

Master Project proposal

Project Details

Title	Capacitive resistivity measurements for deducing 3-D subsurface models
Institution / Company	Applied Geophysics and Geothermal Energy (GGE), E.ON Energy Research Center
Location	Aachen
Principle Supervisor	Dr. Norbert Klitzsch (nklitzsch@eoenerc.rwth-aachen.de)
Local Supervisor in Company	Dr. Norbert Klitzsch, Christopher Nordlund
Supervising University	RWTH Aachen University

The quantitative prediction of the behaviour of the soil-vegetation-atmosphere-system constitutes a major challenge to scientists and policymakers, especially in view of global climate change. The Transregional Collaborative Research Centre TR32, in which this Master project is embedded, is dedicated to the soil-vegetation-atmosphere-system (see tr32.de for more information). Describing the spatial and temporal variability of water fluxes in the system by coupled models is one of the major goals of TR32. For that, subsurface information is required, which shall be provided by capacitive resistivity measurements.

The capacitive resistivity (CR) method (e.g. Timofeev et al., 1994) is a time and labour-saving alternative to traditional direct current (DC) resistivity methods. The CR method utilizes electrodes, which couple capacitively to the ground, to measure the subsurface resistivity. The instrument to be applied (the OhmMapper by Geometrics) uses line electrodes in a dipole–dipole configuration arranged in a straight line on the ground.

In this master thesis project large-scale capacitive resistivity measurements shall be carried out on TR32 test sites located in the vicinity of Aachen. The line electrode array will be mainly pulled by an all-terrain vehicle and partly (in inaccessible areas) by manpower. The field work will be carried out together with researchers from FZ Jülich (Research Centre Jülich).

Besides performing CR measurements, the project will focus on the 3-D inversion of CR data applying DC algorithms. For that, 3-D sensitivity distributions of line electrode configurations have to be analysed in a similar way as proposed by Neulirch and Klitzsch (2010). Moreover, shallow but high-resolution near-surface information obtained from EMI and GPR shall be considered for the inversion of the CR data. The resulting 3-D resistivity distributions will be compared and validated by 2-D SIP or DC resistivity sections measured (as well as EMI and GPR) by other TR32 projects.

Feel free to contact me (e.g. via nklitzsch@eoenerc.rwth-aachen.de) if you are interested in this project or for further information.

References

Neukirch, M. and N. Klitzsch (2010): Inverting Capacitive Resistivity (Line Electrode) Measurements with Direct Current Inversion Programs. *Vadose Zone J.* 9(4): 882-892.

OhmMapper: www.geometrics.com/geometrics-products/geometrics-electro-magnetic-products/ohm-mapper/

Timofeev VM, Rodozinski, AW, Hunter, JA and Douma, M., 1994, A new ground resistivity method for engineering and environmental geophysics. *Proceedings of the Symposium on the Application of Geophysics to Engineering and Environmental Problems, EEGS*, 701-715.

Skill Profile

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comments

Programming		Matlab
Fieldwork		performing OhmMapper measurements
Laboratory work		
Theory		resistivity inversion, sensitivity studies
Processing		OhmMapper data
Interpretation		Relating electrical properties to geology
Geology		

Opportunities provided

comments

Approved Further Education / Training	Yes	
Training with particular software	Yes	Matlab, MagMap
Training with particular hardware	Yes	OhmMapper
Temporary relocation at a research partner	No	not applicable
Temporary relocation for fieldwork	No	day trips only
Coverage of costs relocation/accommodation/expenses	No	not applicable
Local assistance provided	Yes	Visa / housing / financial support
Publication possible	Yes	