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Towards higher spatial resolution of soil CO2 efflux measurements: testing new equipment

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Soil CO2 efflux (Rs) is one of the key determinants of net-ecosystem carbon exchange. The most important drivers for Rs are soil temperature and soil water content. High spatial variability of soil temperature, soil water content and Rs are not rare in natural environments (e.g. in cases of uneven soil depth, organic matter availability and uneven vegetation cover). Therefore we designed and constructed an automated system that continuously monitors Rs with 16 closed dynamic chambers. Special chamber construction minimizes microclimate changes of measurement point while inactive chamber is 0.8m above measurement point. Each chamber is equipped with soil temperature sensor to monitor soil temperature of measurement point. Central system consists of infrared gas analyzer (LI-840) and prototype electronic system that drives chambers, valves, pumps and LI-840. Central system collects temperature and CO2 concentration data of active chamber. Same system sends data during measurement through serial communication to prototype serial data logger or portable computer. Two pumps and 32 valves allow more than 10 m tubing to each chamber. The measuring principle is based on the measurement of the increase in CO2 concentration within an automated chamber in a fixed period of time. The chamber operates by covering over the soil in response to a signal from central system and remains on the measuring point for a fixed period of time. In this way, the chamber allows normal drying and wetting of the soil between measurements. System holds great potential for a long term continuous measurements of soil CO2 efflux in natural environments with high spatial resolution.