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Reconstruction of a medieval landscape through multi-receiver electromagnetic induction survey

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In contrast to investigations on soil variability, electromagnetic induction (EMI) instruments have been used rarely for archaeogeophysical prospection. Nevertheless, the potential of EMI sensors to record simultaneously electrical and magnetic soil properties is a major asset. In non-saline environments the measured apparent electrical conductivity (ECa) mainly relates to soil texture (primarily clay), whereas the apparent magnetic susceptibility (MSa) is often heavily influenced by anthropogenic soil disturbances and iron containing material. The latest generations of multi-receiver EMI sensors allow recording the ECa and MSa of multiple soil volumes simultaneously, enabling the three-dimensional (3D) reconstruction of the natural and anthropogenic soil composition.

Using a multi-receiver EMI instrument, we surveyed in detail an area of 8 ha located within a 25 km2 wetland area in the north of Belgium. The ECa data indicated a heterogeneous environment with accumulated peat, sandy outcrops and lacustrine marl. Within these sediments multiple traces of anthropogenic ditch systems were clearly visible. In addition, a number of regularly arranged punctual structures were detected with the MSa measurements. Based on these observations, two excavation trenches were positioned over the most characteristic anomalies to gain detailed insight into the archaeological features and the stratigraphy of the site. It appeared that most structures could be related to a medieval environment composed of ditches and brick fundaments of larger constructions associated with an adjacent monastery.

To reconstruct the detected medieval landscape, the multi-layered EMI dataset was combined with the excavation data through an inversion procedure. While from one excavation trench stratigraphical information was used to calibrate this landscape model, geometrically correct profile information was used from the other trench to test the validity of the model. Finally, the multi-layered MSa data were combined to visualize the current subsurface expression of the medieval landscape and estimate the preservation potential of the detected structures.

The use of EMI for a combination of digital soil mapping and archaeogeophysical prospection has allowed the reconstruction of the archaeological variation of the study site within its former geomorphological environment. Through EMI data inversion, this geoarchaeological variation could be analysed in 3D offering insight into the human-landscape interactions and the preservation of the site.