SAMTOL-II

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What?
A new device for continuous measurement of ecosystem CO_2 efflux was constructed by KONEL (Zlín, CR) under leading of CzechGlobe. The new system is called SAMTOL-II. Knowledge, skills and experiences learned during development and running of the first version of the SAMTOL system (CzechGlobe) were utilized for construction of the new system. The system SAMTOL-II was installed at mountain grassland at Experimental Ecological Study Site Bílý Kříž at the end of April 2013.

SAMTOL-II placed at the grassland at Experimental Ecological Study Site Bílý Kříž.

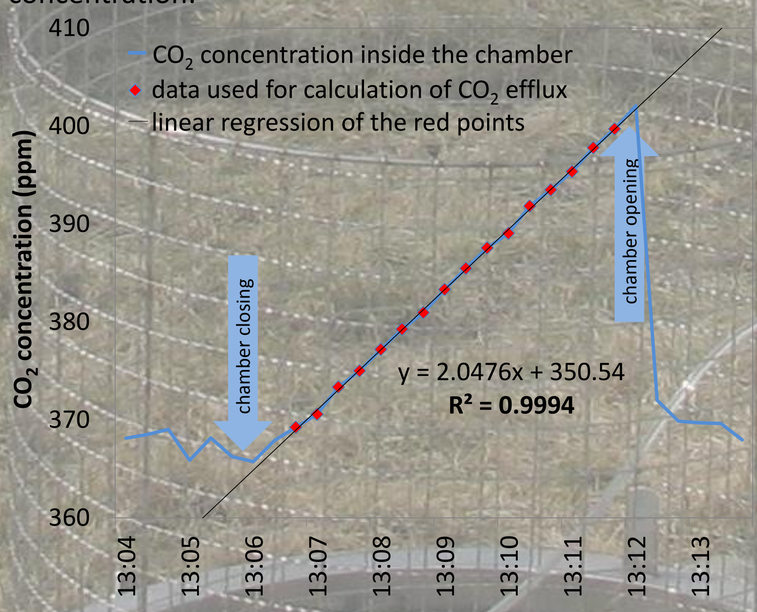
Principe
SAMTOL-II is a closed gasometrical system. The main components of the system are a set of respiration chambers, a gas analyser (LiCor 840A), a computer equipped with on-demand software, a set of switching valves and air pumps.

Chambers
The diameter and the height of the chambers are 60 cm. Chamber closes only for the period of measurement (ca 5 min). Moving of chambers is realized by pneumatic actuators (FluidTechnik Bohemia, Brno, CR). Each chamber is equipped with soil and air temperature sensors, a ventilator for gently controlled air mixing and a net metallic protector of grass inside the chamber (against damaging by the chamber during closing) and a vent for minimizing of overpressure during chamber closing.

Open chamber – parking position

Closed chamber – measuring position

CO_2 concentration increase
Nonlinear CO_2 concentration increase inside respiration chamber is problem in some closed gasometrical system sometimes. A combination of appropriate hardware design and measurement protocol of SAMTOL-II produces nearly perfect linear increase of CO_2 concentration:

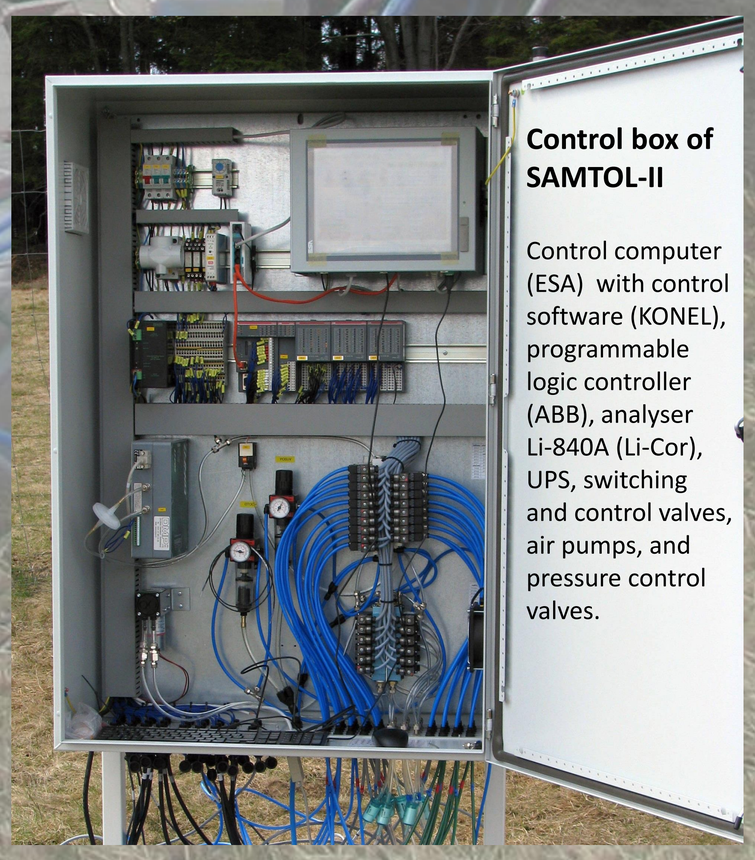


Main advantages
- Full automation
- Minimized influence of the chambers on monitored area (input of radiation, precipitation; air movement)
- Water vapour dilution correction
- Dual system for minimizing of overpressure problem during the chamber closing (slow closing + special active vent for pressure equilibrium)
- Controlled air movement inside the chambers
- Fully remote control of the system via Internet
- Automatic failure warning message via E-mail
- Many settings of the measurement protocol fully and easy controlled by user
- Recording of calculated fluxes and all raw data (CO_2 and H_2O concentration, temperatures, air pressure etc.) for possible future recalculating.

Overpressure „problem“
During closing of any chamber some undesirable overpressure appears. Overpressure inside of SAMTOL-II chambers is very low in comparison with other systems:

System	Max overpressure [Pa]	Pressure difference during measurement [Pa]	Overpressure duration [s]
EGM-4 + OC (PP-system, UK)	19.5	0	3
Li-6400 + OC (Li-Cor, USA)	2.4	0	2
GMP 343 (Vaisala, Finland) + HMC	10.6	0	2
Li-6200 (Li-Cor, USA) + HMC	2.3	0	2
Li-8100 + OC (Li-Cor, USA)	2.2	0	3
SAMTOC (CzechGlobe, CR)	0.7	0	4
SAMTOL-II (CzechGlobe/KONEL, CR)	**1.5**	**0**	**3**

OC – original chamber, HMC – home made chamber.



Control box of SAMTOL-II

Control computer (ESA) with control software (KONEL), programmable logic controller (ABB), analyser Li-840A (Li-Cor), UPS, switching and control valves, air pumps, and pressure control valves.

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