Combining GPR and EMI for soil inventory

Promotor: Prof. dr. ir. M. Van Meirvenne (Dept. of Soil Management)
PhD student: MSc. Fun Meeuws (Dept. of Soil Management)

Introduction

Soil sensors have already been used extensively for soil inventory. Until today, the most important sensor used in our research group is an electromagnetic induction or EMI sensor. This type of sensor measures the electrical conductivity of a certain soil volume. The first extension of this type of sensor was the implementation of multiple coil configurations, which allowed to measure different soil volumes with different depths. Next, a multi-signal extension was introduced, resulting in the simultaneous measurement of 2 out of the 3 geophysical parameters of the soil: electrical conductivity and magnetic susceptibility. The third geophysical parameter, dielectric permittivity, however, can be determined using a ground penetrating radar or GPR. Therefore, the logical next step in this research is a multi-sensor extension combining both an EMI sensor and a GPR.. This GPR gives us a vertical transect of the soil and indicates boundaries of contrasting permittivity. The conductivity measured by EMI sensors can be used to determine several parameters of the soil, which are necessary to process the more complex GPR data. Combining both types of sensors thus permits determining the depth to interfaces and the soil composition, and identifying and locating objects in the subsoil.

Research hypothesis

Combining and integrating two types of soil sensors, EMI and GPR, gives added value for the means of soil inventory.

Research questions

- How can EMI and GPR signals be integrated and used in a multi-sensor platform?
- Which sensor or combination of sensors is best suited for which application?
- Which soil composition is best suited for which application?

Applications

To answer these research questions, several applications will be investigated.

1. Both sensors will be used to locate WWI military structures and other archaeological remnants in different soil types (sandy and clayey soils).
2. Several palaeogeomorphological structures will be thoroughly investigated and mapped to optimise precision agriculture.
3. …