Mesocosms platform data sheet

The Mesocosms platform of the Montpellier European Ecotron is a 700 m² open-air terrace, with adjacent technical rooms for the automates and measuring instruments, were up to 24 mesocosm independent experimental units will be displayed. The installation of the first 12 first ones is planned for 2014. To be more flexible in its use, the principle of these mesocosm units is to have a conditioning and measuring system which will adapt on the ecosystem brought by the researchers. Maximum size will be: lysimeters of 1 m² area and 2 m depth; canopy height of 2 m. The soil conditioning enclosure is modular in height (1 or 2 m) as well as the canopy chamber (0.5; 1.0; 2 m depending on the first experiments). This platform will be connected to a decarbonatation unit which will allow: i) to condition the air at preindustrial CO_2 levels, ii) to continuously inject industrial CO_2 whatever the CO_2 treatment levels which will continuously label the newly synthesised organic matter. For the measurements of ecosystem fluxes (CO_2, CH_4 …) each unit will work either like an open or closed gas exchange system to improve the accuracy of measurements (see figure 1 and table 1 for specifications). Each mesocosm will work with either natural sunlight or under controlled light conditions without any sunlight. Most of the technology to be developed has already been developed in the Macrocosms platform.

Figure 2. Left: The terrace with incorporated fluid distribution where the mesocosm units will be installed and technical rooms behind the wall on the left. The incrusted picture shows Right: The mesocosms prototype with the soil conditioning unit around the lysimeter and the canopy chamber; the soil thermoregulation system is detailed in the incrusted picture; the air conditioning unit is behind the ladder. (Photos J. Roy)

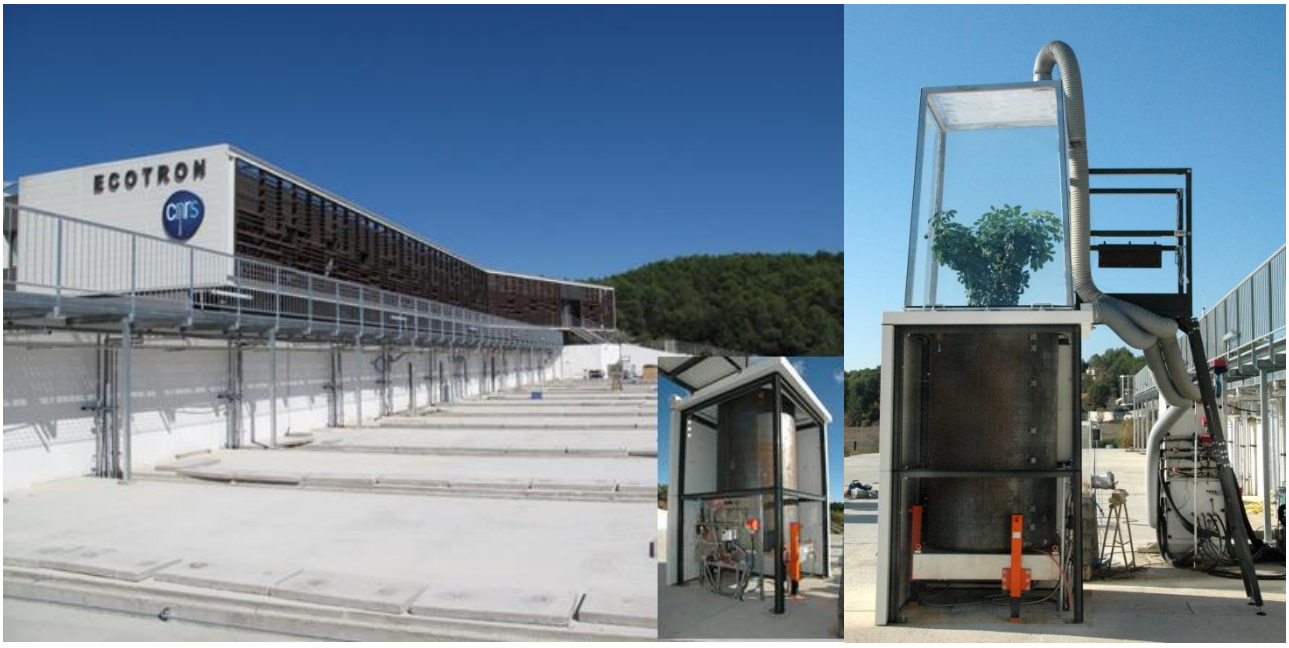

Table 1. Major characteristics of the Mesocosms platform at the Montpellier European Ecotron

Mesocosms – Montpellier European Ecotron (see www.ecotron.cnrs.fr for more details)	
General characteristics	
Design	Set of experimental units designed for the simultaneous environmental simulation and ecosystem-level process measurements of medium-size terrestrial ecosystems
Dimensions	Above ground compartment and air circuit: 2-4 m^3 depending on the height of the canopy chamber; Lysimeter: 0,3 to 2 m deep, area: 0,25 to 1 m^2 (round or square)
Replicates	24 independent experimental units (12 units installed in 2014)
Confinement	Ability to operate in open or closed/confined mode Possibility to partition canopy 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 (+10 to +30 °C)
Air humidity	30 % to 85 % RH depending on temperature
Soil moisture	Automated watering (drip irrigation, water table on demand)
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 Night time: control only above 500 ppm (lower day and night concentration with decarbonated air planned for 2015-2016)
^{13}C	^{13}C labelling with injection of $^{13}C\ CO_2$ (^{13}C depletion with industrial CO_2 when decarbonated air will be available)
Process measurements on line	
Evapotranspiration	Continuous lysimeters' weight measurements (100 g loss detectable)
Net CO_2 exchange	Measurements every 12 mn, whole system independent calibration
Soil CO_2 concentration	Measured continuously on several strata. Used with soil moisture and soil diffusivity to calculate soil respiration per strata
^{13}C balance	3 measurements per hour to be done on one dome (or on several units with a proportional lower frequency)
Net CH_4 exchange	Measurements every 12 mn (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 (installed either on the Macrocosms platform or on the Mesocosms one)
^{13}C	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 (BF5 DeltaT), line quantum sensor (LiCor)
Wind speed	Hot wire sensor (Alborn)
Canopy structure	SunScan (DeltaT)
CO_2 exchange	Portable gas exchange system with leaf and soil chambers (LiCor 6400)
Water potential	Pressure chambers (2) (PMS Instrument)
Stomatal conductance	Porometer (SC1 Decagon)
Leaf area	Bench belt leaf area meter (LI3100-C LiCor)
Data acquisition	Data loggers Campbell CR21X
Study systems	
Intact ecosystems	Intact terrestrial ecosystem sampled *in natura* or from *in situ* experimental plots
Reconstructed ecosystems	Terrestrial ecosystems can be assembled with soil and planted/sown vegetation with or without plant/soil animals diversity manipulations