EGU24-14918, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-14918
EGU General Assembly 2024

Simultaneous Quantification of Soil Water States, Water Fluxes, Greenhouse Gases and BVOC Exchange between soil and atmosphere during transient conditions

Efstathios Diamantopoulos, Hai Anh Nguyen, Frederic Leuther, and Anke Nölscher
University of Bayreuth, Chair of Soil Physics, Bayreuth, Germany (efstathios.diamantopoulos@uni-bayreuth.de)

Biogenic volatile organic compounds (BVOCs) are a diverse group of chemicals emitted from living organisms. These compounds are involved in a variety of ecological processes, as well as the formation of aerosols and ozone, which can impact air quality and climate. Recent studies suggest that BVOCs can be released and taken up by soil through biotic and abiotic pathways in high amounts. In this work, we simultaneously quantified the BVOCs exchange between , soil water evaporation fluxes, and matric potential under transient conditions (drying-rewetting experiments). The experiment was conducted with 250 cm³ soil cores (n=4) packed with sieved soil (loamy sand, bulk density: 1.6g/cm³) taken from agricultural topsoil. Aluminum chambers (1L in volume) were attached to the top of the soil cylinders and gas with different BVOCs concentrations was applied at the inlet. At the outlet, the analysis of BVOCs mixing ratios and BVOCs emission was done with a Proton Transfer Reaction – Time of Flight – Mass Spectrometry (PTR-ToF-MS). In addition, a Greenhouse Gas Analyzer (GGA) was used for monitoring the fluxes of methane, carbon dioxide, and water vapor. The analysis of soil water retention curves was done with a Hydraulic Property Analyzer (HYPROP). The results showed a strong negative correlation between ambient mixing ratios and soil emission rates of water-soluble BVOCs when the soil was wet. As the soil moisture fell below a threshold of 0.18 m^3m^{-3} volumetric water content, BVOCs emission negatively correlated to soil water content. The more frequently the soil was rewetted, the more BVOCs could be taken up by wet soil. In conclusion, the study suggests that the BVOCs mixing ratio in the ambient air was the dominant driving factor of the BVOCs emission rate in disturbed soil samples from agricultural land use. Lastly, soil water content affected BVOCs emission mainly when the soil was dry.