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Influence of soil moisture on soil respiration

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The aim of this work was to describe an impact of soil moisture on soil respiration. Study was performed on soil samples from morphologically diverse study site in loess region of Southern Moravia, Czech Republic. The original soil type is Haplic Chernozem, which was due to erosion changed into Regosol (steep parts) and Colluvial soil (base slope and the tributary valley). Soil samples were collected from topsoils at 5 points of the selected elevation transect and also from the parent material (loess). Grab soil samples, undisturbed soil samples (small - 100 cm3, and large – 713 cm3) and undisturbed soil blocks were taken. Basic soil properties were determined on grab soil samples. Small undisturbed soil samples were used to determine the soil water retention curves and the hydraulic conductivity functions using the multiple outflow tests in Tempe cells and a numerical inversion with HYDRUS 1-D. During experiments performed in greenhouse dry large undisturbed soil samples were wetted from below using a kaolin tank and cumulative water inflow due to capillary rise was measured. Simultaneously net CO_2 exchange rate and net H_2O exchange rate were measured using LCi-SD portable photosynthesis system with Soil Respiration Chamber. Numerical inversion of the measured cumulative capillary rise data using the HYDRUS-1D program was applied to modify selected soil hydraulic parameters for particular conditions and to simulate actual soil water distribution within each soil column in selected times. Undisturbed soil blocks were used to prepare thin soil sections to study soil-pore structure. Results for all soil samples showed that at the beginning of soil samples wetting the CO_2 emission increased because of improving condition for microbes' activity. The maximum values were reached for soil column average soil water content between 0.10 and 0.15 cm3/cm3. Next CO_2 emission decreased since the pore system starts filling by water (i.e. aggravated conditions for microbes, closing soil gas pathways etc.). In the case of H_2O exchange rate, values increased with increasing soil water contents (up to 0.15-0.20 cm3/cm3) and then remained approximately constant.

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