



Relating the composition and water content of soils to electrical permittivity and conductivity: Results from laboratory and field measurements

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In the framework of the EU-project iSOIL geophysical measurements on soil samples of different texture have been conducted. The measurements serve to investigate the so-called pedo-tranfer functions describing the relation between soil composition, porosity and water saturation on the one hand and geophysical properties which can be mapped in the field on the other hand. In the present study we are concentrating on geoelectric and GPR measurements in the laboratory.

Our measuring cell consists of a large plastic cylinder (75cm height, 25cm diameter) equipped with metallic plate and ring electrodes for measuring soil conductivity. The lower plate electrode is also used as reflector for GPR measurements using a 1600MHz antenna placed at the upper surface of the soil sample inside the cylinder. All measurements are done on different soil samples with various textures. They are saturated in steps of approximately 2-3% volumetric water content. The GPR data is first examined to determine the soil permittivity. Additionally different approaches are investigated to extract information about attenuation and quality factor.

The relationship between permittivity and electrical conductivity is investigated. Results from laboratory and in situ field measurements are compared.

The following results have been found:

- For several samples permittivity and electrical conductivity show a nearly linear relationship.
- This relationship can be successfully applied to field measurements.
- The expected positive relationship between saturation and attenuation is confirmed.

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