6th CARGESE school: FLOW and Transport In porous and fractured MEdia (FLOWTIME)
Linking life supporting functions of the subsurface across disciplines
10-21 Jun 2024 Cargèse (France)

Geophysics hands-on

Making the invisble visible, electrical geophysics as a tool to caracterize subsurface properties and life-supporting functions

Objectives:

The main scope of the geophysical hands-on is to train a group of students from every horizons to use a simple but powerful tool to study life supporting functions of the subsurface at interfaces between hydrology, geophysics and biological processes.

Teachers: Thomas Hermans (week 1), Quentin Chaffaux and Damien Jougnot (week 2)

Timeframe: The praticals will be split in two parts:

(1) The first week, the student will learn about the theory of electrical resistivity measurement and tomography (ERT) (Figs. 1 and 2), the use of a state-of-the-art resistivity-meter (Syscal from IRIS Intrument) and data processing tools (ResIPy).

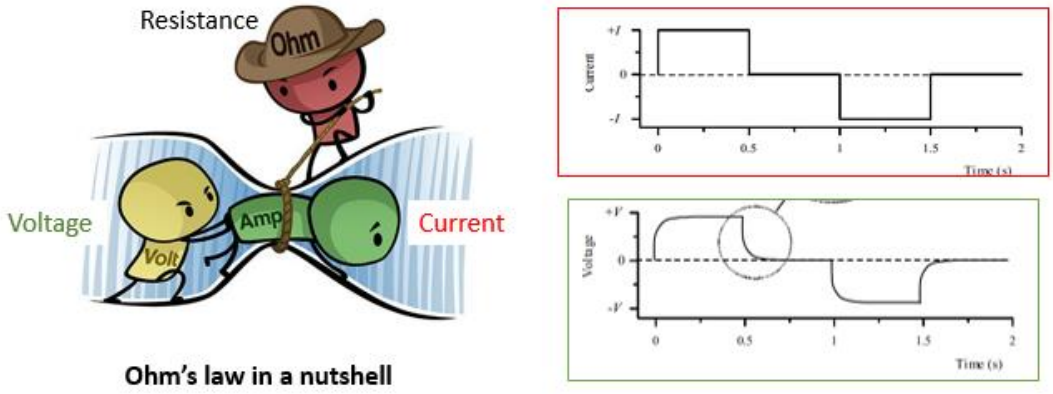

Figure 1: Ohm's law, the physical basis of electrical resistivity measurement.

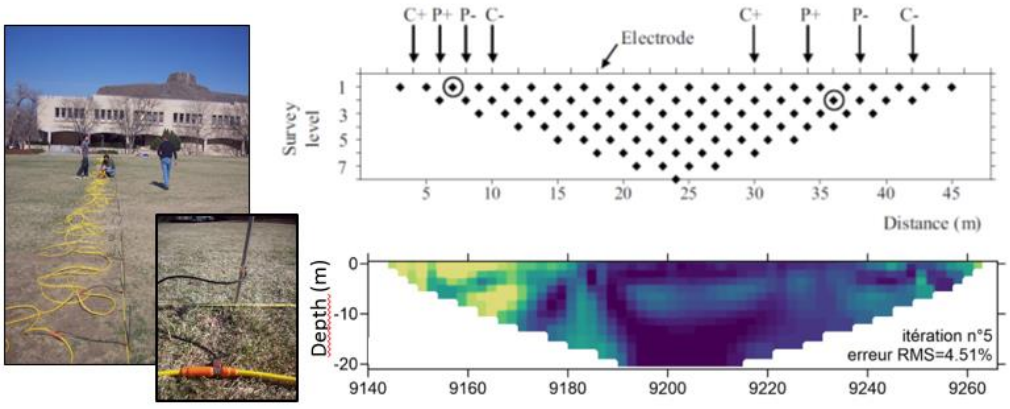

Figure 2: Picture (left) and sketch (top) of an ERT set-up (modfied from Binley & Kemna, 2005). Electrical resistivity tomogram after inversion (bottom).

(2) The second week, the student will propose and execute a research project related to characterization and/or monitoring of a soil-tree(s) system with there newly acquired knowledge of ERT (Fig. 3). Among possible project, monitoring of roots systems (measurements during day-night cycles) and/or trunk imagery and/or water infiltration monitoring and/or subsurface heterogeneity characterization at the plot scale.

We encourage the students to take a look at a recent review on the subject (Loiseau et al. 2023).

Figure 3: Field implementation of geophysical techniques discussed in Loiseau et al. (2023). The label (E) locate the electrical resistivity tomography (ERT) that can be used to characterize the spatial heterogeneity of subsurface properties around the tree-root systems and possibly monitor the water dynamics.

Facility for the practicals:

The presentation of the theory and data processing (e.g., inversion) will require a room with a screen.

The measurements will be conducted outside at the IESC. Identifying and selecting the exact location of the measurements will be part of the practical.

References:

Binley, A., Kemna, A. (2005). DC resistivity and induced polarization methods. In Hydrogeophysics (pp. 129-156). Dordrecht: Springer Netherlands.

Loiseau, B., Carrière, S. D., Jougnot, D., Singha, K., Mary, B., Delpierre, N., Guérin, R., K. Martin-StPaul, N. (2023) The geophysical toolbox applied to forest ecosystems – a review, Science of the Total Environment, 899, 165503, doi:10.1016/j.scitotenv.2023.165503.