Geophysical Research Abstracts
Vol. 18, EGU2016-4285, 2016
EGU General Assembly 2016

Using an electromagnetic induction sensor to estimate mass and depth of metal objects in a former battlefield

Marthe Smetryns, Timothy Saey, Nicolas Note, and Marc Van Meirvenne

Research Group Soil Spatial Inventory Techniques, Faculty of Bioscience Engineering, Ghent University, Coupure 653, 9000 Gent, Belgium (Marthe.Smetryns@UGent.be)

Electromagnetic induction (EMI) sensors are used to perform a non-invasive geophysical survey of land, revealing electrical and magnetic properties of the soil. The technique is used for a variety of agricultural and archaeological purposes to map the soil and locate buried archaeological objects. Besides this, EMI sensors have proven effective to detect metal objects, like the metal remains of the First World War (WW1) in the Western part of Belgium. Most EMI sensors employed for metal detection rely on a single or multiple signal(s) coming from one receiver coil. In this research a multiple coil EMI sensor was used to survey several fields in the former war zone of WW1. This sensor, the DUALEM-21S sensor, consists of one transmitter and four receiver coils leading to four simultaneous measurements of the electric and magnetic properties of the soil. After mapping the fields, the possible metal objects were delineated based on a combination of all electrical measurements and safely excavated. By combining the signals from the different coil configurations, depth intervals for the buried metal objects were assigned to all selected anomalies. This way the metal objects could be located either within the plough layer (0 – 0.45 m), just underneath the plough layer (0.45 – 0.70 m) or deeper than 0.70 m under the surface. Finally, mass models were established within every depth interval to be able to predict the metal mass of every selected anomaly .

This methodology was successfully validated in another field where several metal objects were buried. Finally, it was applied on several arable fields at a different location within the former WW1 front zone. Fields located in the centre of the former war zone contained more than 400 metal pieces per hectare, most of them just underneath the plough layer. Fields on the edge of the former war zone contained substantially less metal items per hectare.

To conclude, the developed methodology can be employed to differentiate between heavy metal objects buried deeply in the soil, and light metal objects buried superficially. Furthermore, it could be used to map and estimate the depth and mass of the metal remains from WW1 on arable fields.