The ecotron as controlled surrogate for reality.
Too good to be true?

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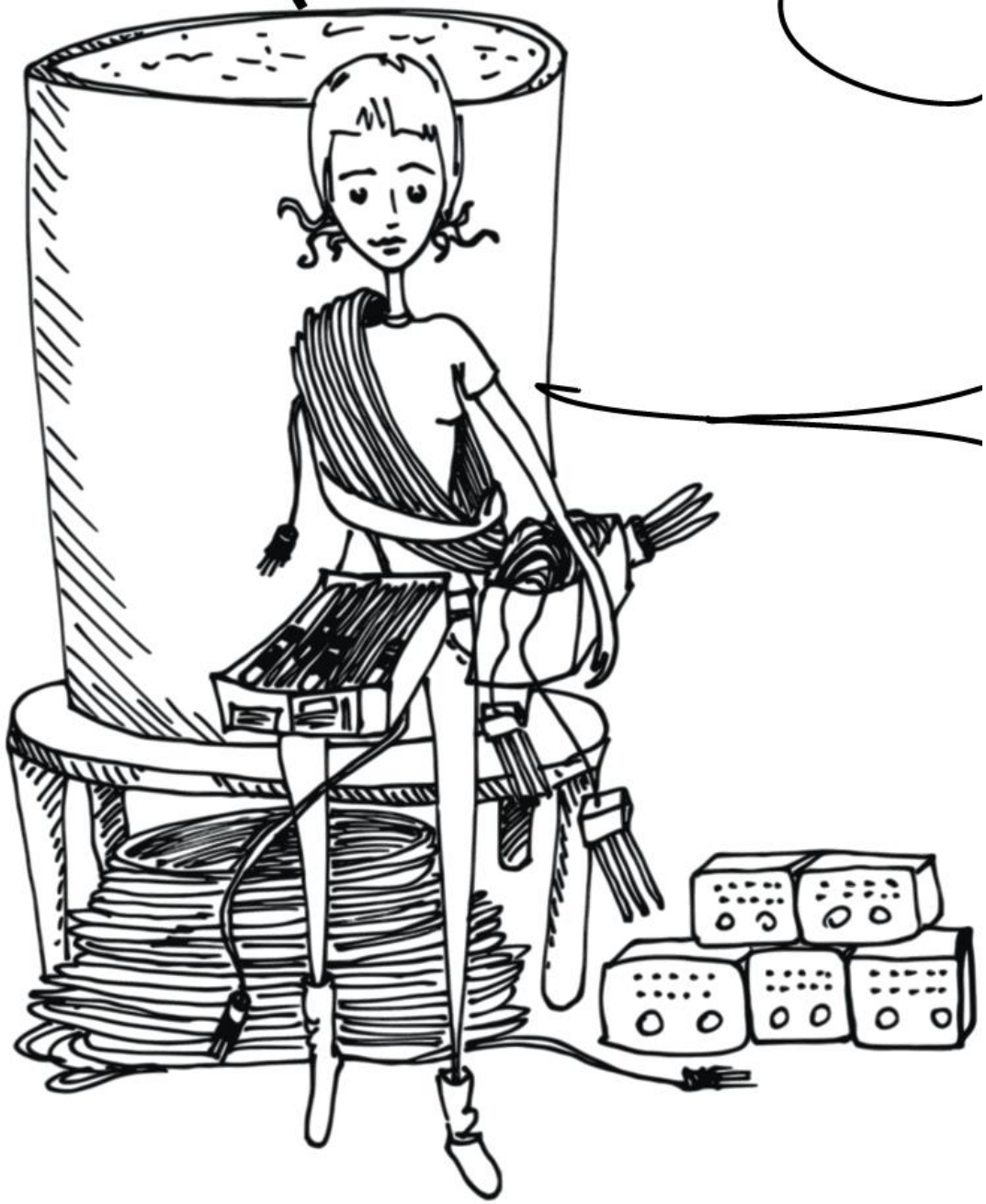
TERENO International conference 2018 | Berlin



Drawing graphic acknowledgements PhD

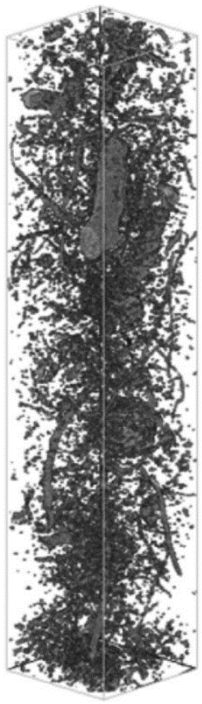
How adapt to climate change?

How can we preserve ecosystems and the services they deliver?

Ecotron Uhasselt, Belgium

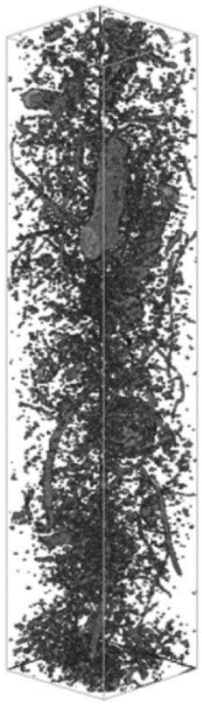
Design new ecosystems?

SCALE GAP



8.5 cm

SCALE GAP



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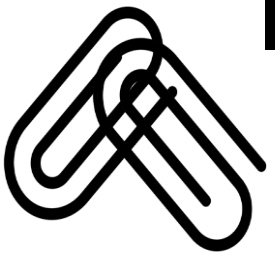
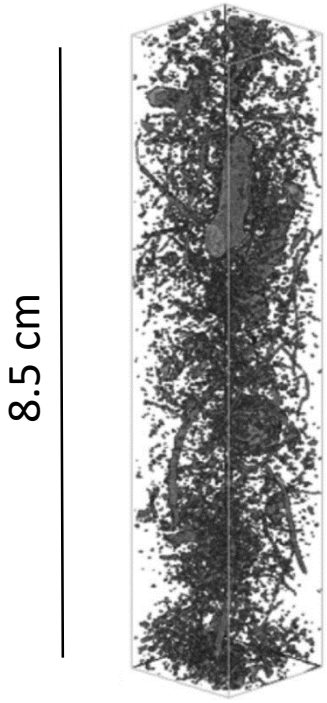


Intertwined processes

SCALE GAP

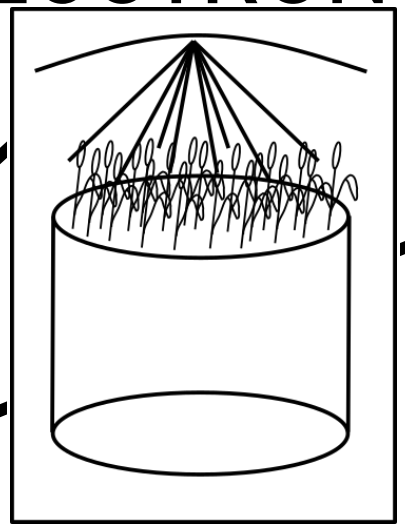
MODELS?

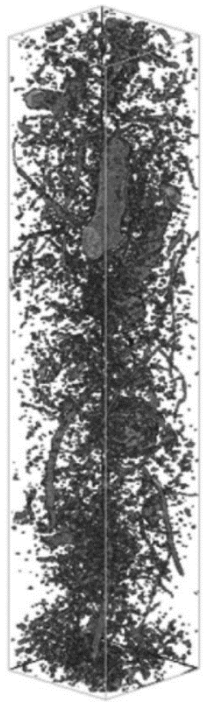


Intertwined processes

SCALE GAP

ECOTRON?





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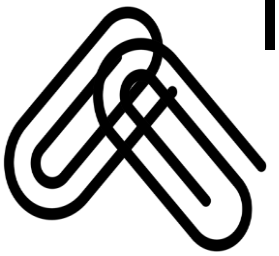


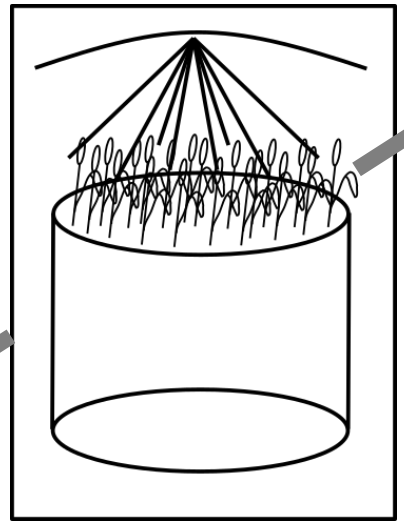
Intertwined processes

MODELS

Calibration
Model improvement

+

Experimental
design



Upscaling

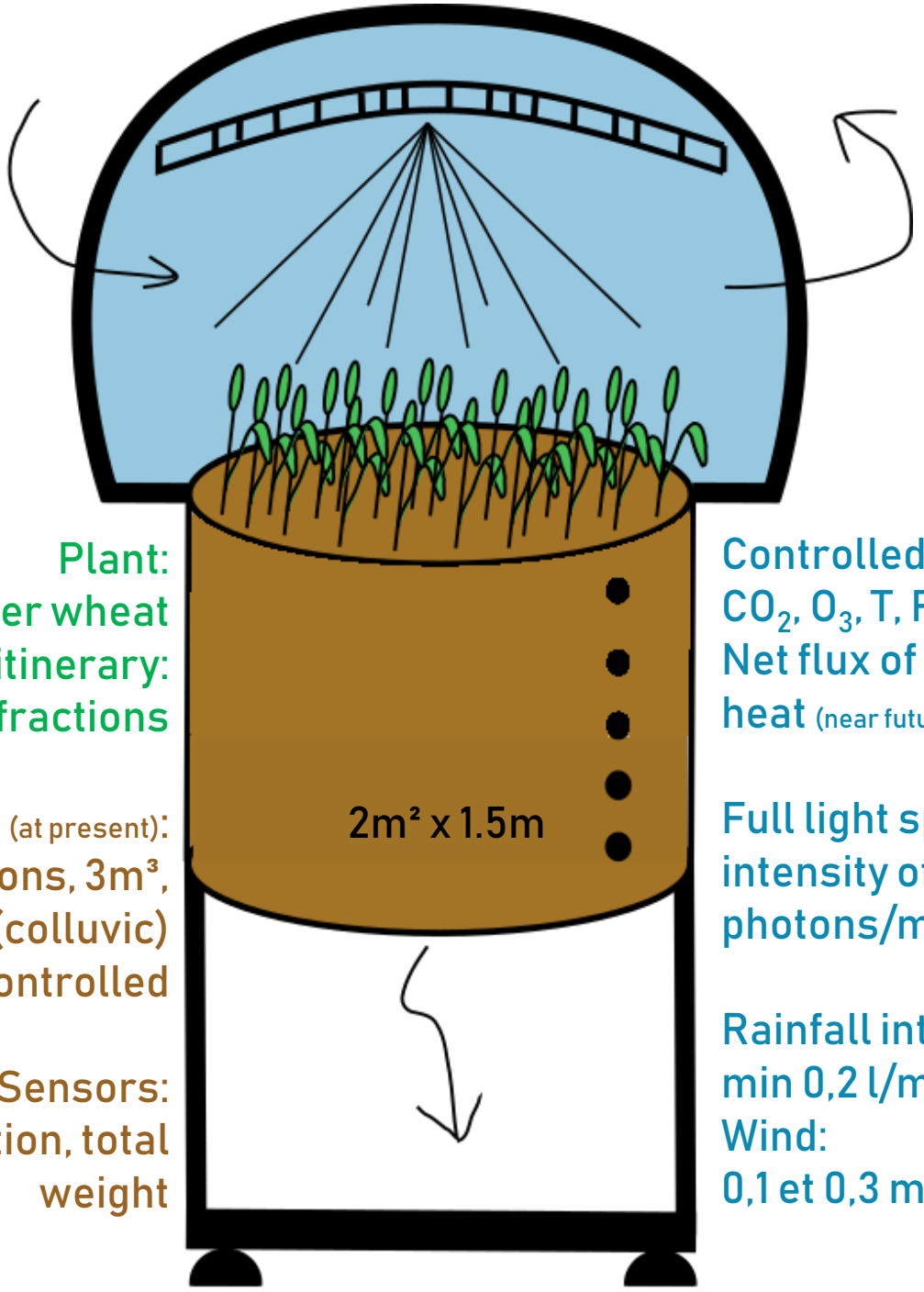
Downscaling

« An ECOTRON is a facility where ecosystems are *confined* in experimental chambers, allowing the simultaneous *control* of environmental conditions and the on-line monitoring of processes »

ECOTRON

a tool to quantify the effect of current and future climate on our reality

LIÈGE université
Gembloux
Agro-Bio Tech



Plant:
Winter wheat
Technical itinerary:
180 kgN/ha, 3 fractions

Reconstructed soil (at present):
2 horizons, 3m³,
cutanic Luvisol (colluvic)
Soil T and h controlled

Sensors:
T, WC, h, soil solution, total weight

Controlled atmosphere
CO_2, O_3, T, RH, Rainfall
Net flux of CO2, H2O, sensible heat (near future)

Full light spectrum
intensity of max 1200 µmole photons/m²/s

Rainfall intensity
min 0,2 l/min; max 7 l/min
Wind:
0,1 et 0,3 m/s

Measurement of process & state variables

High number of controlled variables

Possibility to reach tipping points (resilience limits) by increasing a constraint

Experiment 0

Field 2015

ICOS labelled site,
Lonzée BE

Ecotron 2015

Meteorological conditions 2015

#3

Ecotron 2091

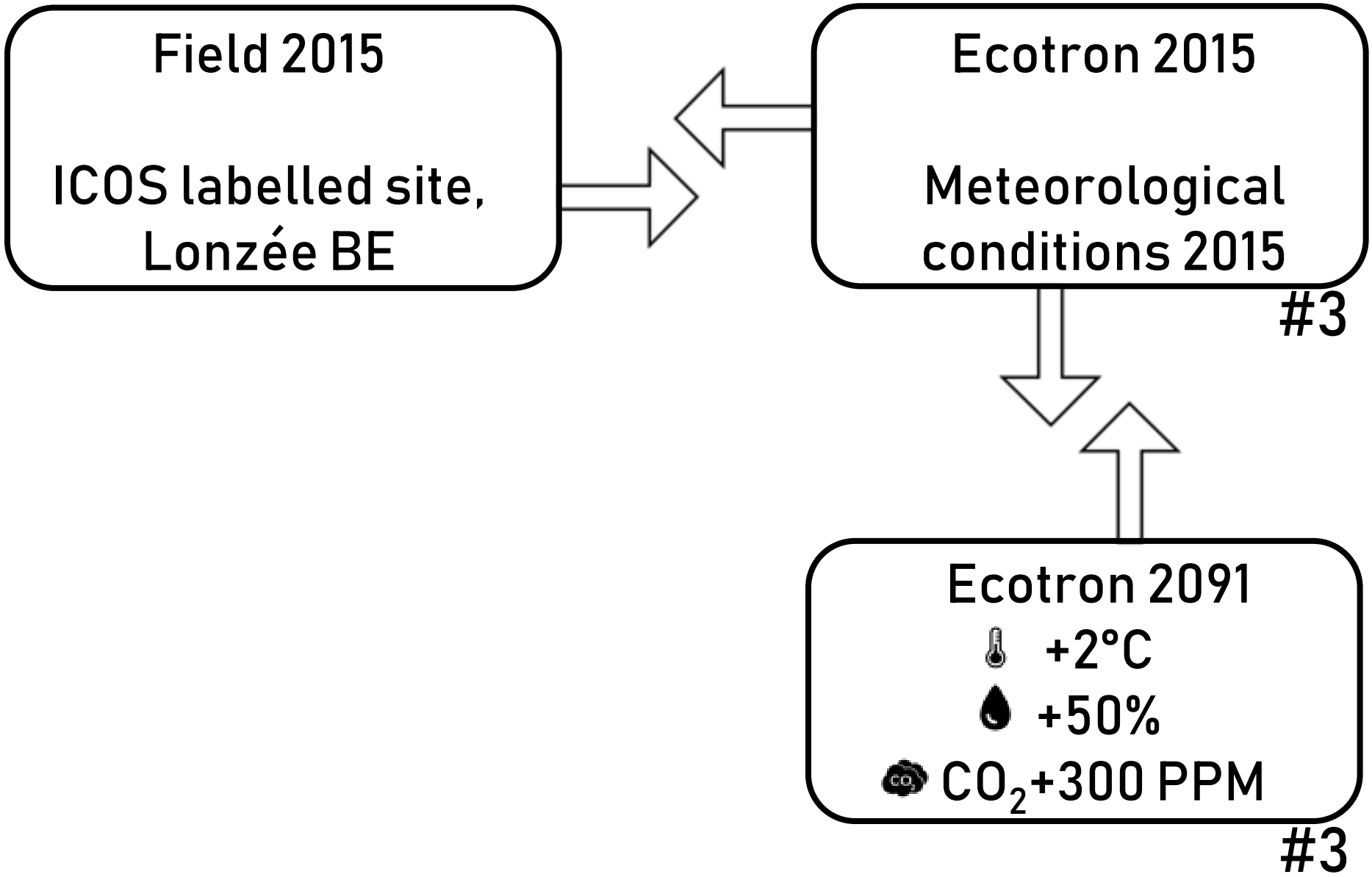
+2°C

+50%

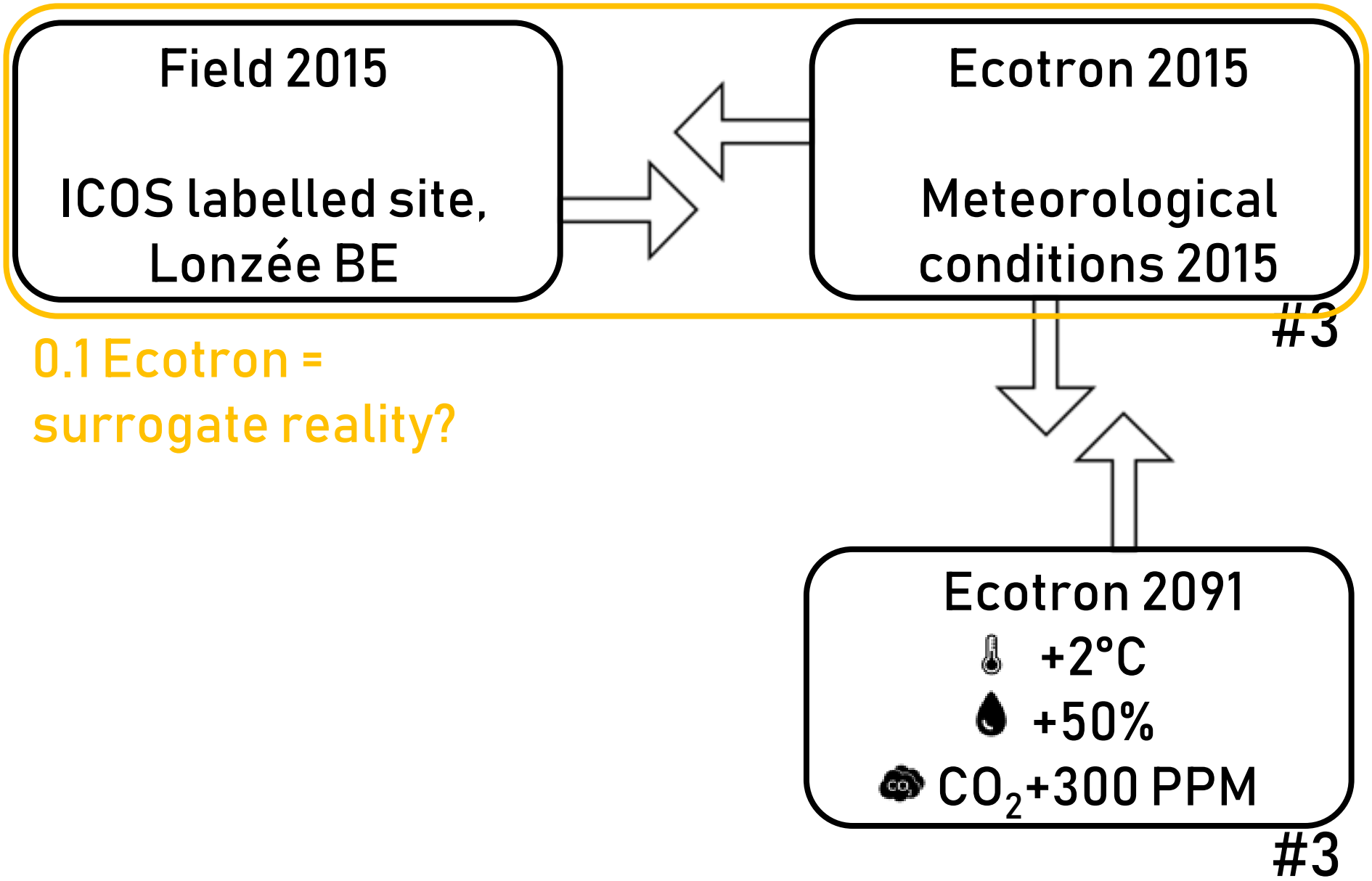
CO_2+300 PPM

#3

Experiment 0



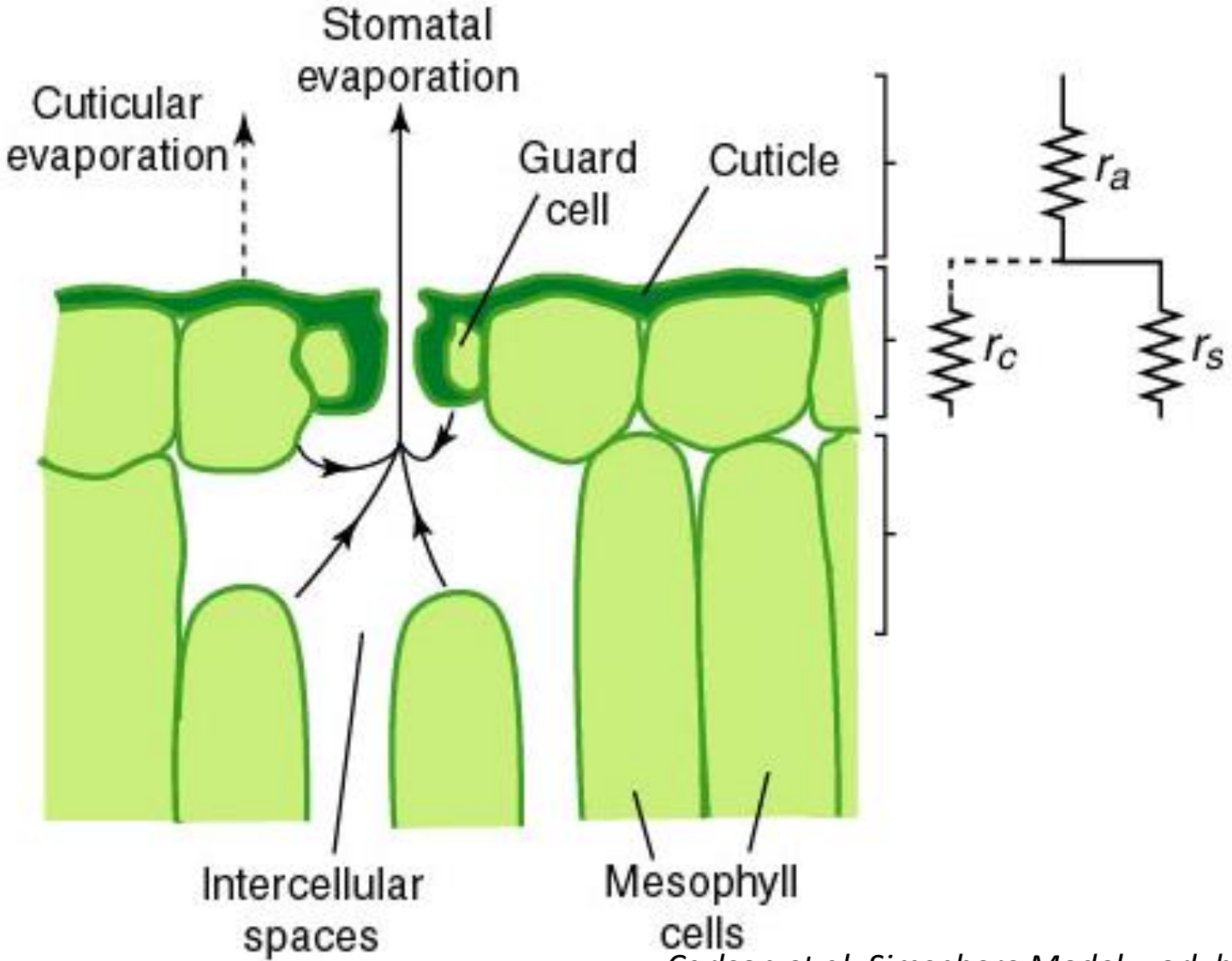
Experiment 0



Experiment 0.1
Possible bottlenecks

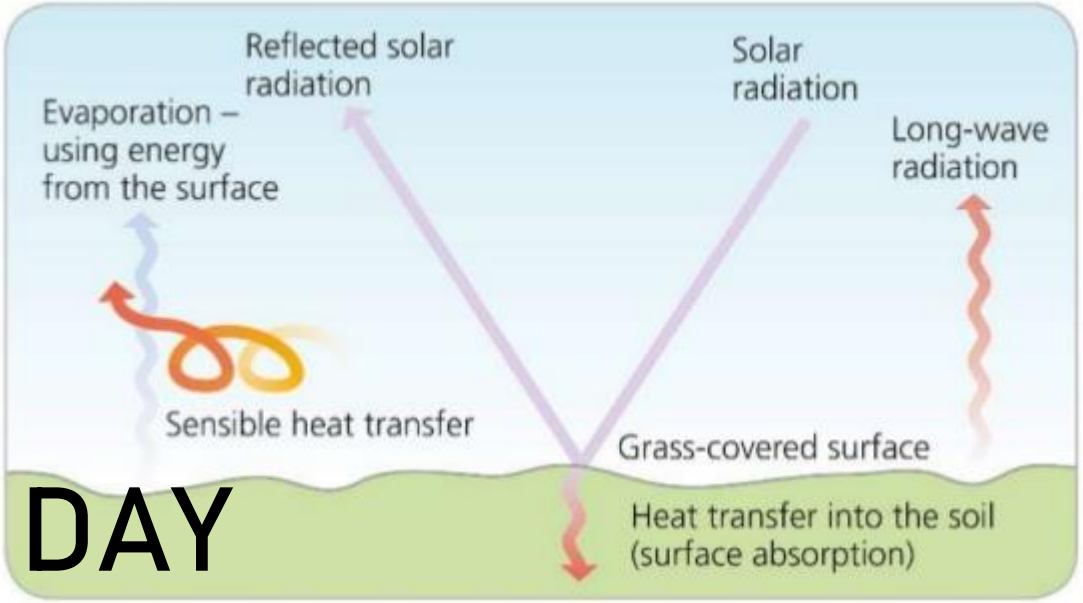
- Reproduction of wind and resulting turbulence
- Thermal infra-red inputs from walls >< clear sky
- Light intensity is limited to 1200 µmole photons.m^{-2}.s^{-1}
- Reconstructed soil (repacked horizons as in the field)

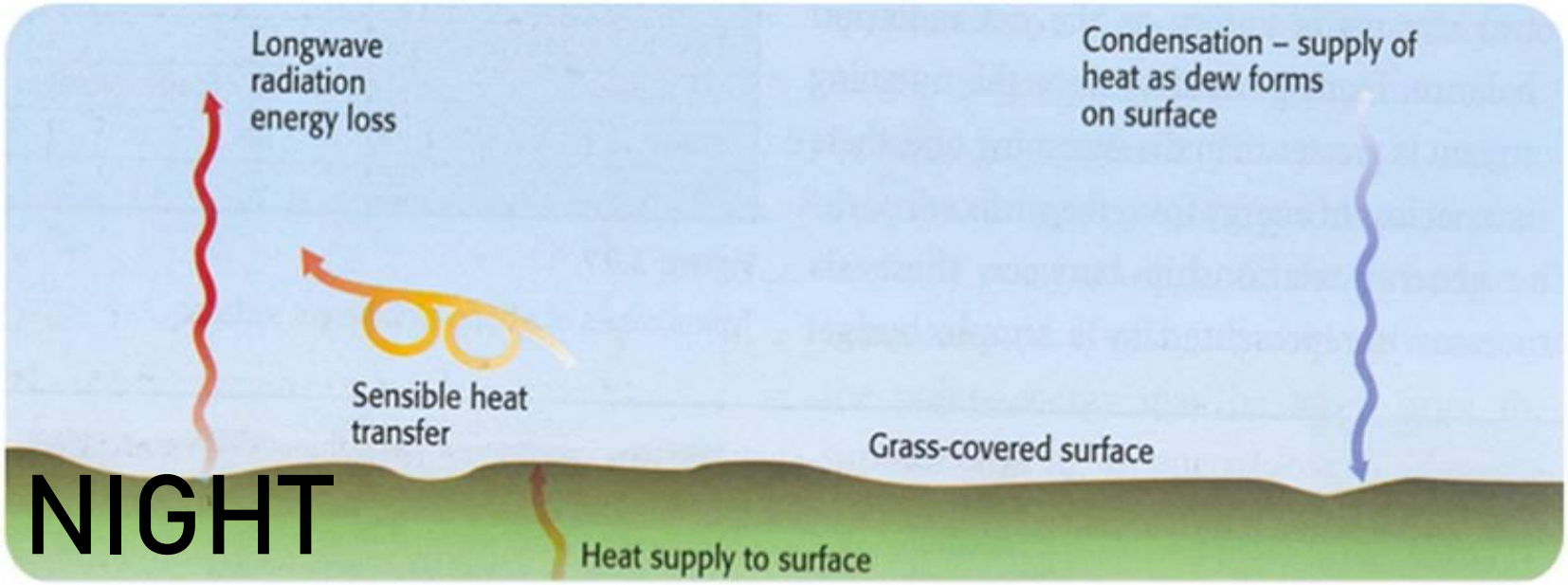
No wind



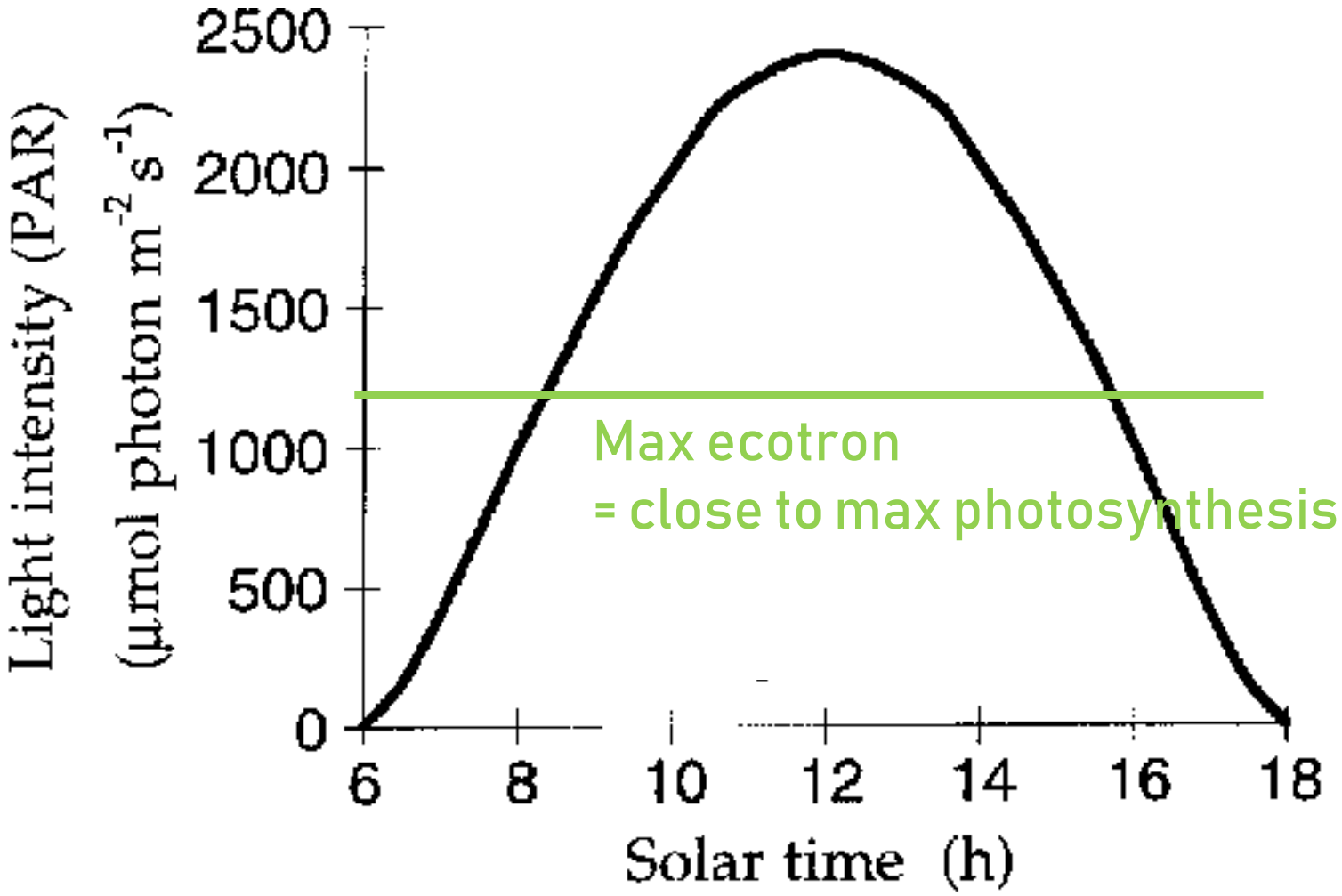
Carlson et al. Simsphere Model work book

No radiative sky cooling





Intensity solar radiation



Repacked soil

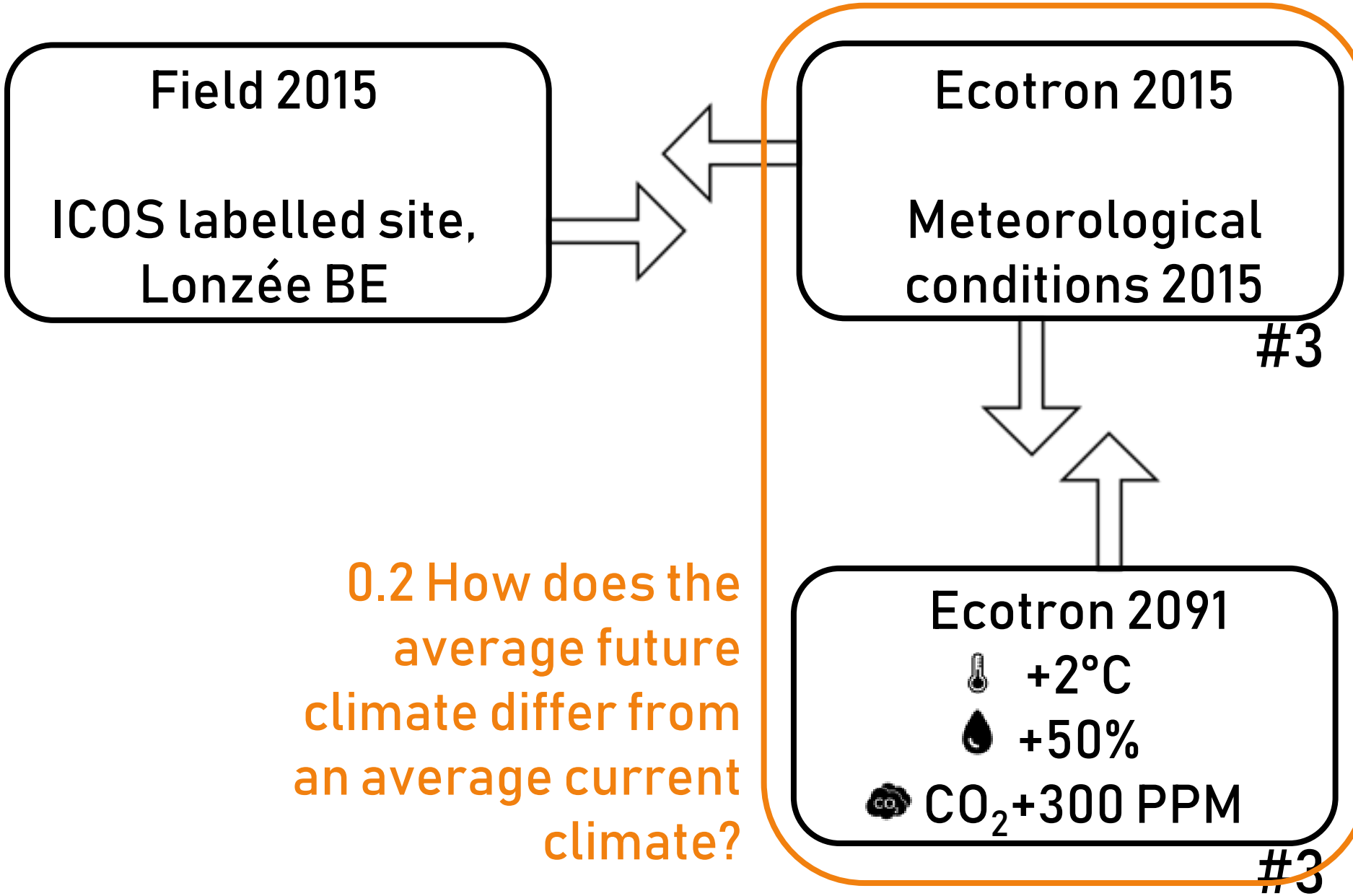
Quantify impact of these bottlenecks with adapted models

STICS | crop
PASIM | pasture

Coupled with ASPECT (atmosphere flux model)

Impact soil structure: HYDRUS

Experiment 0



0.2 How does the average future climate differ from an average current climate?

Experiment 0

Field 2015

ICOS labelled site, Lonzée BE

Ecotron 2015

Meteorological conditions 2015

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Ecotron 2091

+2°C

+50%

CO_2+300 PPM

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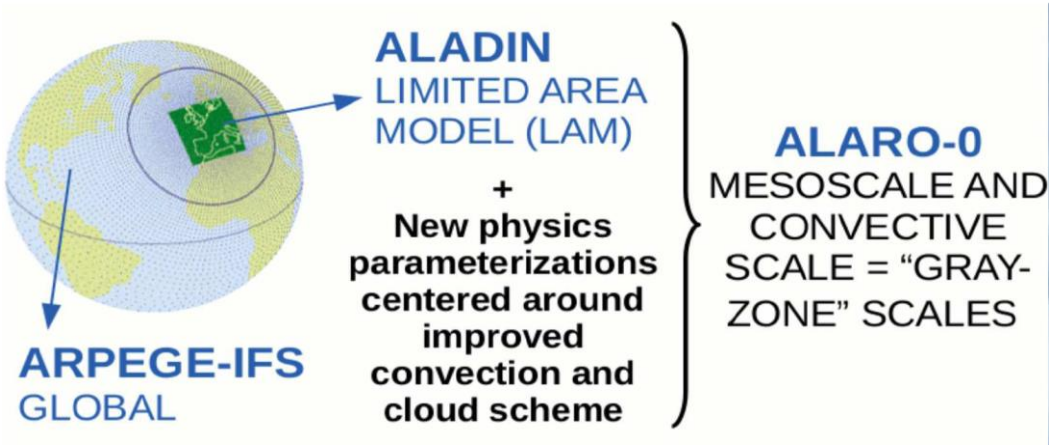
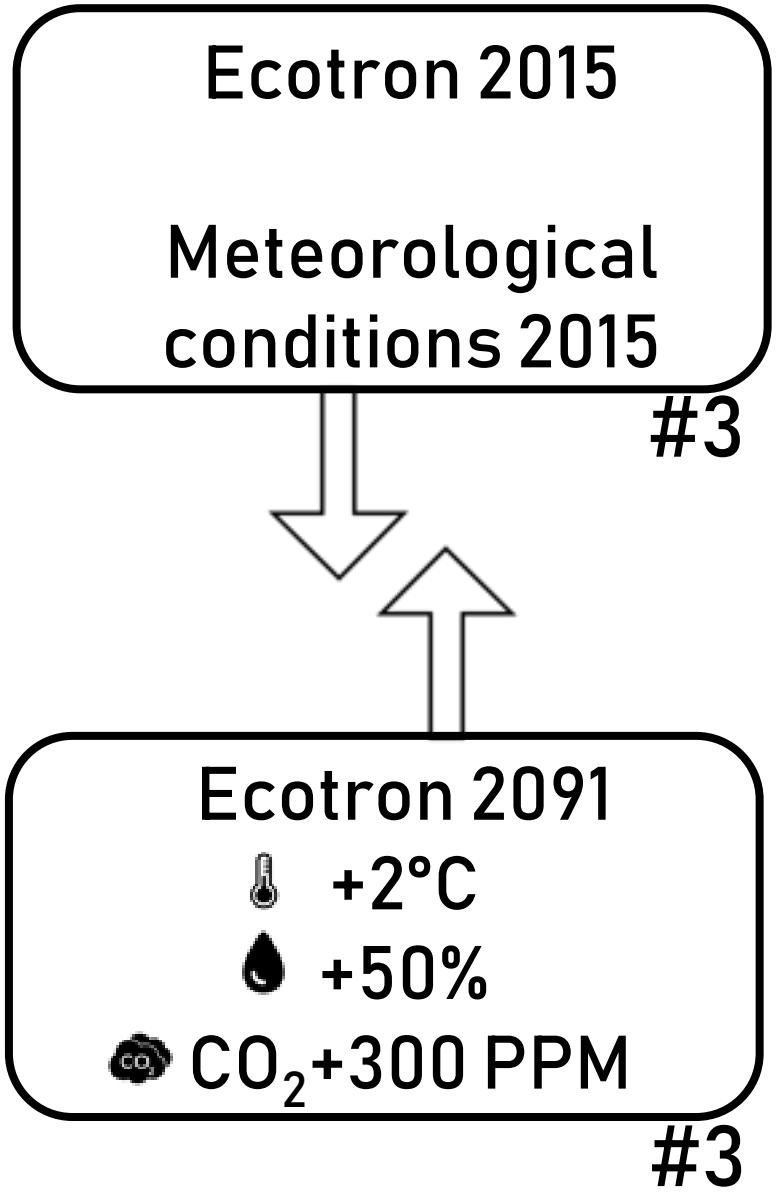


Experiment 0.2

Test ability of crop models to predict crop growth under current and future climate



Conclusion

Want to use the ecotron or its data?

www.terra.uliege.be

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