3D IMAGING OF SOIL APPARENT ELECTRICAL CONDUCTIVITY FROM VERIS DATA USING A 1D SPATIALLY CONSTRAINED INVERSION ALGORITHM

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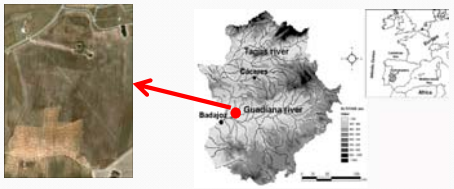
1 Introduction and Objectives.

Maps of apparent electrical conductivity of the soil (ECs) are commonly used in precision agriculture to indirectly characterise some important properties, like salinity and clay content. Traditionally, these studies are made through an empirical relationship between ECs and properties measured in soil samples collected at a few locations and at a few selected depths. Recently, some authors have used not the ECs values but the soil bulk conductivity (in 2D or 3D) calculated from measured ECs through the application of an inversion method. All the published works used data collected with electromagnetic instruments.

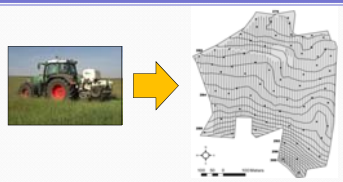
We present a **new software to invert the ECs data collected with VERIS 3100 and 3150** (or the more recent version with three pairs of electrodes) using the **1D spatially constrained inversion method** (1D SCI). The software allows the calculation of the distribution of the bulk electrical conductivity in the survey area until a depth of 1 m. The algorithm is applied to experimental data and correlations with some soil properties have been established using soil samples collected at some boreholes.

2 Materials and Methods.

- *Experimental field*: Cerro del Amo (38º 58' 14" N, 6º 33'394 W, 225 m a.s.l, Datum WGS84), 33-ha field located in Badajoz (southwestern Spain).



- ***Deep and shallow ECs*** (0-90 and 0-30 cm depth respectively) data for all sampling sites were obtained from different transects of the measurements of ECs conducted using a VERIS 3100.
- ***70 georeferenced soil samples*** were collected using a stratified random sampling scheme and analysed for some soil properties (eg, soil texture, cation exchange capacity –CEC-, pH, and primary nutrients availability).

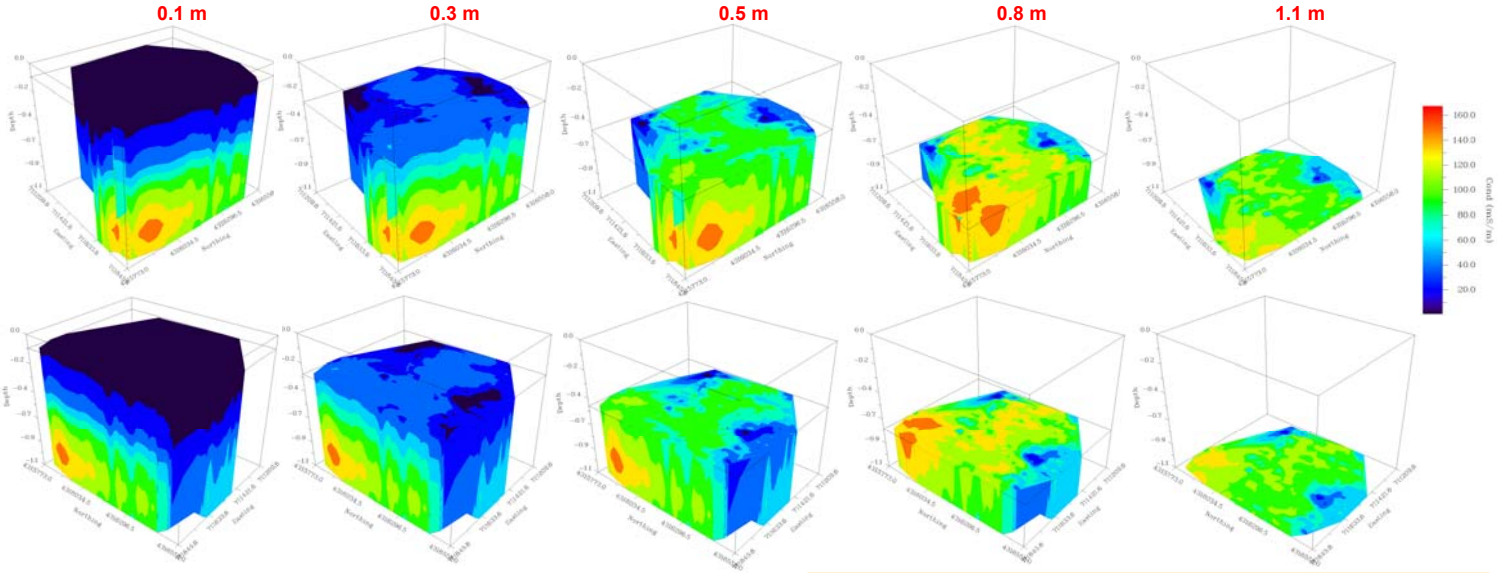


Data collected with VERIS were processed using the new **invVERIS software**

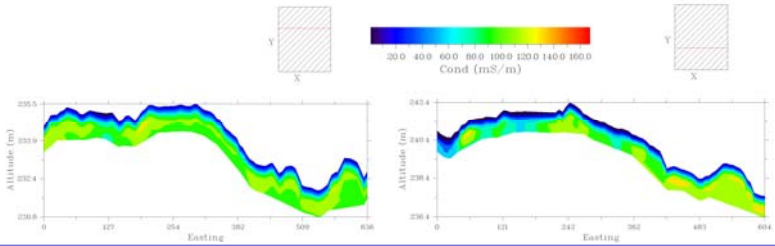
Inversion of data were performed using a 1D spatially constrained technique

3 Results.

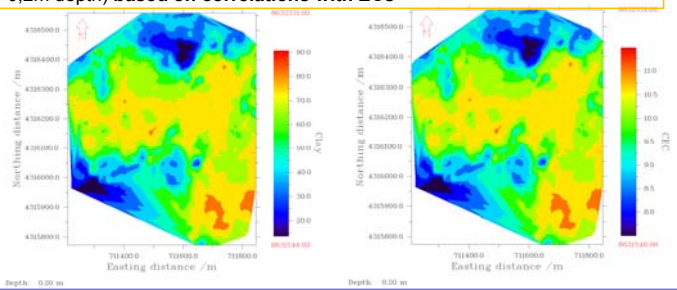
3D imaging of ECs and horizontal slices at different depths (two orientations for visualisation are shown in both files**).**
In a similar way, vertical slices in a 3D image can also be provided.



Vertical slices of the field, showing the ECs distribution in the shallow soil layer



Maps of the spatial distribution of soil properties (eg, clay and CEC at 0,2m depth) **based on correlations with ECs**



4 Conclusions.

The **invVERIS software** is capable of inverting ECs data of surveys covering large areas and results can be exported in different formats to be used in a GIS or other programs.

Consequently, the spatial distribution of topsoil and subsoil ECs can be visualised and soil properties correlated with ECs can be also displayed at different depths.

The invVERIS software is a powerful tool to map ECs and other soil properties in 2 dimensions and, particularly, **3 dimensions**.

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