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Continuous CO2-monitoring in soil - field test of a new measurement tool for soil science

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The representative measurement of gas concentration and fluxes in heterogeneous soils is one of the current challenges for understanding and analysis of the interactions of biogeochemical processes in soils and global change. Furthermore, recent research projects on CO2-sequestration have an urgent need of CO2-monitoring networks. Therefore, a measurement method based on selective permeation of gases through tubular membranes has been developed. Combining the element-specific diffusion rates of a membrane set and Dalton's principle, the gas concentration (or partial pressure) can be determined by the measurement of physical quantities (pressure or volume) only. Due to the comparatively small diffusion constants of the used membranes, the influence of the sensor on its surrounding area can be neglected. The design of the sensor membranes can be adapted to the spatial scale from the bench scale to the field scale. The sensitive area for the measurement can be optimized to obtain representative results. A continuous time-averaged measurement is possible where the time for averaging is simply controlled by the wall-thickness of the membrane used.

As a first attempt, the new measurement technique was designed for continuous in situ monitoring of CO2 in soil inside the environmental monitoring site Schmorren (Saxony). Two sensor sets, containing three 1 m - lances each horizontally drilled in the undisturbed soil in the depths 10 cm, 30 cm and 60 cm below surface. Thereby the first set is situated below grass land and the second set was placed into an adjacent agricultural test site (winter wheat). The monitoring was started in February this year.

We present the new measurement tool, its field installation, the calibration procedure and the actual records of CO2.