Geophysical Research Abstracts
Vol. 16, EGU2014-4217, 2014
EGU General Assembly 2014

Evaluation of soil water stable isotope analysis by H_2O(liquid)-H_2O(vapor) equilibration method

Benjamin Gralher and Christine Stumpp

Institute of Groundwater Ecology, Helmholtz Zentrum München, Neuherberg, Germany
(benjamin.gralher@helmholtz-muenchen.de)

Environmental tracers like stable isotopes of water (δ18O, δ2H) have proven to be valuable tools to study water flow and transport processes in soils. Recently, a new technique for soil water isotope analysis has been developed that employs a vapor phase being in isothermal equilibrium with the liquid phase of interest. This has increased the potential application of water stable isotopes in unsaturated zone studies as it supersedes laborious extraction of soil water. However, uncertainties of analysis and influencing factors need to be considered. Therefore, the objective of this study was to evaluate different methodologies of analysing stable isotopes in soil water in order to reduce measurement uncertainty. The methodologies included different preparation procedures of soil cores for equilibration of vapor and soil water as well as raw data correction. Two different inflatable sample containers (freezer bags, bags containing a metal layer) and equilibration atmospheres (N2, dry air) were tested. The results showed that uncertainties for δ18O were higher compared to δ2H that cannot be attributed to any specific detail of the processing routine. Particularly, soil samples with high contents of organic matter showed an apparent isotope enrichment which is indicative for fractionation due to evaporation. However, comparison of water samples obtained from suction cups with the local meteoric water line indicated negligible fractionation processes in the investigated soils. Therefore, a method was developed to correct the raw data reducing the uncertainties of the analysis.. We conclude that the evaluated method is advantageous over traditional methods regarding simplicity, resource requirements and sample throughput but careful consideration needs to be made regarding sample handling and data processing. Thus, stable isotopes of water are still a good tool to determine water flow and transport processes in the unsaturated zone.