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How to achieve a good evaluation of soil moisture content at different depths with available measuring techniques?

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Soil moisture is a key variable in the soil-vegetation-low atmosphere system. It is seen as an impact factor for several exchange processes such as soil gas diffusion and migration. Higher soil moisture leads to constrained gas diffusion and to some extent even to soil gas accumulation. Therefore, it is indispensable to measure soil gas concentration or fluxes jointly with soil moisture. The Time Domain Reflectometry (TDR) has become a standard method for field measurements of the soil moisture content. However, field TDR measurements show a high spatial and temporal variability. On the other hand, it is also difficult to implement this method in probes for depth oriented measurements in boreholes/wells.

Therefore, an alternative approach to estimate the soil moisture content was demanded. The work was carried out within the “RATIEF” project, funded by the German Federation of Industrial Research Associations (AIF), aiming in developing a measuring device and a modular probe system to measure depth oriented soil gas concentration and fluxes (especially CO2 and 222Rn) by taking into account the relevant influencing parameters (e.g. soil temperature, and soil moisture).

Field data indicate a strong correlation of contact resistances measured during self-potential measurements and TDR data. The derivation of soil moisture data using this observed linear fitting function achieved a valuable prediction for these data. However, this is a site specific approach and a lot of data are needed to obtain reliable fitting results. Laboratory experiments in conjunction with modelling showed that a certain soil moisture range (0-30%) has the greatest impact on soil gas migration processes. Therefore, an approach is needed to assess the variability of soil moisture within this range.

Since resistivity measurement can measure data simultaneously providing integral information from different depths and locations, several studies used this method for estimating the soil moisture variability. Ongoing studies determine explicit relationships between soil moisture and resistivity parameters and therefore, offer a potential for assessing the in-situ soil moisture condition.

This poster presentation will show results of laboratory experiments investigating the application of contact resistance measurements and resistivity methods within the modular probe system to estimate the soil moisture content. In addition, it will also discuss influencing parameters which need to be assessed for a reliable interpretation.