

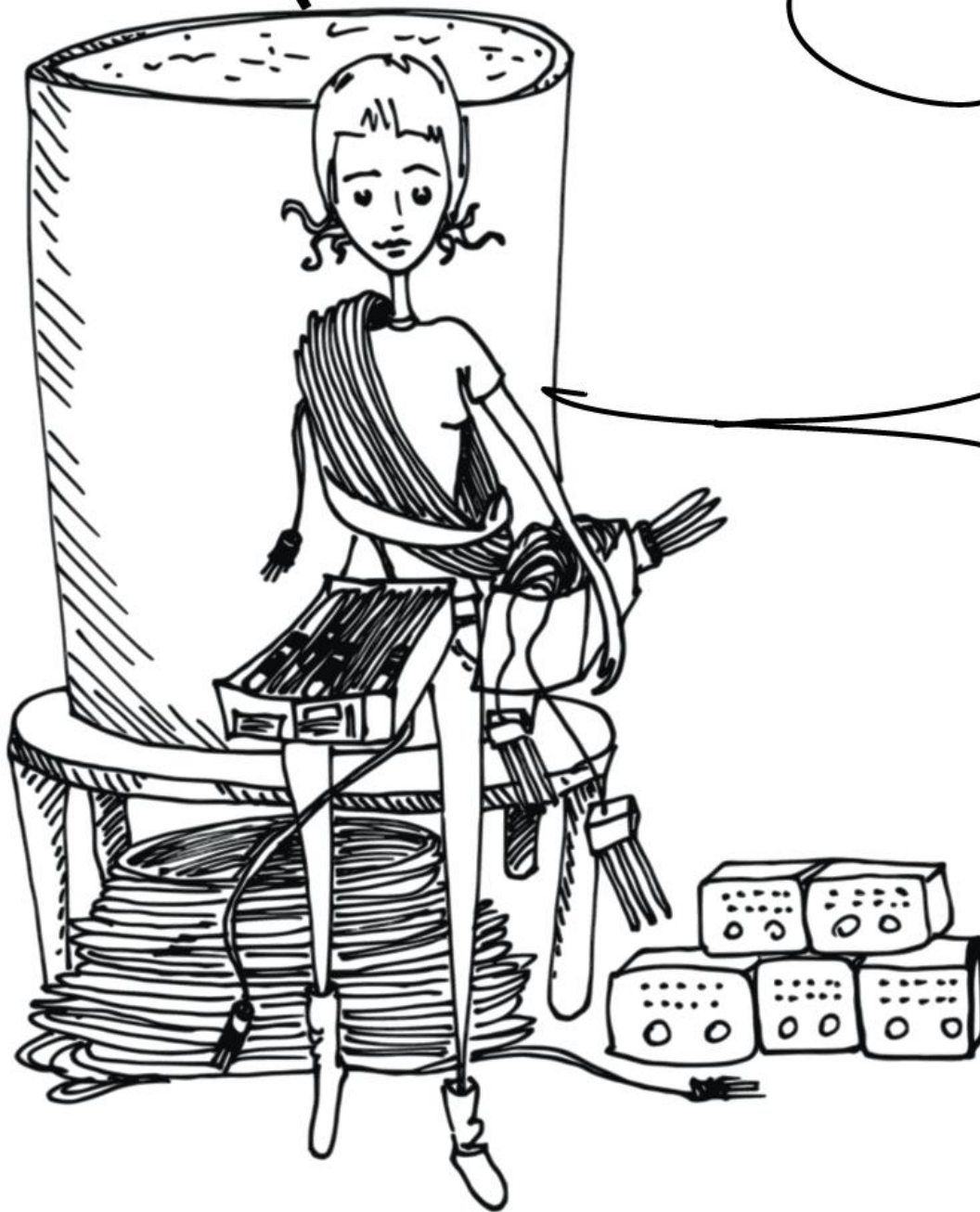
The image shows the interior of an ecotron, a controlled environment for plant growth. The ceiling is equipped with numerous rectangular light fixtures, some of which are illuminated, providing a controlled light spectrum. The walls are white and feature a grid-like pattern, likely for ventilation or light diffusion. In the center of the room, a large, circular metal tray is filled with a dense growth of green plants, including tall grasses and flowering yellow plants. The floor is a light-colored, smooth surface. The overall atmosphere is clean and controlled, typical of a laboratory or research facility.

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

Sarah Garré*, Bernard Longdoz, Vincent Leemans
Liège University, Gembloux Agro-Bio Tech, TERRA

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 Uhaselt, Belgium





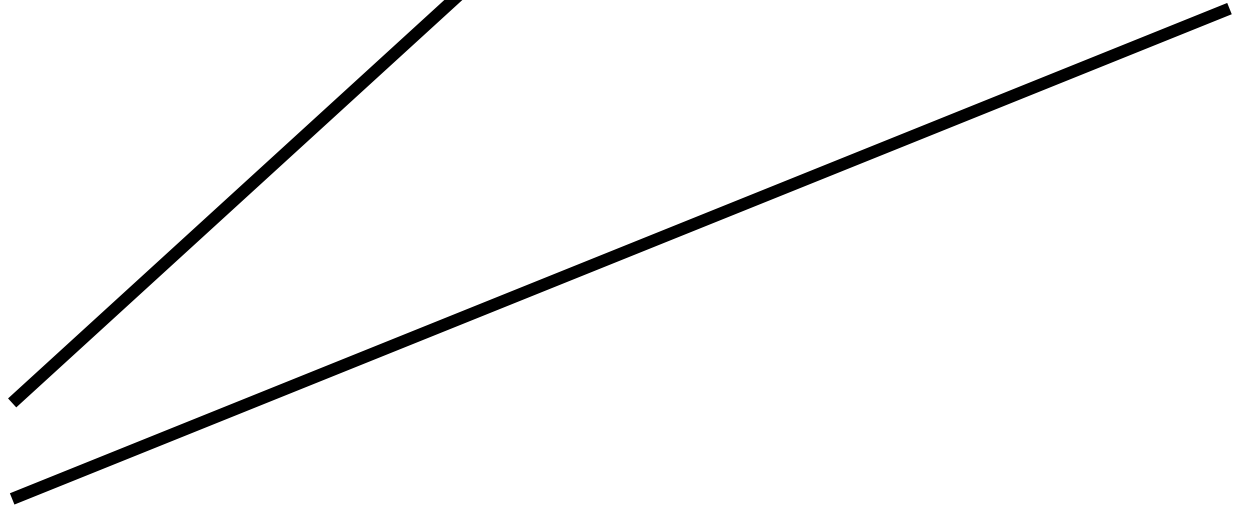
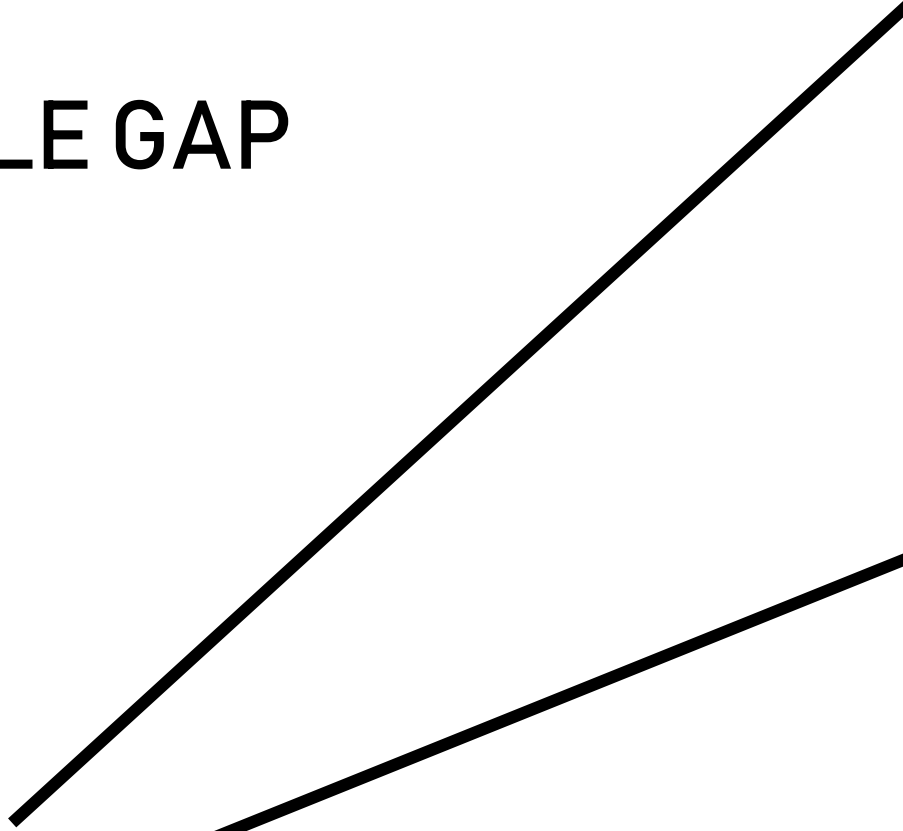
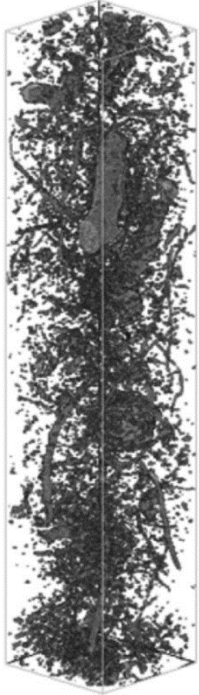


Design new ecosystems?



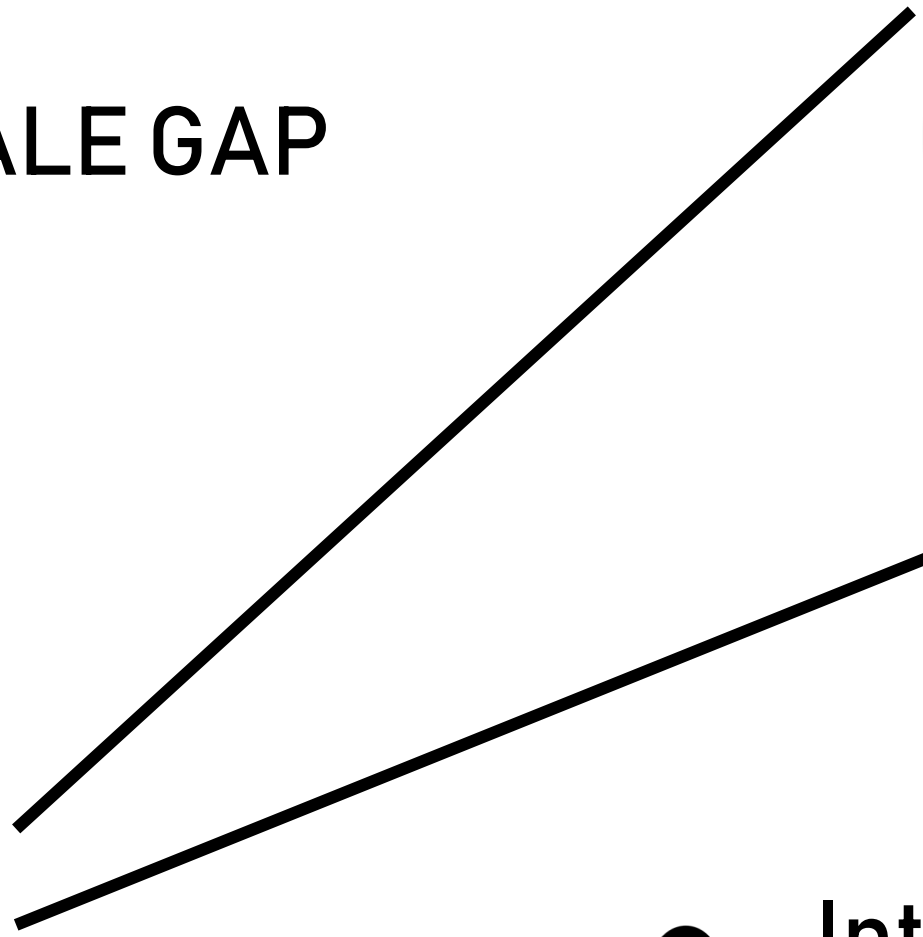
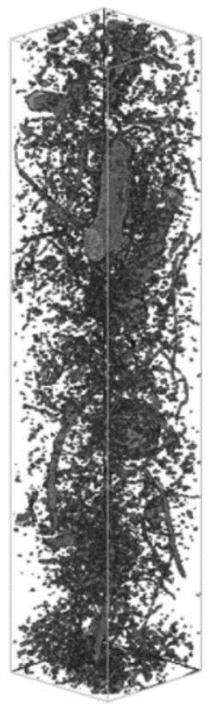
SCALE GAP

8.5 cm



SCALE GAP

8.5 cm



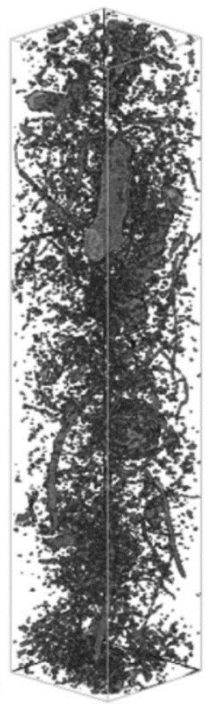
**Intertwined
processes**

SCALE GAP



MODELS?

8.5 cm

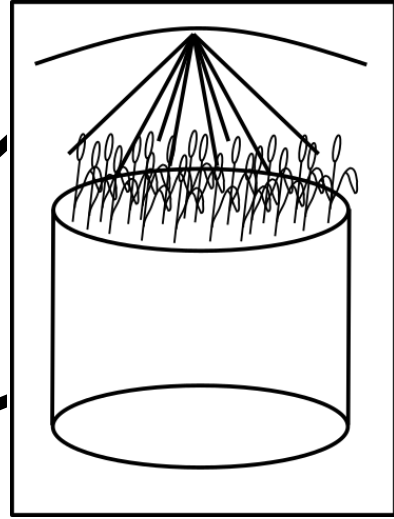


**Intertwined
processes**

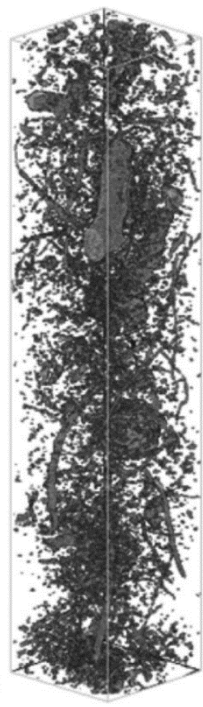
SCALE GAP



ECOTRON?



8.5 cm



Intertwined processes



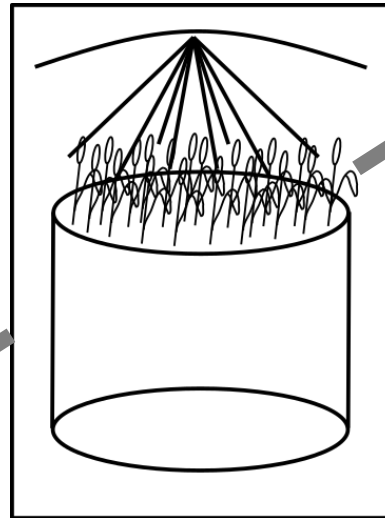


MODELS

+

Calibration
Model improvement

Experimental
design



Upscaling

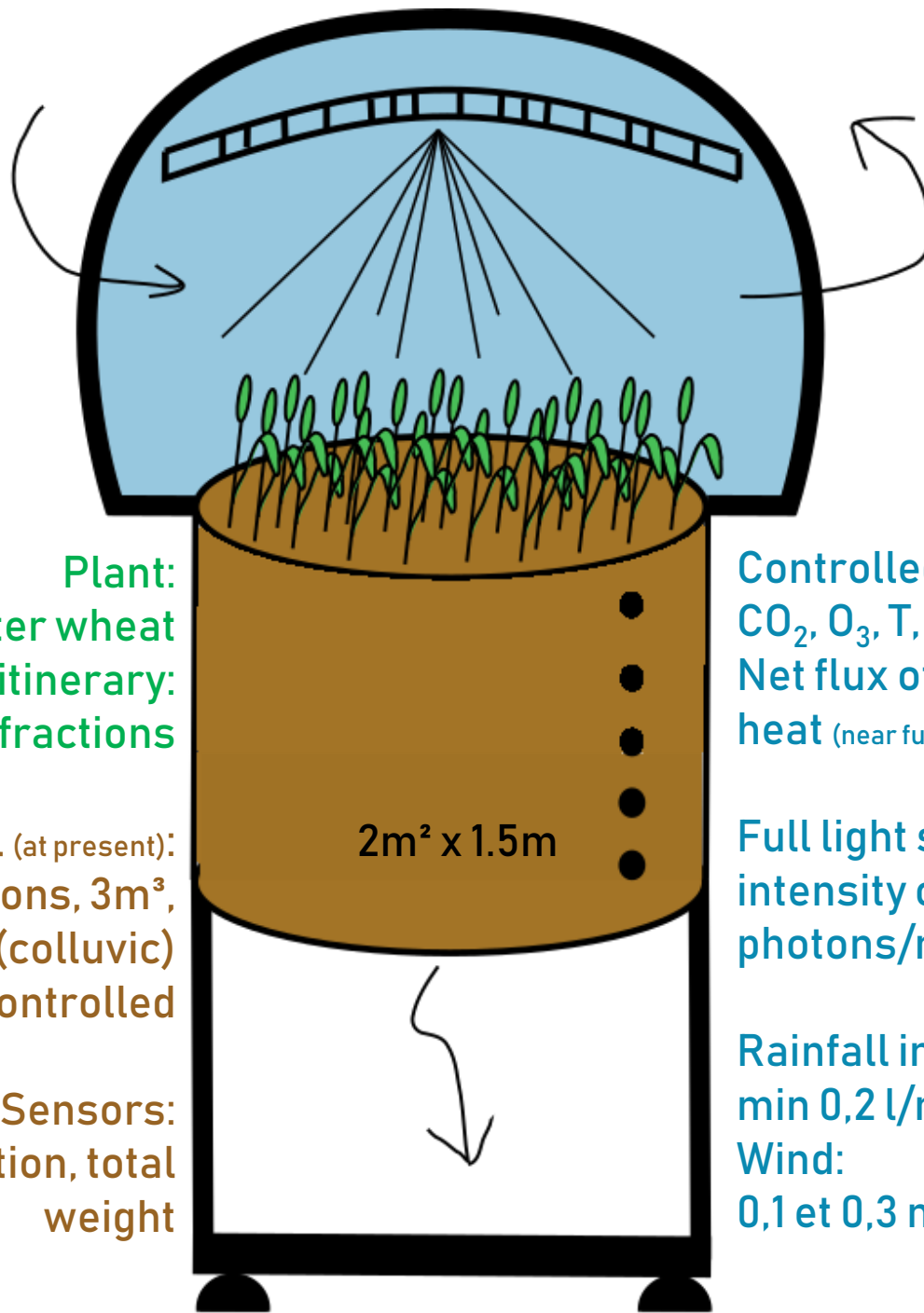
Downscaling



« 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



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
CO₂, O₃, 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

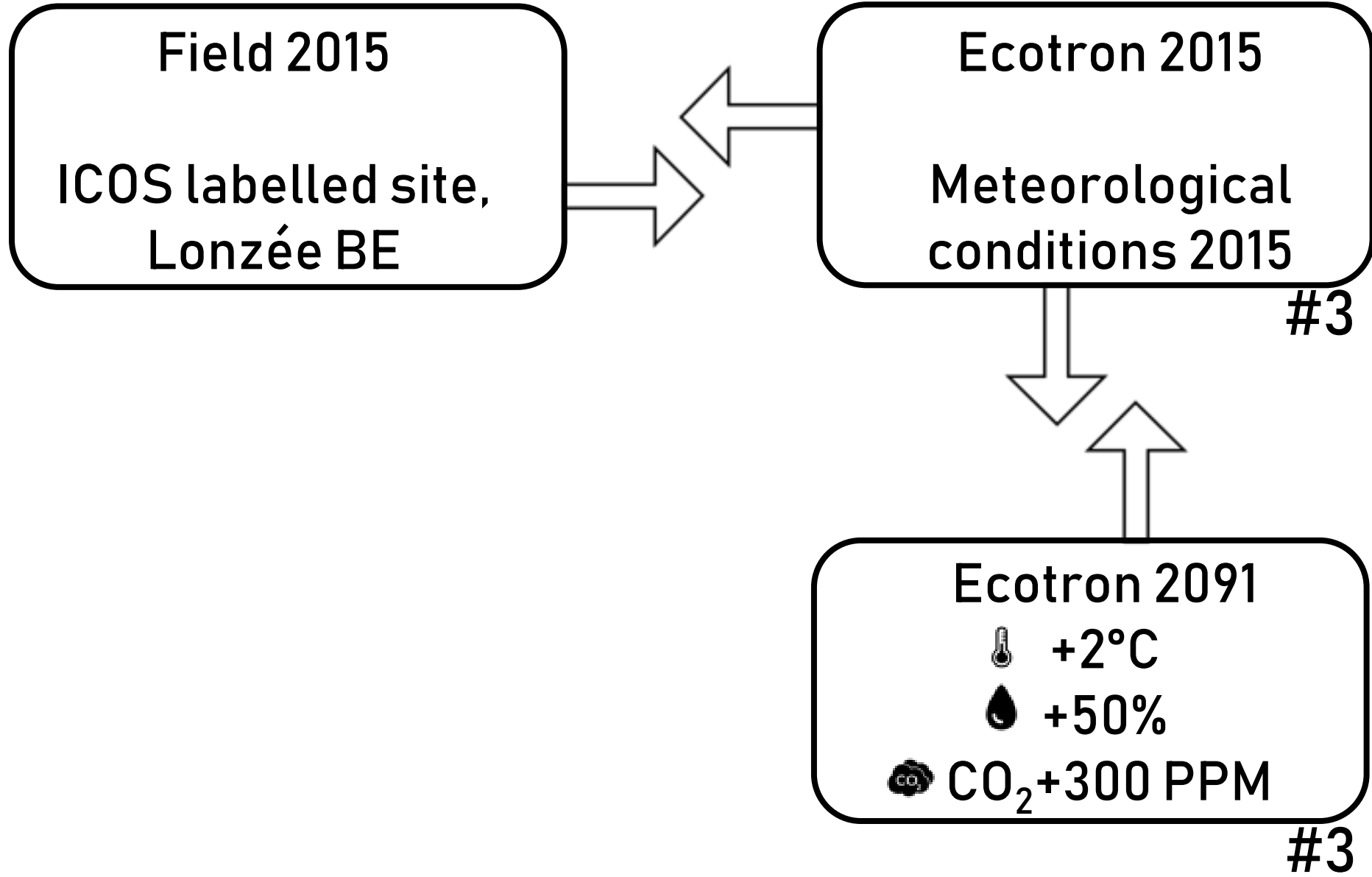
💧 +50%

🌫️ CO₂+300 PPM

#3



Experiment 0



Experiment 0

Field 2015

ICOS labelled site,
Lonzée BE

Ecotron 2015

Meteorological
conditions 2015

0.1 Ecotron =
surrogate reality?

Ecotron 2091

🌡️ +2°C

💧 +50%

🌫️ CO₂+300 PPM

#3

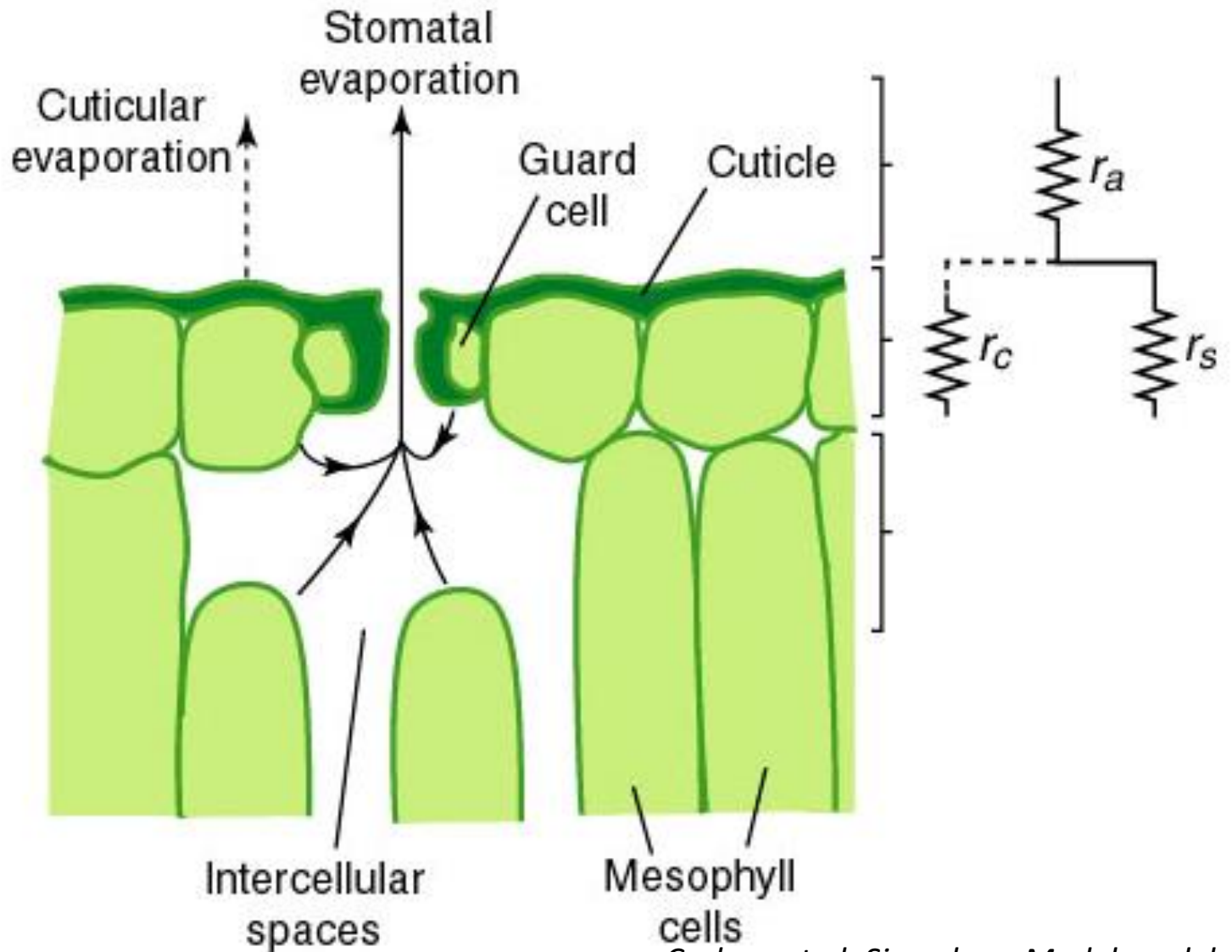
#3

Experiment 0.1

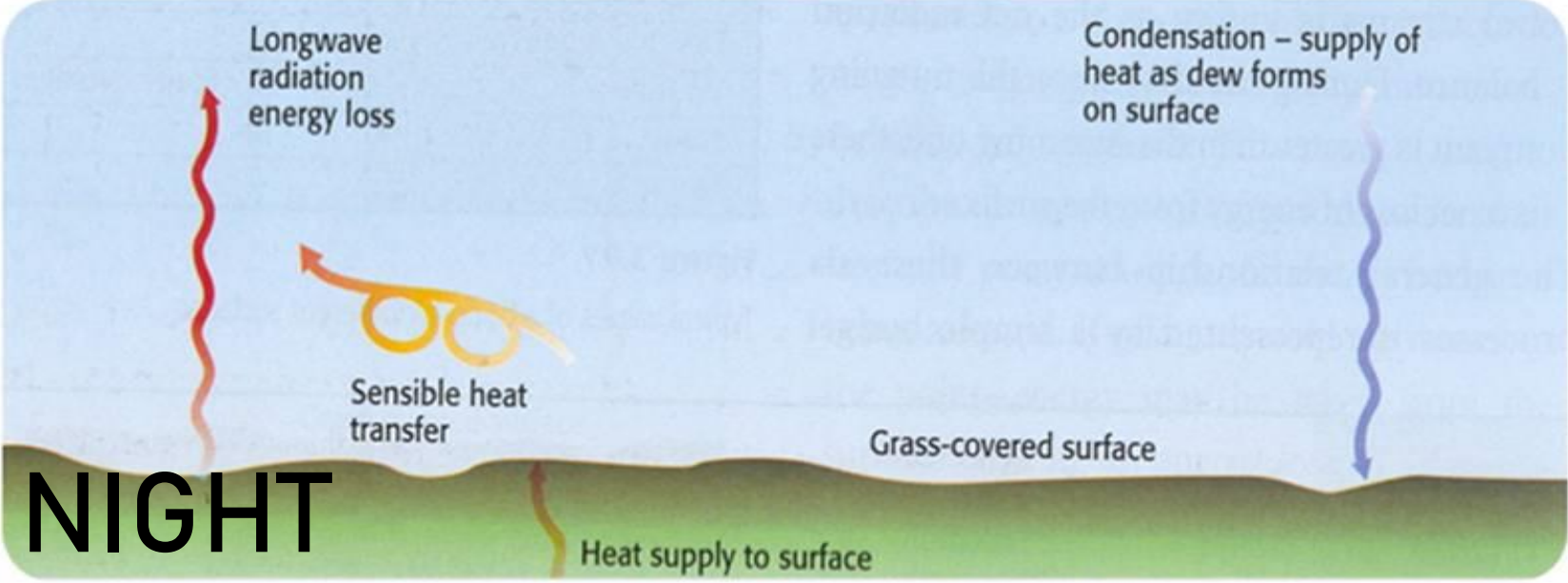
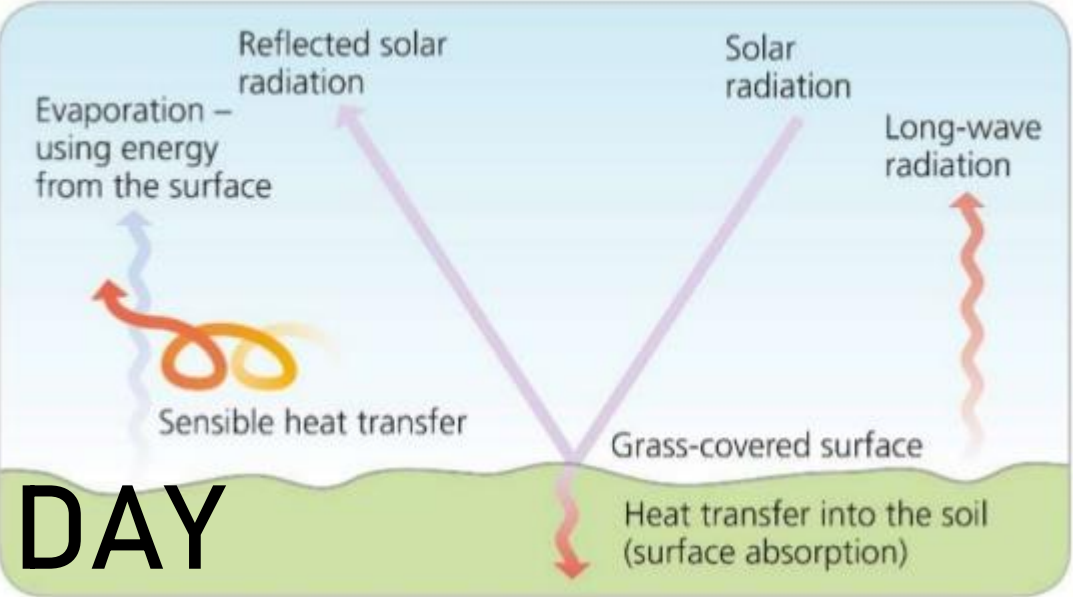
Possible bottlenecks

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

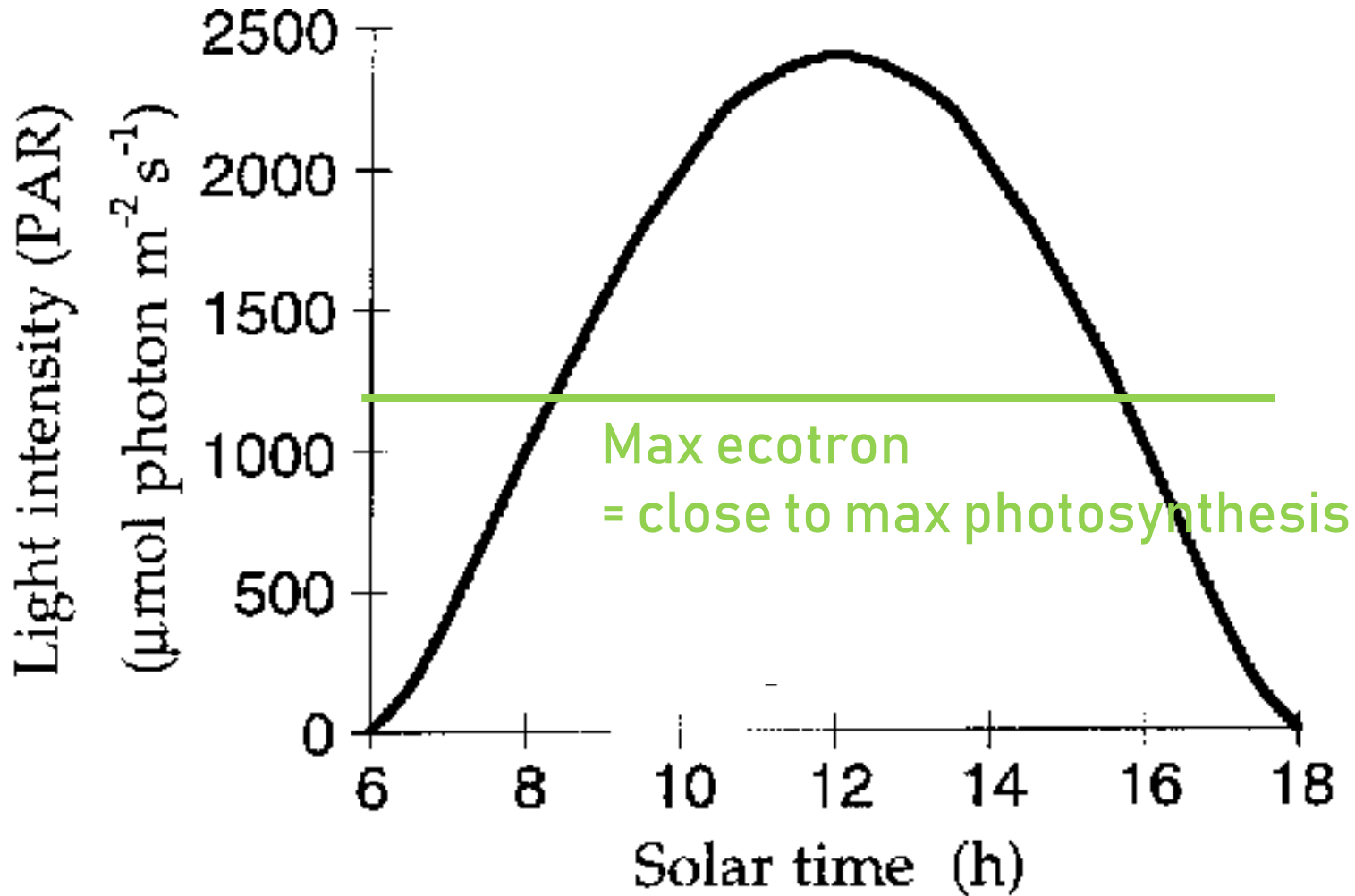
No wind



No radiative sky cooling



Intensity solar radiation



Repacked soil



Quantify impact of these bottlenecks with adapted models



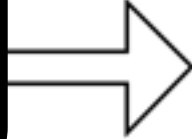
STICS | crop
PASIM | pasture

Coupled with ASPECT
(atmosphere flux model)

Impact soil structure:
HYDRUS

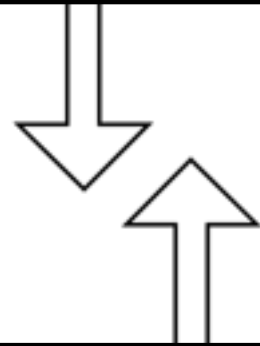
Experiment 0

Field 2015
ICOS labelled site,
Lonzée BE



Ecotron 2015
Meteorological
conditions 2015

#3



Ecotron 2091
🌡️ +2°C
💧 +50%
🌫️ CO₂+300 PPM

#3

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

#3

Ecotron 2091

 +2°C

 +50%

 CO₂+300 PPM

#3

ALADIN
LIMITED AREA
MODEL (LAM)

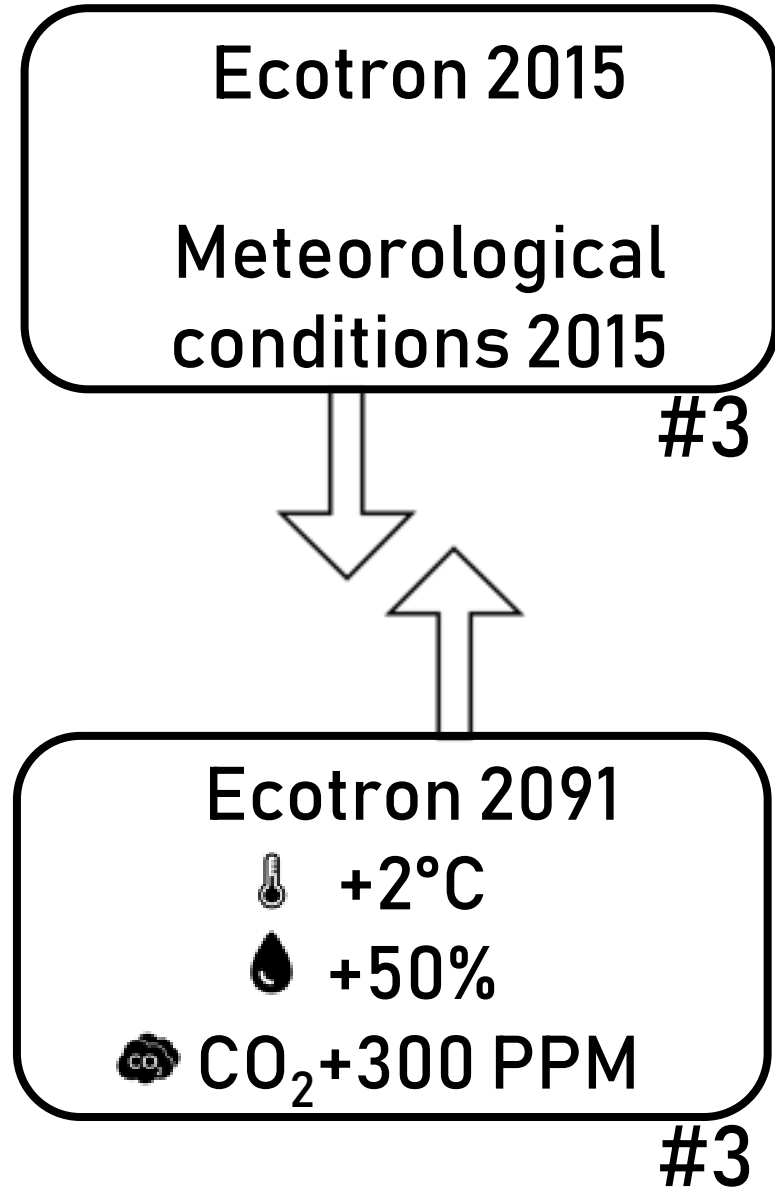
+
New physics
parameterizations
centered around
improved
convection and
cloud scheme

ALARO-0
MESOSCALE AND
CONVECTIVE
SCALE = "GRAY-
ZONE" SCALES



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



Pr. Bernard LONGDOZ

Bernard.longdoz@uliege.be

Vincent LEEMANS

Vincent.Leemans@uliege.be



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