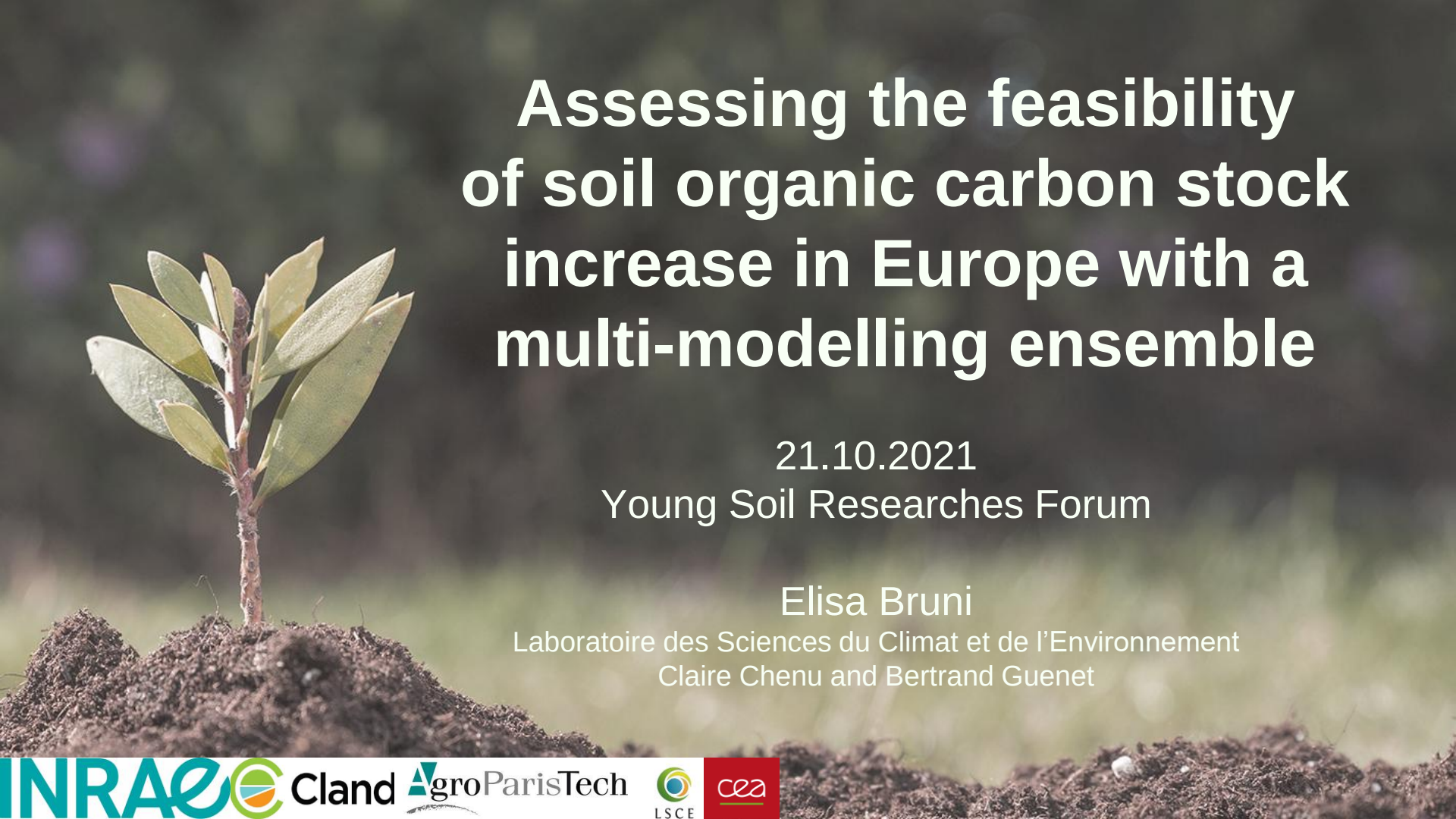


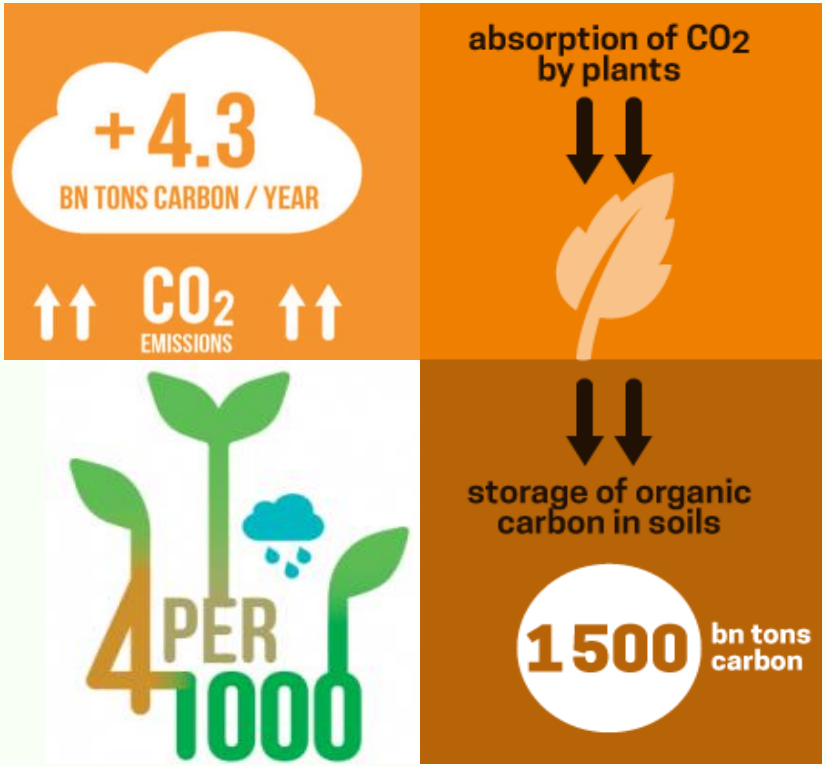
Assessing the feasibility of soil organic carbon stock increase in Europe with a multi-modelling ensemble

21.10.2021
Young Soil Researches Forum

Elisa Bruni
Laboratoire des Sciences du Climat et de l'Environnement
Claire Chenu and Bertrand Guenet

CONTEXT

The 4 per 1000 initiative



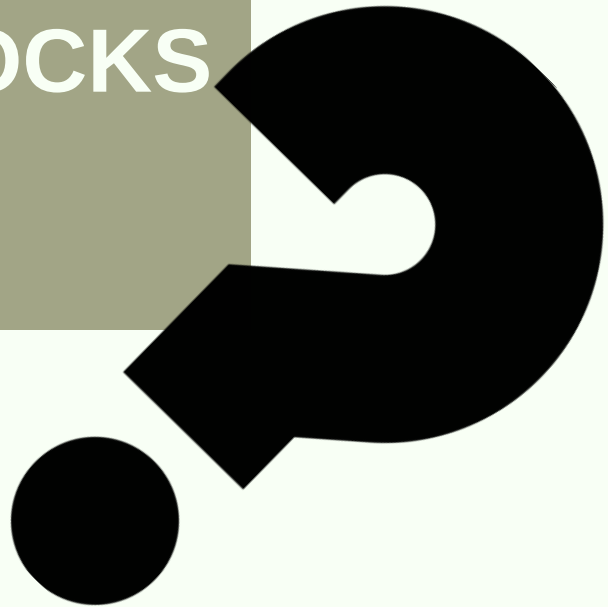
www.4p1000.org

Increasing soil organic carbon stocks

Increase
C inputs

Decrease
C outputs

ESTIMATE THE CARBON INPUT REQUIRED TO INCREASE SOC STOCKS BY 4 PER 1000



METHODS

1 Century

Biogeosciences, 18, 3981–4004, 2021
https://doi.org/10.5194/bg-18-3981-2021

Biogeosciences Open Access EGU

Additional carbon inputs to reach a 4 per 1000 objective in Europe: feasibility and projected impacts of climate change based on Century simulations of long-term arable experiments

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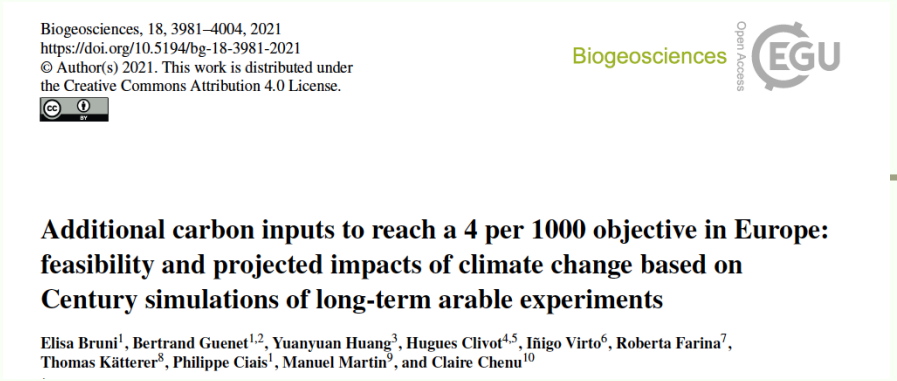
1 Century

2 Multi-modelling



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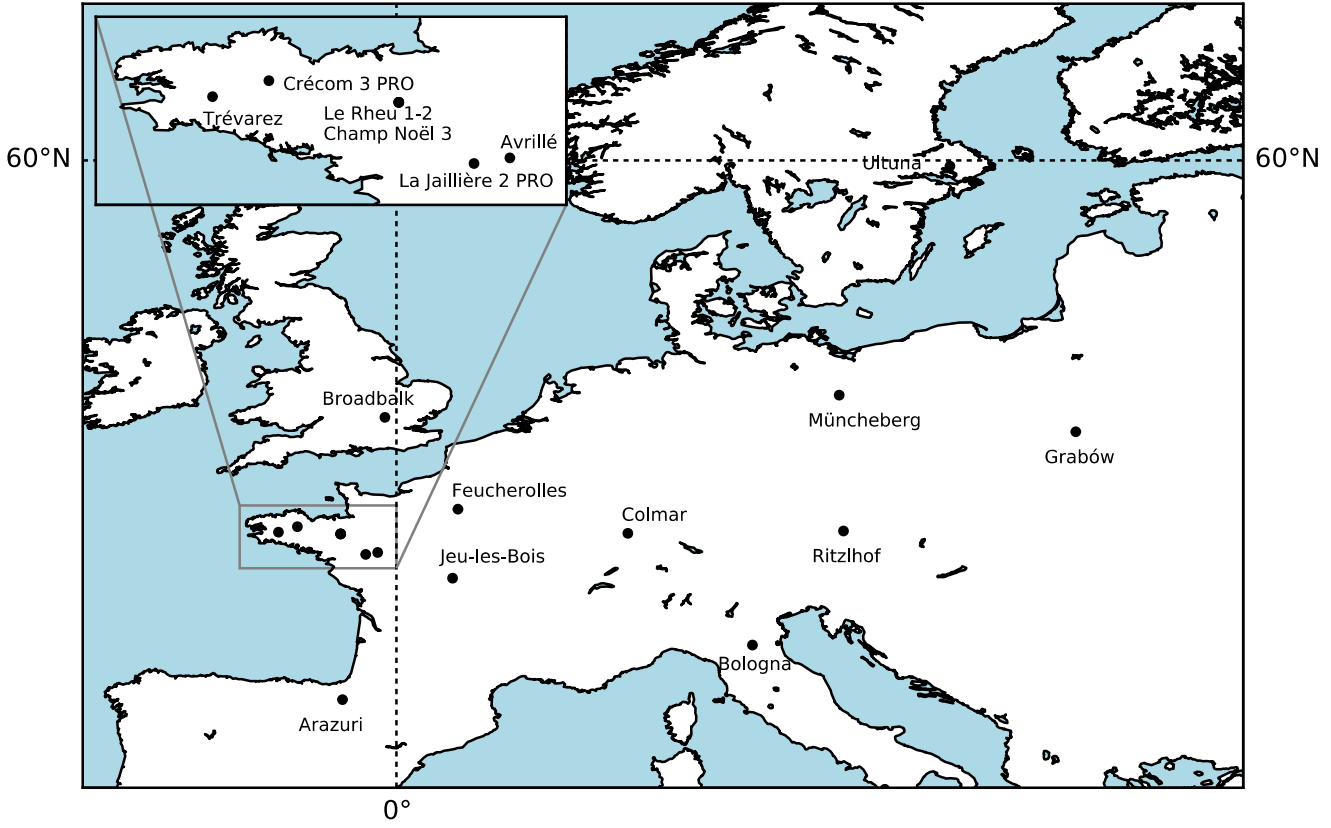
Century
Roth-C
ICBM
AMG
MIMICS
Millennial

17 long-term agricultural experiments

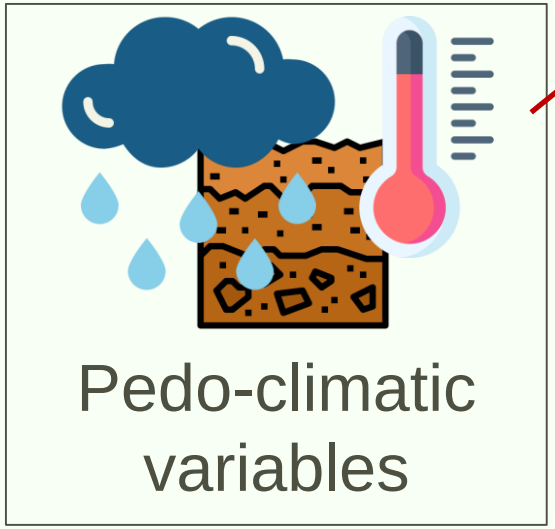
46 exogenous organic matter treatments

SOC stocks measured at several dates



1

Forward simulations

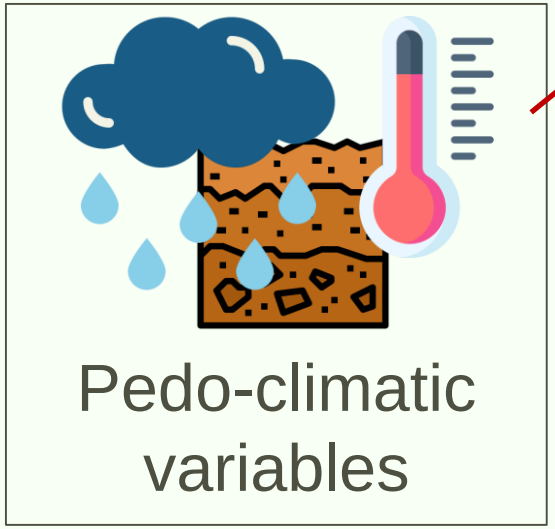


MODELS

SOC STOCKS

2

Calibration of models parameters

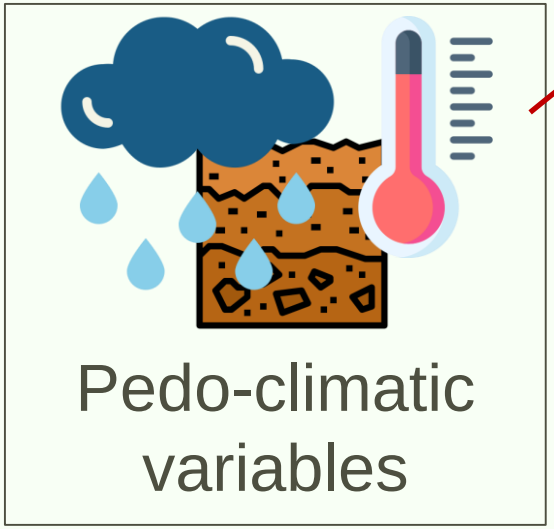


MODELS

SOC STOCKS

3

Inverse modelling



Pedo-climatic variables

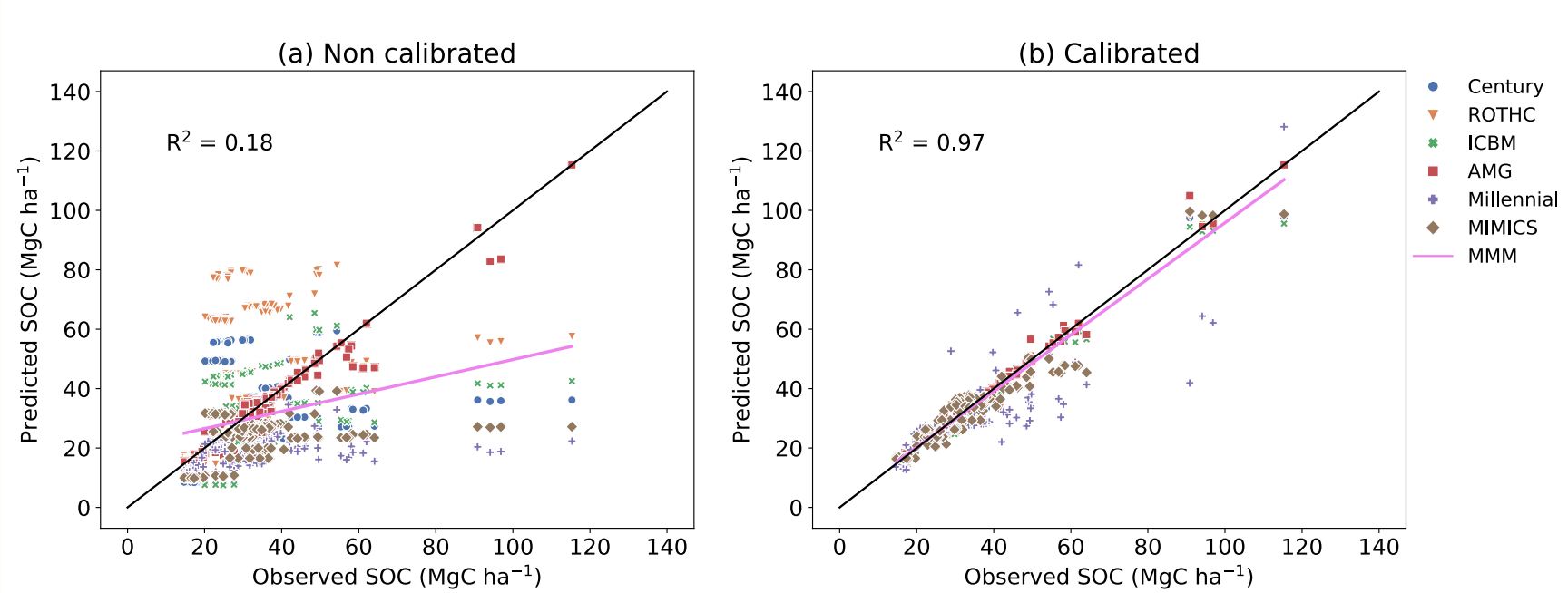
MODELS

SOC STOCKS

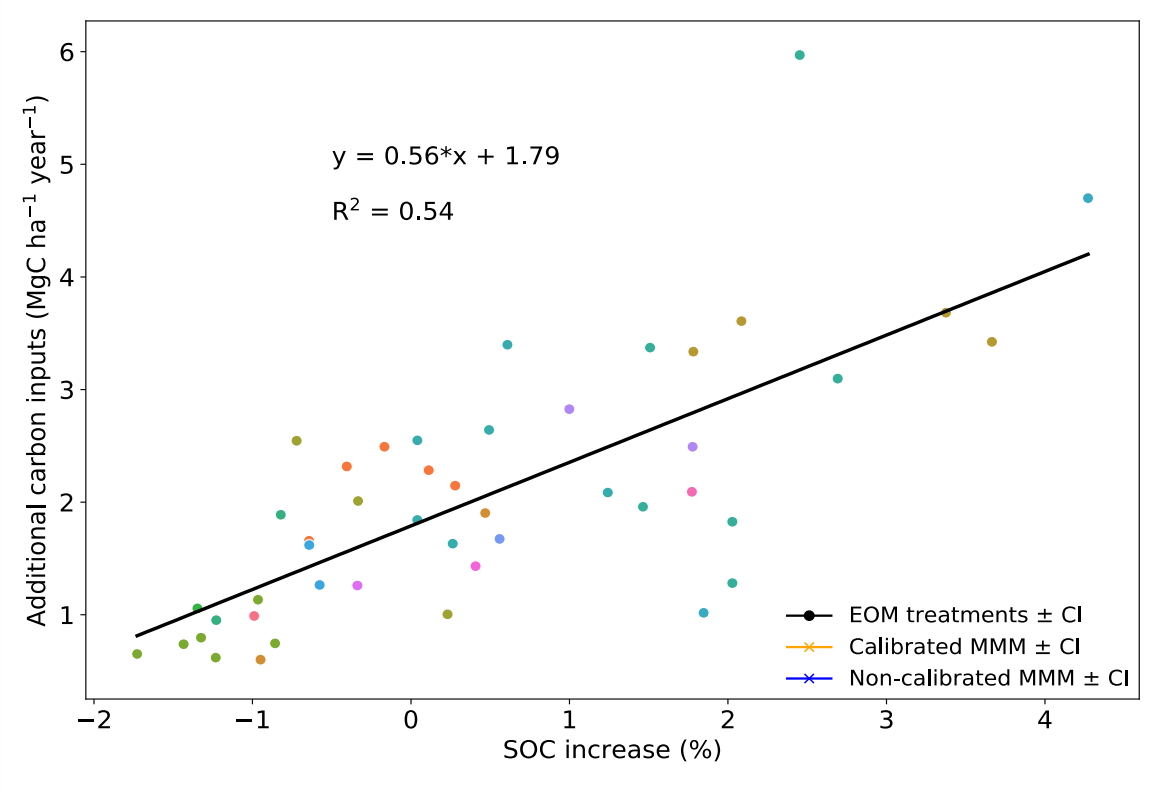
RESULTS

Validation

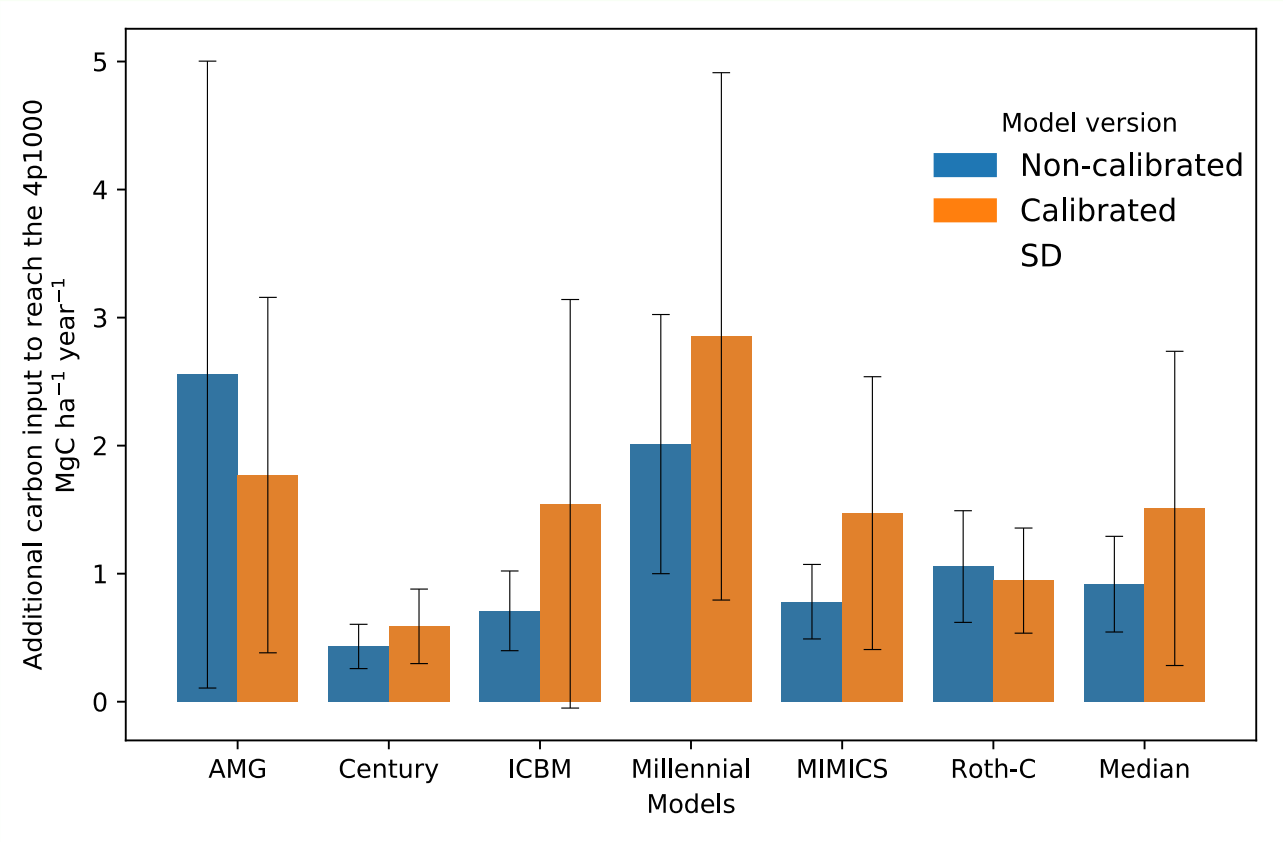
The calibrated ensemble fits SOC stocks

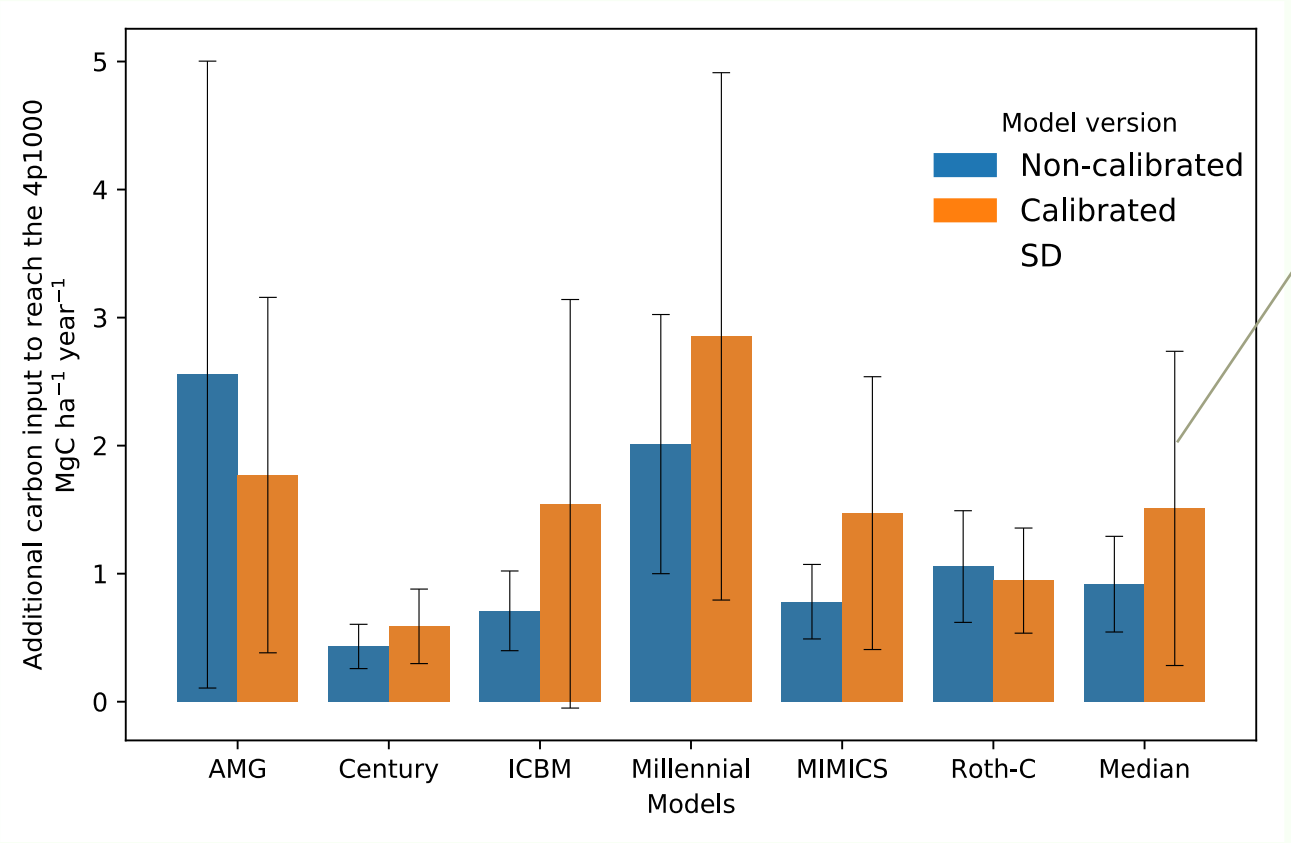


Simulated additional C input to reach the 4 per 1000 in line with EOM

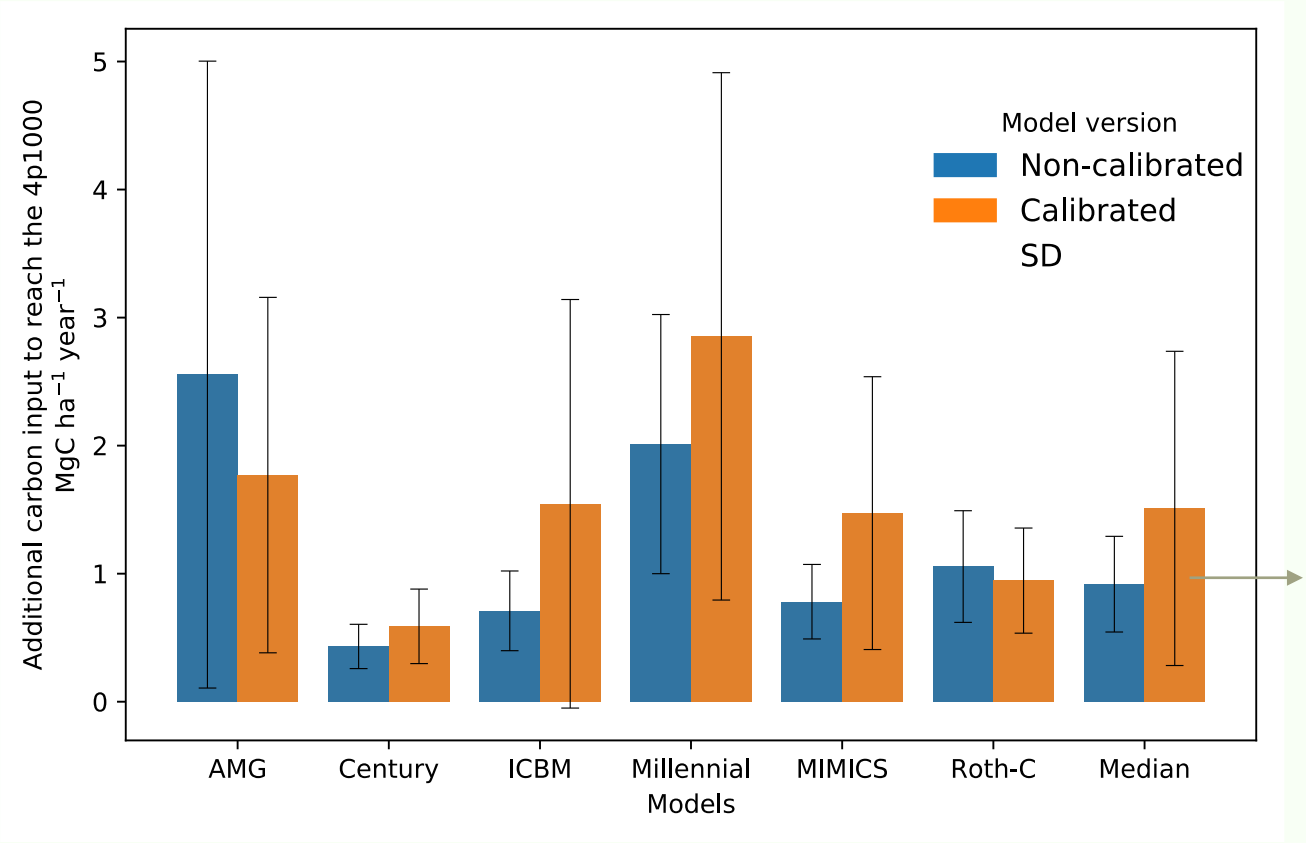


Reaching the 4 per 1000 objective

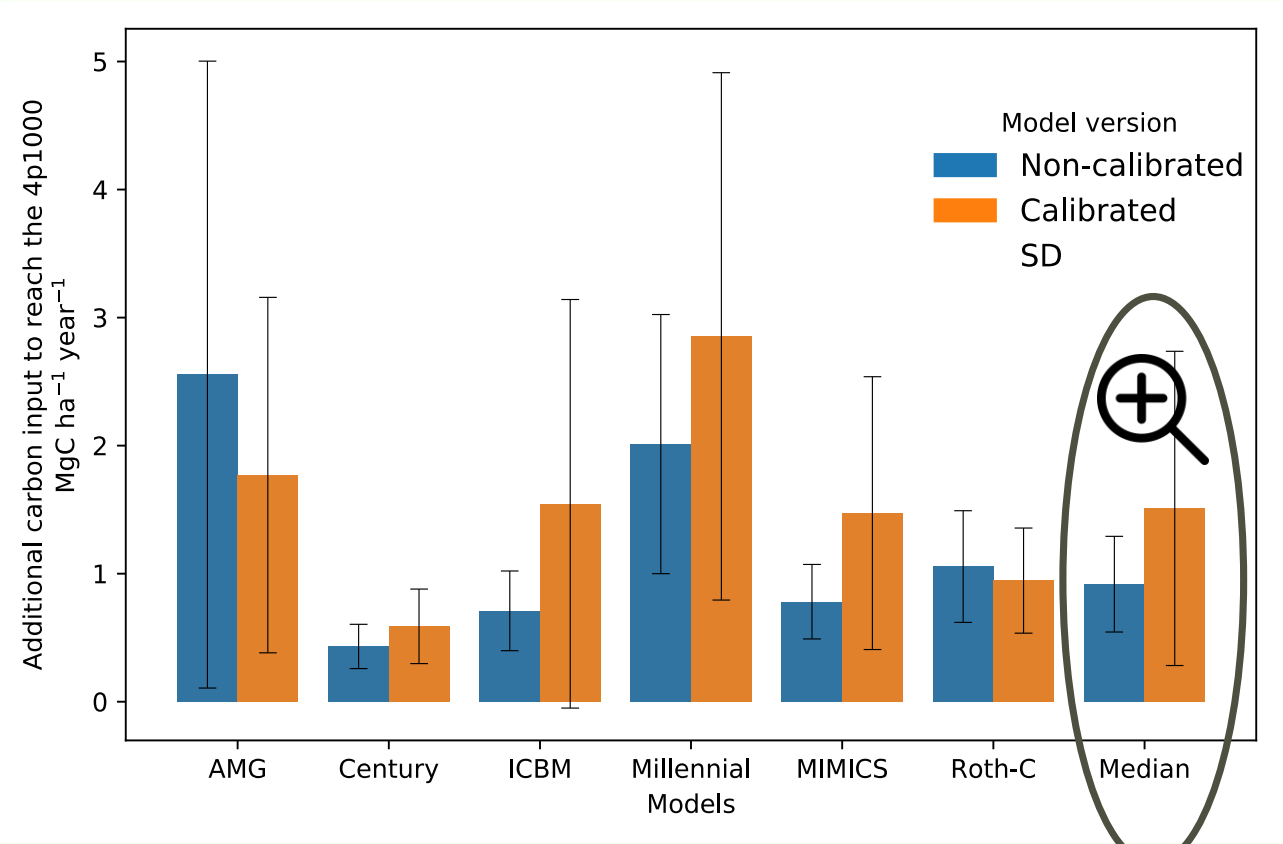

Additional carbon input to reach the 4p1000
MgC ha^{-1} year^{-1}
0
1
2
3
4
5
Model version
Non-calibrated
Calibrated
SD
AMG
Century
ICBM
Millennial
MIMICS
Roth-C
Median
Models



Higher variability across sites when models are calibrated



High variability among the different models in both configurations


Additional carbon input to reach the 4p1000
MgC ha^{-1} year^{-1}
0
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2
3
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Model version
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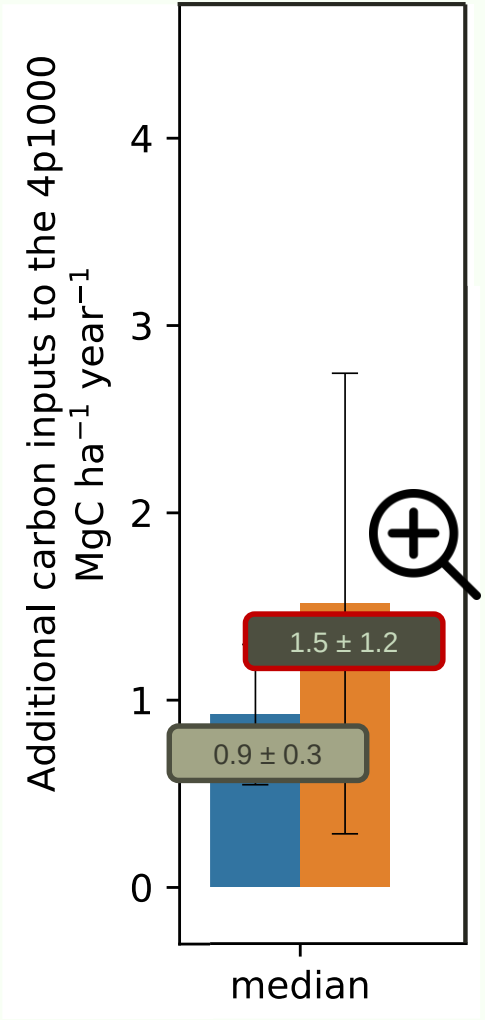
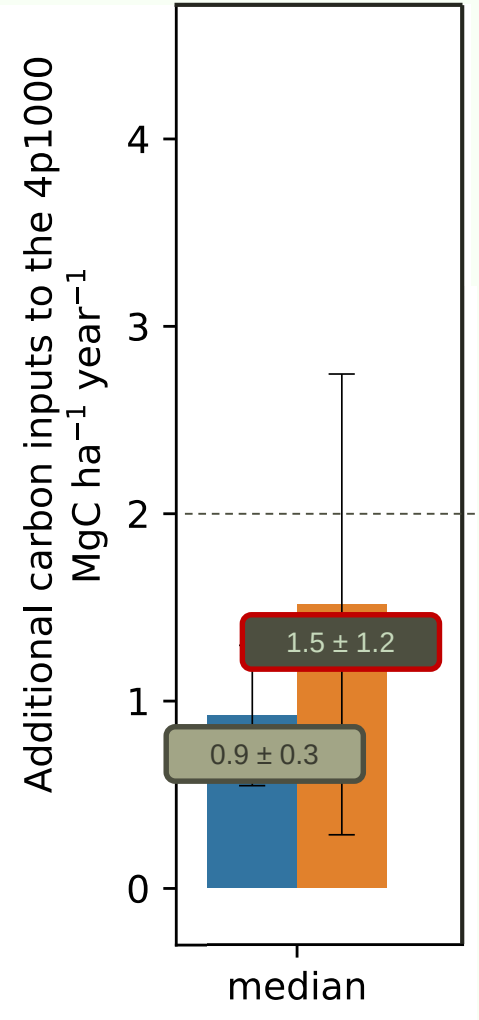
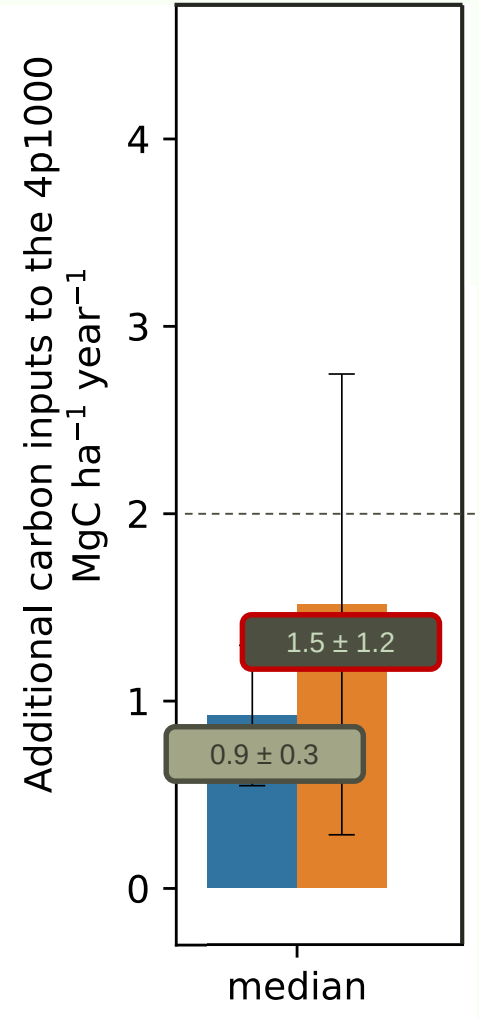

Additional carbon inputs to the 4p1000
MgC ha^{-1} year^{-1}
4
3
2
1
0
1.5 ± 1.2
0.9 ± 0.3
median



Average C input in EOM treatments:

2.1 ± 1.1

And what about the EOM treatments?



Average C input in EOM treatments:

2.1 ± 1.1

1.6

0.5

And what about the EOM treatments?

Conclusion

- Increasing SOC stocks seems feasible under some experimental conditions

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- Hard to achieve at a large scale since high levels of C input must be employed

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- The calibration improved the simulation of SOC stocks

Conclusion

- Increasing SOC stocks seems feasible under some experimental conditions
- Hard to achieve at a large scale since high levels of C input must be employed
- The calibration improved the simulation of SOC stocks
- High variability among different models

THANK YOU

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