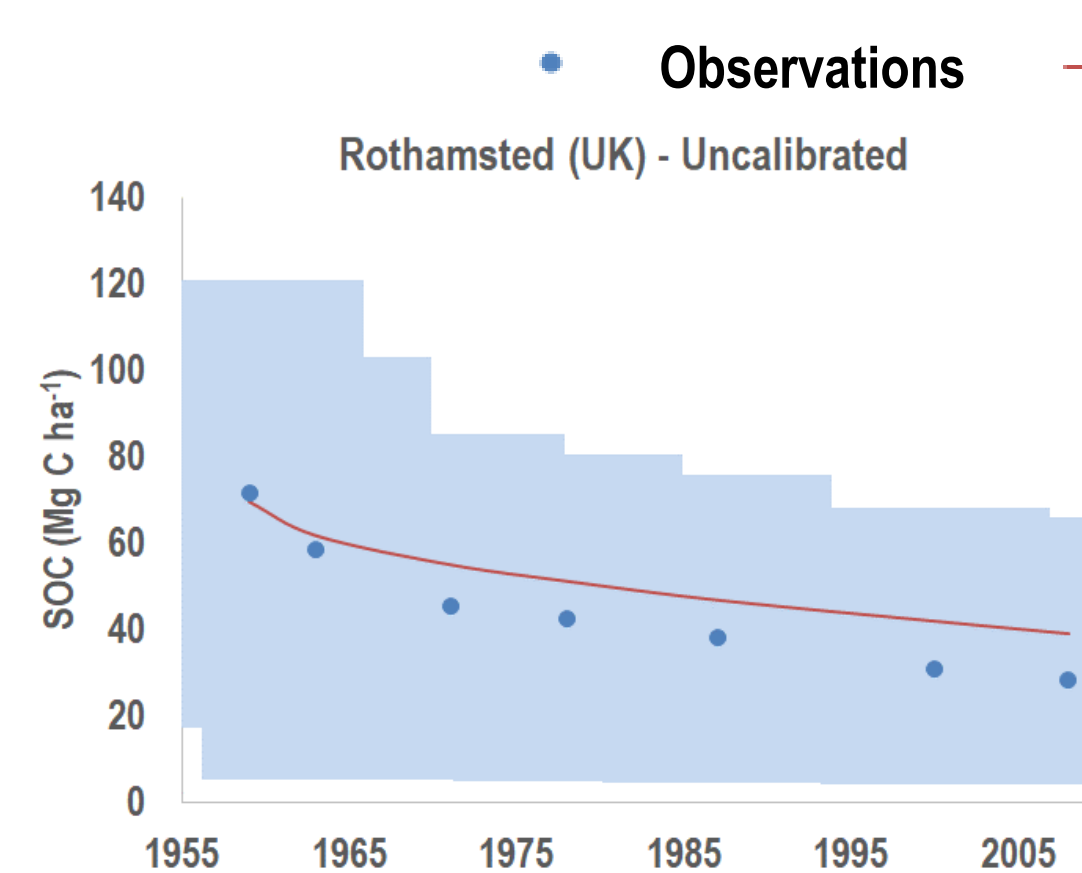
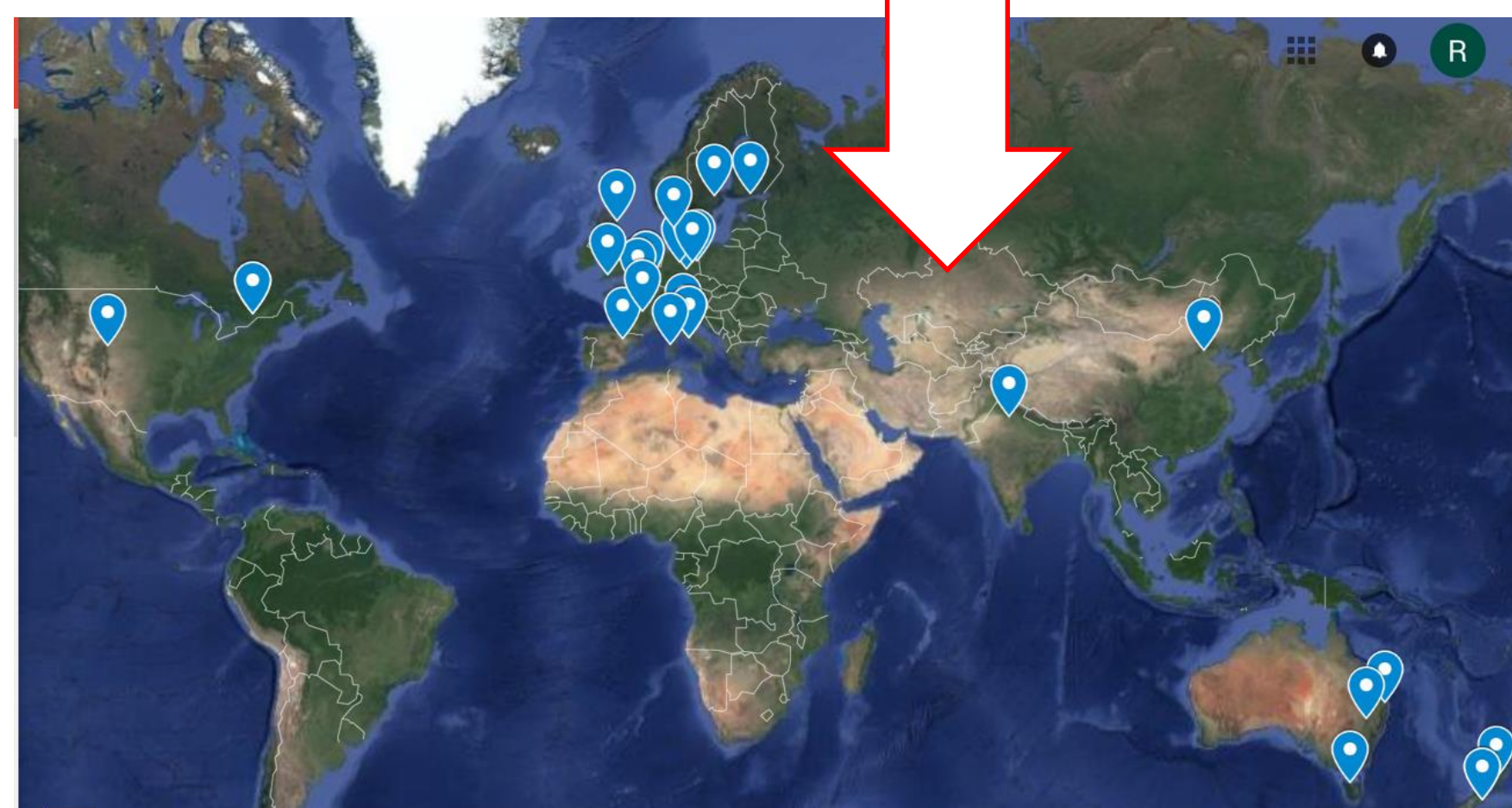
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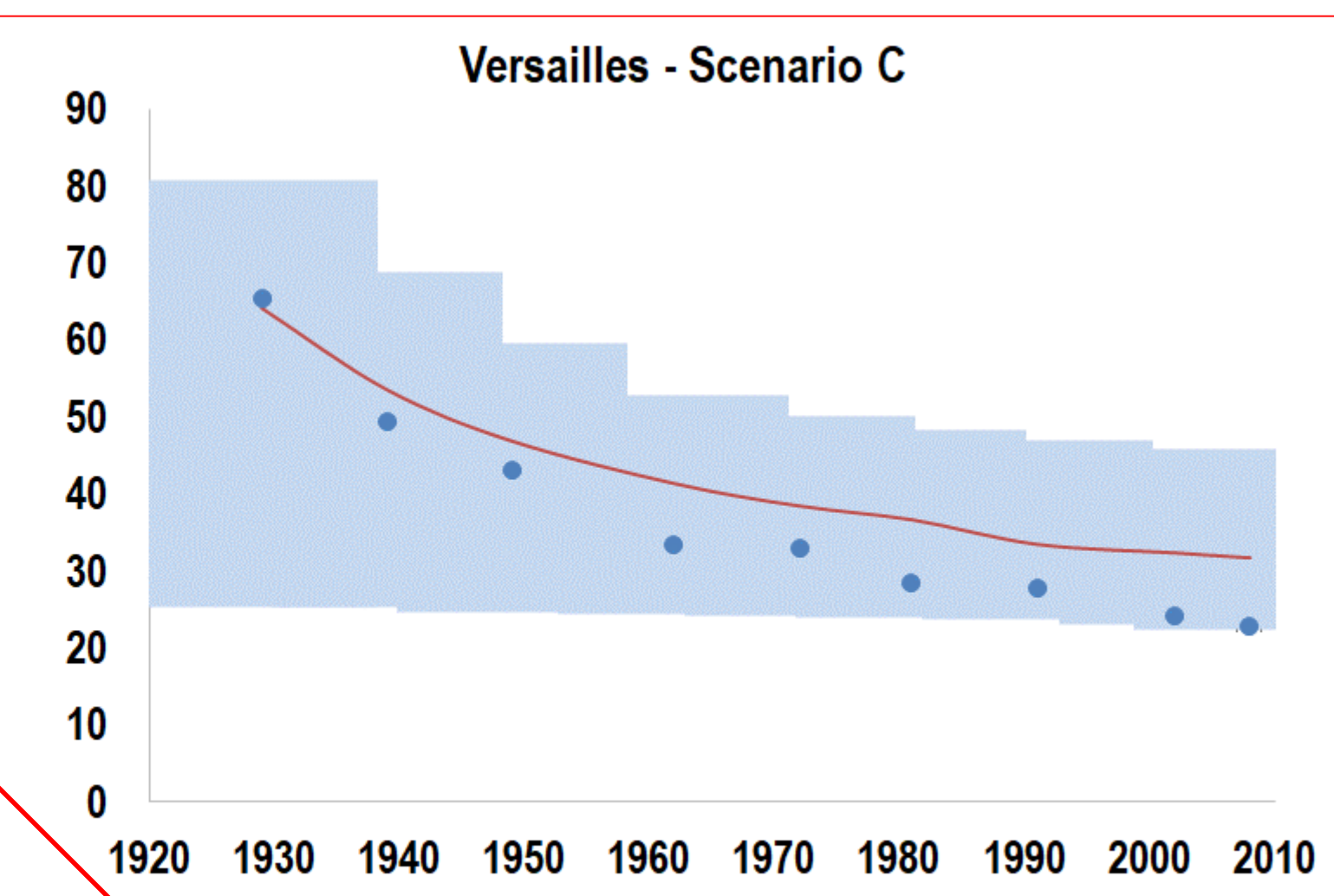
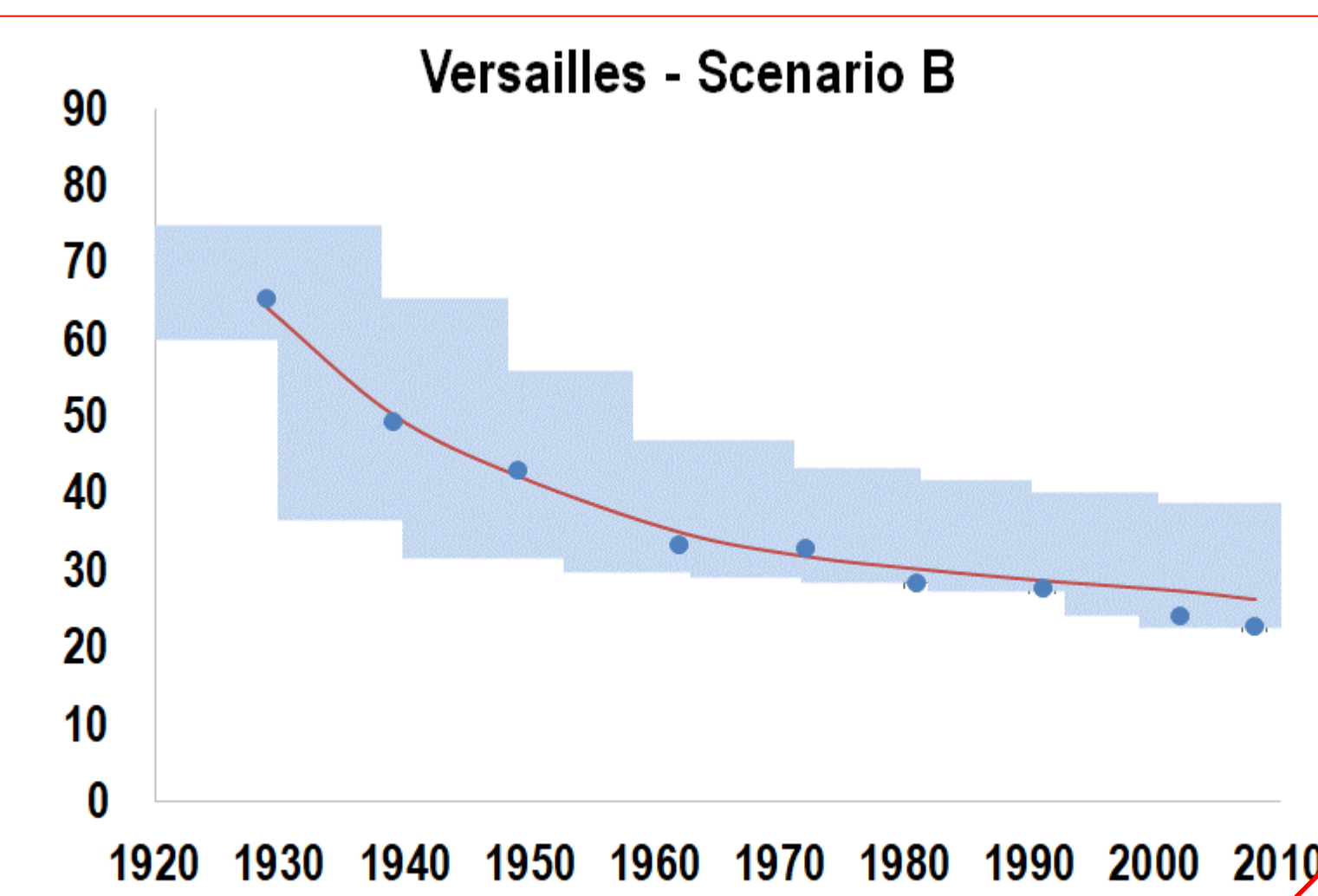
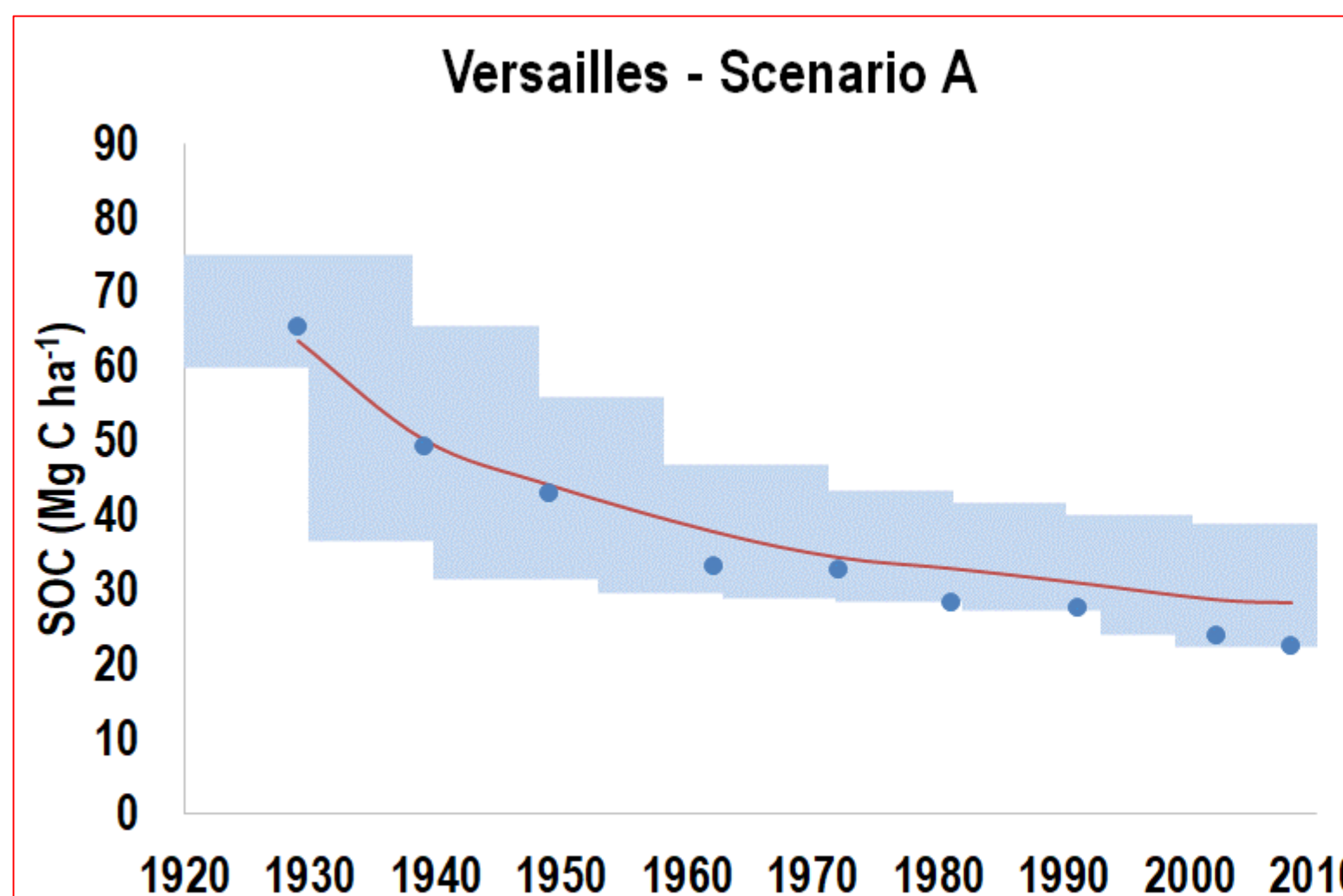
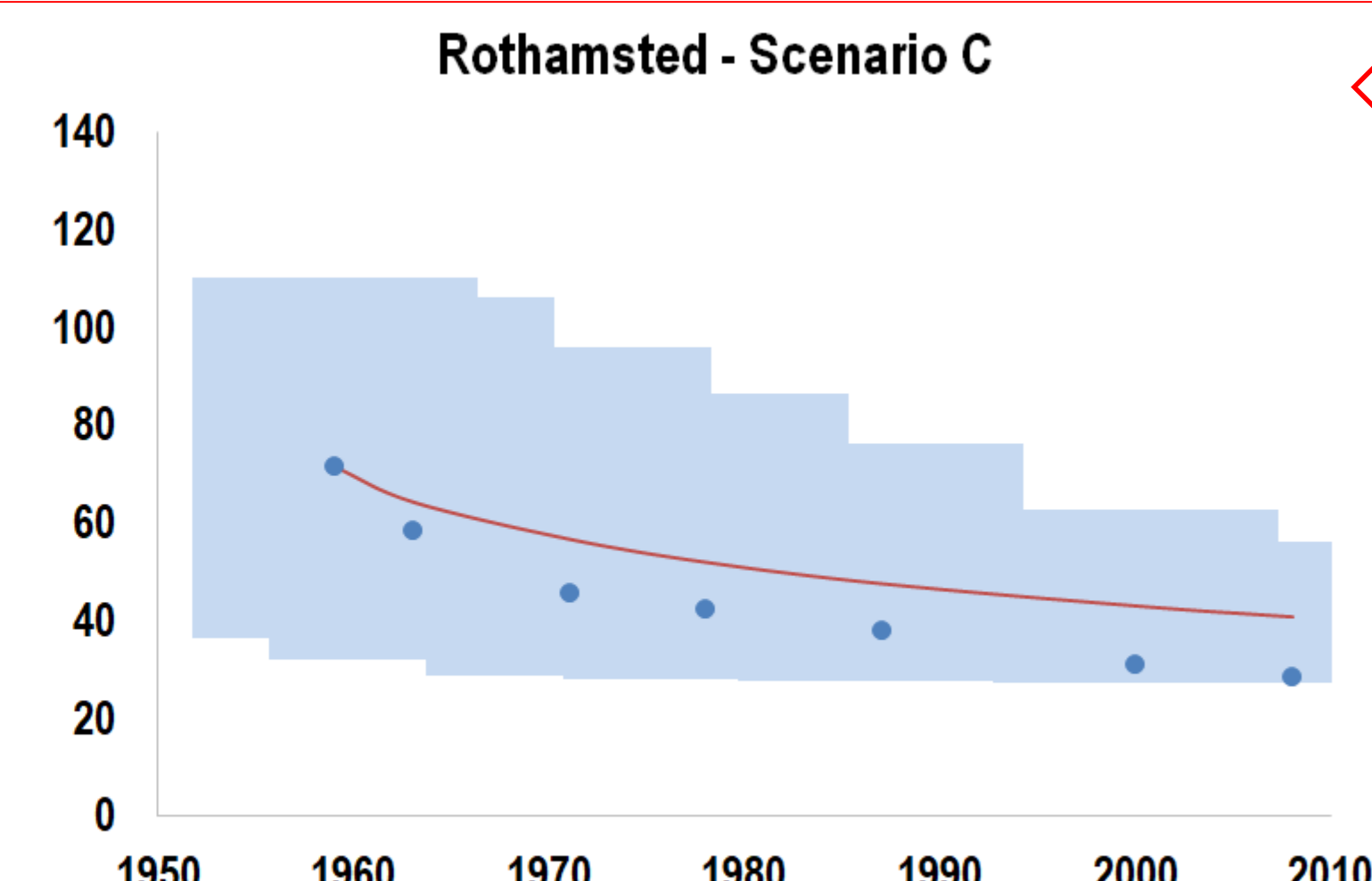
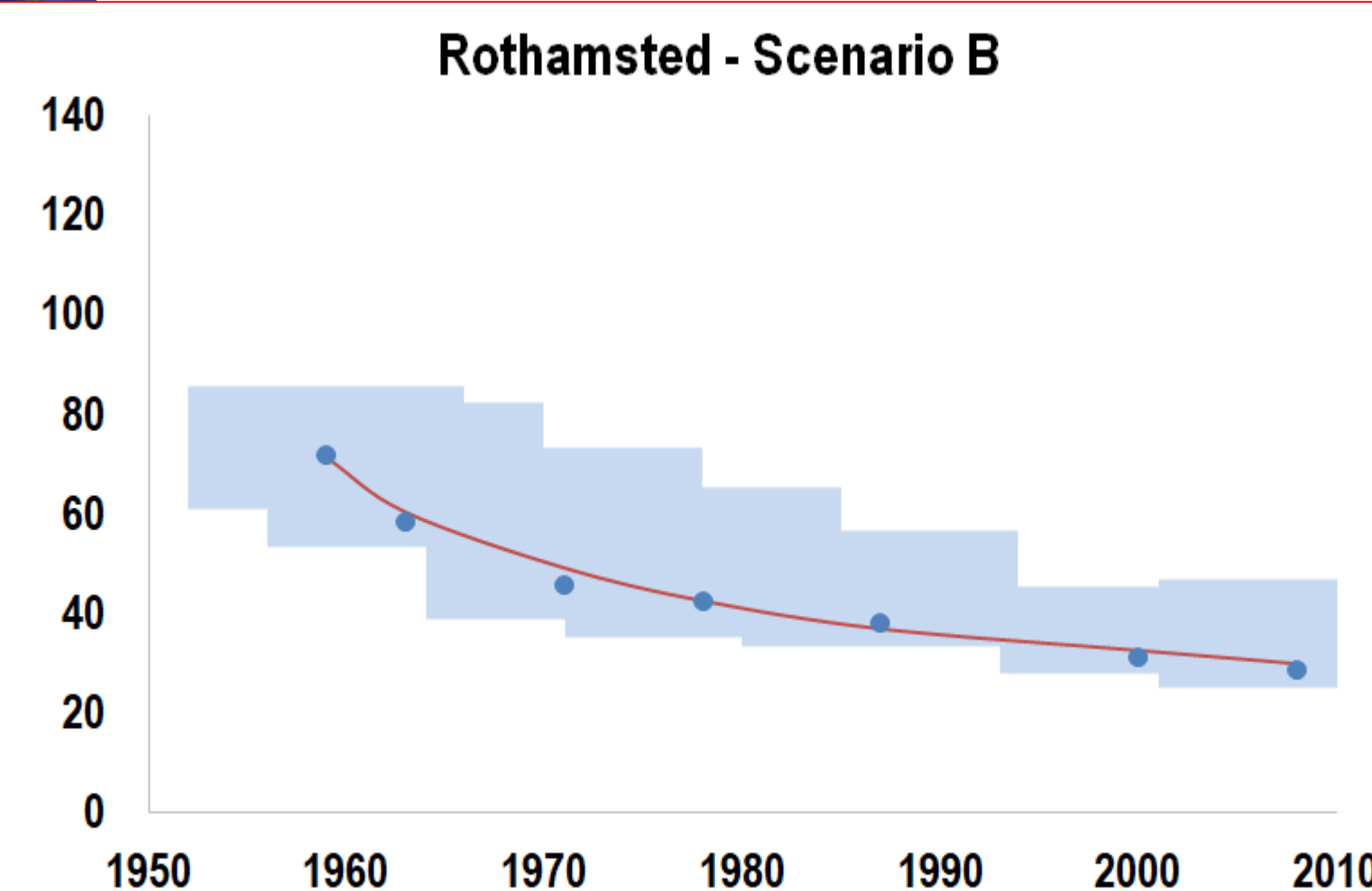
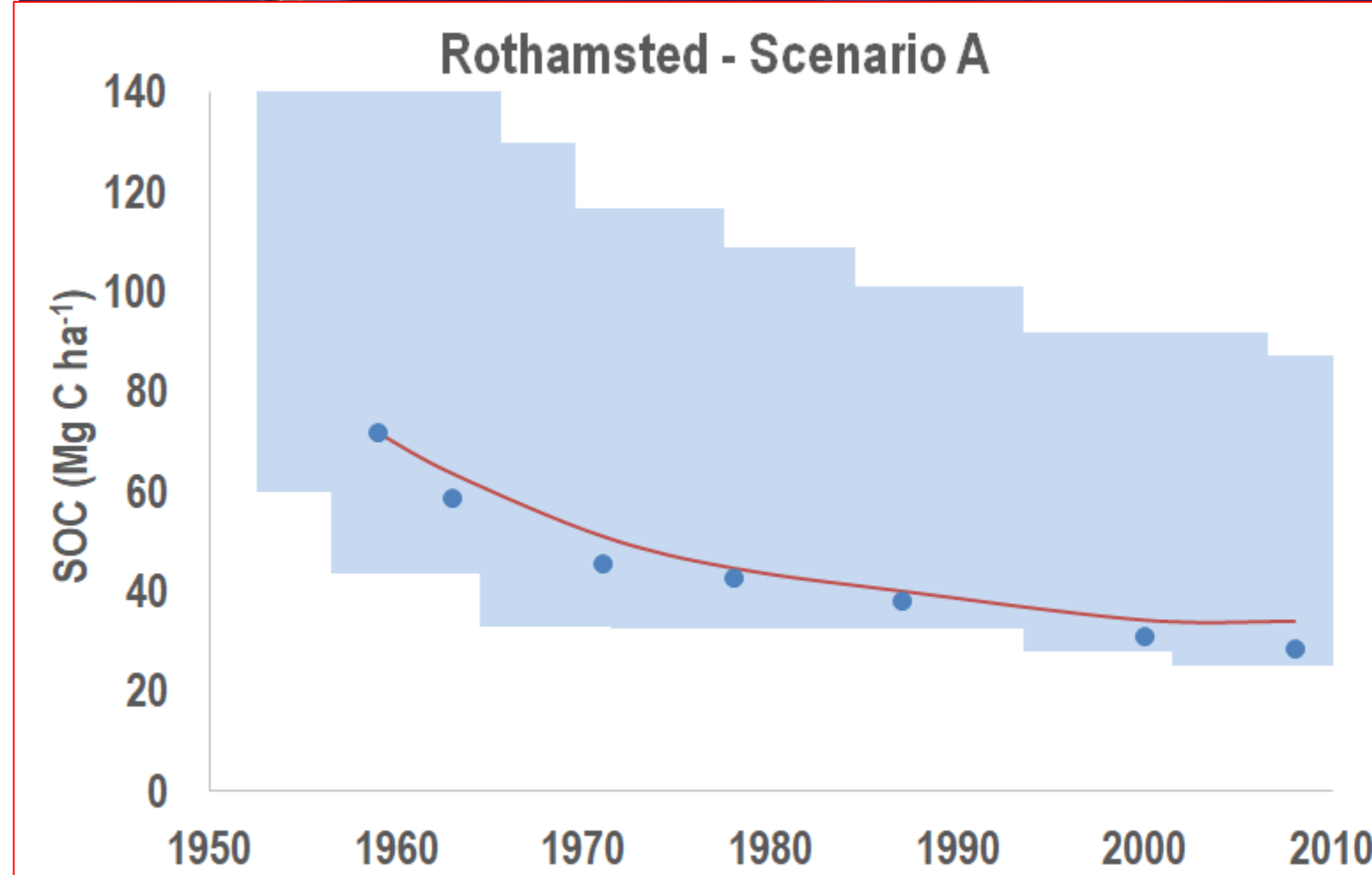
- C sequestration in agricultural soils contributes to the achievement of COP-21's "4 per 1000" initiative and there is a need of **reliable methodologies to assess soil C sequestration potential** of agricultural lands
- As part of international benchmarking actions, the C-MIP action was initiated in 2016 to address the question of whether **ensemble modelling** could improve the simulation of soil organic carbon (SOC) dynamics
- A network of six **long-term bare fallow (LTBF) experiments** offer ideal conditions to assess SOC simulations
- A multi-model ensemble with **process-based models** from 25 teams worldwide was implemented to compare simulations (before and after model calibration) to SOC data



## Two study sites



## Uncalibrated models



## Calibration scenarios

| Model category               | Factors                        | Approaches        | Scenarios |   |   |
|------------------------------|--------------------------------|-------------------|-----------|---|---|
|                              |                                |                   | A         | B | C |
| Spin-up (SP) based models    | Historical management/land use | Site-specific     | X         | X |   |
|                              |                                | Generic/universal |           |   | X |
|                              | Decomposition processes        | Site-specific     |           | X |   |
|                              |                                | Generic/universal | X         |   | X |
| No spin-up (NS) based models | Partitioning of C pools        | Site-specific     | X         | X |   |
|                              |                                | Generic/universal |           |   | X |
|                              | Decomposition processes        | Site-specific     |           | X |   |
|                              |                                | Generic/universal | X         |   | X |

- The multi-model approach (multi-model median) represents SOC dynamics more accurately than individual models
- Calibration improves SOC simulations and reduces model variability according to different scenarios

| Site       | Model Quality Indicator – Multi-Model Median<br>(best, 0≤MQI≤1, worst) |                   |        |        |
|------------|------------------------------------------------------------------------|-------------------|--------|--------|
|            | Uncalibrated models                                                    | Calibrated models |        |        |
|            |                                                                        | A                 | B      | C      |
| Rothamsted | 0.2785                                                                 | 0.2510            | 0.2320 | 0.2707 |
| Versailles | 0.2683                                                                 | 0.2415            | 0.2435 | 0.2631 |

- Multi-metric indicator reflects the balance between model agreement and complexity

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