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Field evaluation of a direct push deployed sensor probe for vertical soil water content profiling

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Reliable high-resolution information about vertical variations in soil water content, i.e. total porosity in the saturated zone, is essential for flow and transport predictions within the subsurface. However, porosity measurements are often associated with high efforts and high uncertainties, e.g. caused by soil disturbance during sampling or sensor installation procedures. In hydrogeological practice, commonly applied tools for the investigation of vertical soil water content distribution include gravimetric laboratory analyses of soil samples and neutron probe measurements. A yet less well established technique is the use of direct push-deployed sensor probes. Each of these methods is associated with inherent advantages and limitations due to their underlying measurement principles and operation modes. The presented study describes results of a joint field evaluation of the individual methods under different depositional and hydrogeological conditions with special focus on the performance on the direct push-deployed water content profiler. Therefore, direct push-profiling results from three different test sites are compared with results obtained from gravimetric analysis of soil cores and neutron probe measurements. In direct comparison, the applied direct push-based sensor probe proved to be a suitable alternative for vertical soil water content profiling to neutron probe technology, and, in addition, proved to be advantageous over gravimetric analysis in terms vertical resolution and time efficiency. Results of this study identify application-specific limitations of the methods and thereby highlight the need for careful data evaluation, even though neutron probe measurements and gravimetric analyses of soil samples are well established techniques (see Vienken et al. 2013).

Reference: Vienken, T., Reboulet, E., Leven, C., Kreck, M., Zschornack, L., Dietrich, P., 2013. Field comparison of selected methods for vertical soil water content profiling. Journal of Hydrology, 501: 205-212.