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NMR relaxation in natural soils: Fast Field Cycling and T1-T2 Determination by IR-MEMS

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Soils are natural porous media of highest importance for food production and sustainment of water resources. For these functions, prominent properties are their ability of water retainment and transport, which are mainly controlled by pore size distribution. The latter is related to NMR relaxation times of water molecules, of which the longitudinal relaxation time can be determined non-invasively by fast-field cycling relaxometry (FFC) and both are obtainable by inversion recovery – multi-echo- imaging (IR-MEMS) methods. The advantage of the FFC method is the determination of the field dependent dispersion of the spin-lattice relaxation rate, whereas MRI at high field is capable of yielding spatially resolved T1 and T2 times.
Here we present results of T1- relaxation time distributions of water in three natural soils, obtained by the analysis of FFC data by means of the inverse Laplace transformation (CONTIN)1. Kaldenkirchen soil shows relatively broad bimodal distribution functions D(T1) which shift to higher relaxation rates with increasing relaxation field. These data are compared to spatially resolved T1- and T2 distributions, obtained by IR-MEMS. The distribution of T1 corresponds well to that obtained by FFC.