Macrocosms platform data sheet

The Macrocosms platform of the Montpellier European Ecotron is a 100 m long building which houses 12 identical and independent experimental units. It is composed of 14 transparent domes on the roof of the building (2 serves to eliminate the border effect) and of 12 rooms housing for each experimental unit, the soil part of the terrestrial ecosystems (lysimeters) and the machinery for the environmental controls (see table 1 for specifications). Each experimental unit has a volume of 40 m^3 and can receive lysimeters from 2 to 12 tonnes. For the measurements of ecosystem fluxes (CO_2, CH_4, …) each unit works like a large open gas exchange system (see figure 1 and table 1 for specifications). Design to work with natural light, each unit can also be run under controlled light conditions with a totally opaque cover blocking sunlight.

Figure 1. (Clockwise from top left) Scheme describing the components of a macrocosm with the air circuits (Cros, Saubion, Billet, Chabiky), lysimeters insertion (photothèque CNRS H. Raguet), instrumented lysimeter (photo J. Roy), gas and isotopes measurements laboratory (photo Cl. Piel).

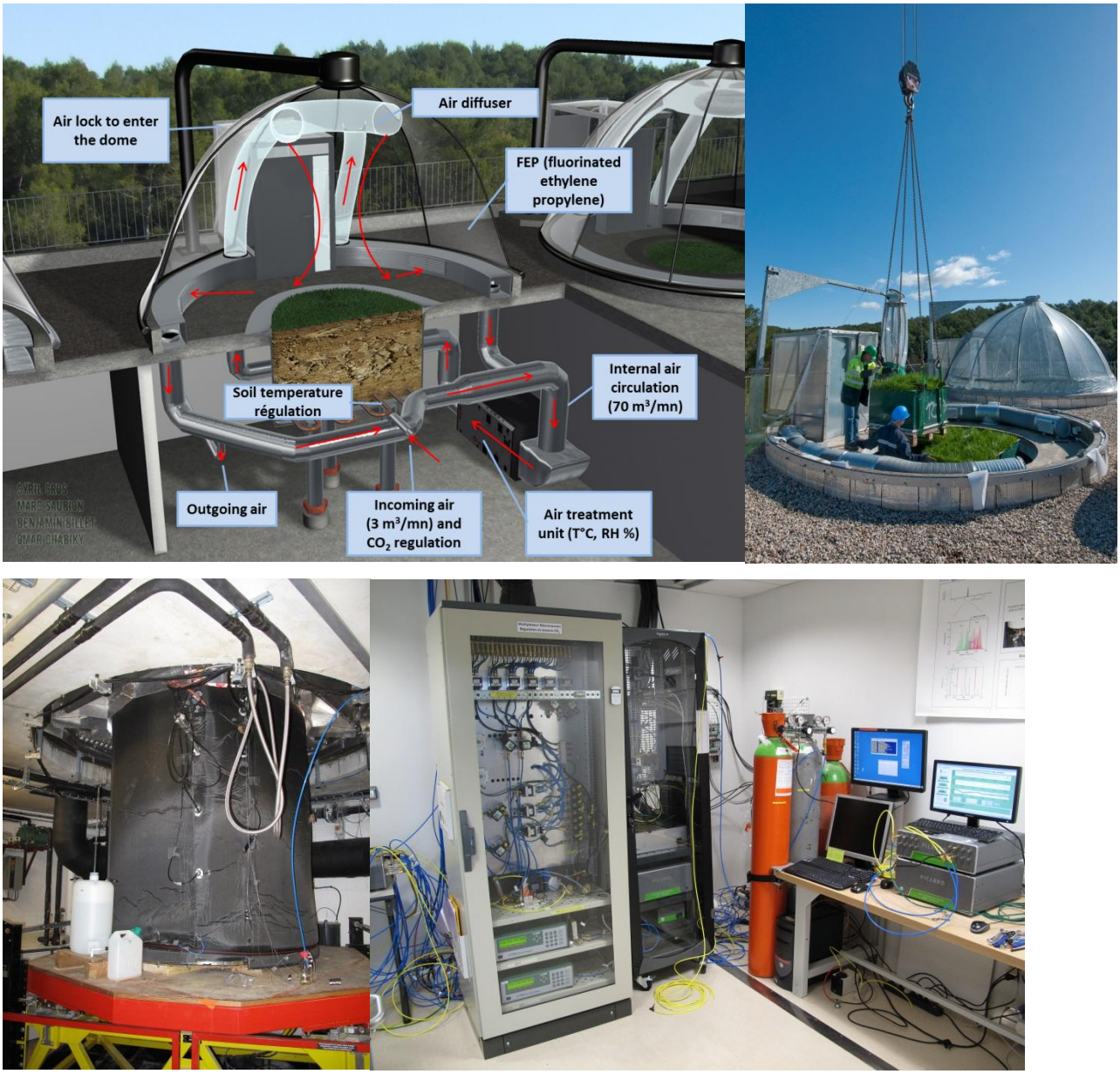

Table 1. Major characteristics of the Macrocosms platform at the Montpellier European Ecotron

Macrocosms – Montpellier European Ecotron (see www.ecotron.cnrs.fr for more details)	
General characteristics	
Design	Set of experimental units designed for the environmental control and process measurements of large terrestrial ecosystems
Dimensions	Above ground compartment and air circuit: 40 m^3 Lysimeter: 0,5 to 2 m deep, area: 2, 4 or 5 m^2 (round, square, round respectively)
Replicates	12 independent experimental units
Confinement	Confined, not closed, controlled environment facility Possibility to separate canopy fluxes and soil fluxes
Environment control – continuous automated control	
Temperature	Above ground : -10°C to +50°C (± 0.5°C) with season's constraints on the extremes Soil: vertical gradient through lysimeter base temperature control (+12 to +30 °C)
Air humidity	30 % to 85 % RH depending on temperature
Soil moisture	Automated watering (sprinklers, drip irrigation, water table)
Lighting	Natural light conditions: transmission PAR: 80 %, UVa 60 %, UVb 40% Possibility of neutral shadings Controlled lighting: Plasma lamps with solar-like spectrum: 500 µmol/m^2/s at 40 cm
Atmospheric chemistry control – continuous automated control	
CO_2	Daytime: 380- 1000 ppm ± 10 ppm (lower level dependent upon photosynthesis) Night time: control only above 500 ppm (no CO_2 trap)
^{13}C	^{13}C enrichment with injection of $^{13}CO_2$
Process measurements on line	
Evapotranspiration	Continuous lysimeters' weight measurements (300 g loss detectable)
Ecosystem net CO_2 exch	Measurements every 12 mn, whole system independent calibration (accuracy 0.5 µmol m^{-2} s^{-1})
CanopyCO_2exchange	Measurements every 12 mn (not compatible with Net ecosystem CO_2 exchange)
SoilCO_2concentration	Measured continuously on several strata. Used with soil moisture and soil diffusivity to calculate soil respiration per strata. Possibility to measure $\delta^{13}C$ of CO_2 and CH_4 mole fraction with a manual sampling system (1 measurement per hour for a given strata).
Discrimination $\delta^{13}C$ of the net CO_2 flux	3 measurements per hour to be done on one dome (or on several domes with a proportional lower frequency)
Net CH_4 exchange	8 measurements per hour to be done on one dome (or several domes with a proportional lower frequency). Resolution limit : 0.5 nmol.s^{-1} (installed either on the Macrocosms platform or on the Mesocosms one)
Environmental measurements	
Light	Quantum sensors
Temperature, RH	PT100, RH and T probes (Michell)
CO_2	LiCor 7000, Picarro G2301, Vaisala GMT222 and GMP343
Methane	Picarro G2301 (range 0 to 20 µmol.mol^{-1}, precision : 0.3 nmol.mol^{-1}) (installed either on the Macrocosms platform or on the Mesocosms one)
$\delta^{13}C$ of CO_2	Picarro G2101-i (accuracy from 0.2 to 0.5‰ depending on sampling frequency).
Soil moisture and T°C	TDR sensors (Pico 32 Trime)
Data retrieval	
All data	Automated quality check; real time (+1h) viewing and retrieval of data through a customized software (Liaison) allowing also to establish the experimental design
Mobile instrumentation	
Light	Spectrometer (Jaz Ocean Optics) / Sunshine sensor (BF5DeltaT), line quantum sensor (LiCor)
Wind	Hot wire anemometer (Ahlborn)
Canopy structure	SunScan (DeltaT)
Leaf gas exchange chlorophyll fluoresc.	Portable gas exchange system with leaf and soil chambers and fluorescence system(LiCor 6400)
Water potential	Pressure chambers (2) (PMS Instrument)
Stomatal conductanc	Porometer (SC1 Decagon)
Leaf area	Bench belt leaf area meter (LI3100-C LiCor)
Data acquisition	Data loggers (Campbell CR211)
Study systems	
Intact ecosystems	Intact terrestrial ecosystem sampled *in natura* or from *in situ* experimental plots
Reconstructed systems	Terrestrial ecosystems can be assembled with soil and planted/sown vegetation with or without plant/soil animals diversity manipulations