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Influence of soil texture and degree of saturation on the equilibration time of water isotope in closed systems using direct H2O(liquid) - H2O(vapour) equilibration method

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The direct liquid-vapour equilibration (DLVE) method is a new method to measure the stable isotopes of oxygen and hydrogen in soil pore water. Advantages of DLVE are (a) minimum sample handling, (b) direct isotope measurement from the samples without the need of extracting the water, (c) comparatively low costs, (d) and high reliability. However, the impact of different water content and equilibration times on the isotope measurement of different soil types is not well understood yet. Therefore, this study focuses on advancing our knowledge of the effect of different soil types and soil water contents on the isotope measurement of the DLVE method. Three different types of soil (sand, silt and clay) representing sediment samples with different pore sizes were saturated using tap water with a known isotopic value in a water bath. Different degrees of saturation (100%, 80%, 60% and 40%) were established, placed in Ziploc bags and equilibrated for different time spans ranging from 1 hour up to 8 days at constant surrounding temperature (about 20^{o}C). The isotope measurements were obtained using cavity ring down laser spectroscopy (CDRS) for each test samples. The time taken for the $H_2O_{(liquid)}$-$H_2O_{(vapour)}$ equilibration for different soil textures and different water contents in Ziploc bags were determined. Results showed that sandy soil samples took shorter time to reach isotopic equilibrium with the headspace in the Ziploc bags compared to clayey soil which took comparatively longer for the same soil saturation level. Regardless of the soil type, 100% saturated soil samples took shorter time to reach liquid-water equilibration compared to low saturated soil samples. These findings could lead to protocols of soil sample measurements using DLVE regarding the influence of different soil textures and soil moisture contents.