

**Name of course: ELECTROMAGNETIC SOIL SENSORS – THEORY AND APPLICATIONS**

**ECTS credits: 5**

**Course parameters:**

*Language:* English

*Level of course:* PhD course

*Time of year:* Q2 2023

*No. of contact hours/hours in total incl. preparation, assignment(s) or the like:* 120

*Capacity limits:* 20

**Objectives of the course:** Recent technological advances over the last two decades have led to increased use of soil sensing technologies to supplement tedious soil sampling procedures for comprehending soil status. A significant contribution to Pedometrics was particularly made by the developments in georeferencing and electromagnetic soil mapping sensors. Progressively, these sensors are becoming more affordable and finding new applications in precision agriculture for sustainable use of the soil resource. Moreover, the evolution of unmanned aerial vehicles, robots and multi-sensor platforms has further improved their mobilization and accessibility. In this course, we cover the recent developments in proximal and remote electromagnetic sensor technologies with a hands-on experience in measurements and modelling. In addition, case studies will be presented motivating the use of these sensors in general soil mapping applications such as archaeology, environmental, industrial and urban soil studies along with precision agriculture.

**Learning outcomes and competencies:**

At the end of the course, the student **should be able to:**

- Comprehend the role of soil sensors in digital soil mapping
- Know the basics of georeferencing (GPS/GNSS)
- Understand the working principles of electromagnetic soil sensors
- Develop an intuition on what they measure
- Understand what soil properties can influence their measurements and model the relationships
- Do fieldwork and data processing to a basic extent

**Compulsory programme:**

Lectures, exercises, field and laboratory measurements. Active participation in both lectures and group work is expected. A short report should be submitted towards satisfactory course completion.

**Course contents:**

The course provides formal lectures introducing working principles, instrument configuration, applications, and hands-on experience for the following electromagnetic sensing techniques.

- Electromagnetic induction
- Ground penetrating radar
- Time-domain reflectometer
- Different cameras
- Visible near-infrared spectroscopy
- Gamma radiometric

Moreover, the participants will be introduced to georeferencing, employing spatial data on a GIS platform, sensor-directed soil sampling, multi-sensor platforms and data fusion. The exercises will be mainly performed in groups and based on quality datasets available from the ongoing research projects.

**Prerequisites:** PhD students with a background in agronomy, environmental engineering and geophysics.

**Name of lecturer[s]:** John Triantafyllis (Manaaki Whenua – Landcare Research, New Zealand), Fenny van Egmond (ISRIC – World Soil Information, The Netherlands), Sabine Chabrilat (GFZ-Potsdam, Germany) Mogens H. Greve, Anders Vest Christiansen, Maria Knadel, Anton Gårde Thomsen, Amelie Beucher, Lucas de Carvalho Gomes, Rene Larsen, Eva Overby Bach, Henrik Nørgaard, Triven Koganti (Aarhus University, Denmark)

**Type of course/teaching methods:**

The course will last for seven days. Each day begins with a lecture session. The second half of the day will mainly involve hands-on measuring and modelling activities.

**Literature:** Obligatory reading before the start of the course. The material will be distributed to participants after signing up.

**Course homepage:** none

**Course assessment:**

Individual student evaluation (pass/not pass) will be based on contribution to class discussions, group work, and presentation of results in a short individual report at the end of the course.

**Provider:**

Department of Agroecology

**Special comments on this course:** The course fee is 800 Euros (incl. meals). The participants have to find their own accommodation and transport to the campus.

**Time:** 5<sup>th</sup> – 11<sup>th</sup> June 2023

**Place:** Aarhus University Viborg, Blichers Alle 20, 8830 Tjele, Denmark

**Registration:**

The deadline for registration is the 15<sup>th</sup> of May. Information regarding admission will be sent out no later than the 20<sup>th</sup> of May. Please note the capacity limit (20 participants); the allotment will be based on a first come first served basis.

For registration: <https://events.au.dk/soilsensors2023/signup>

If you have any questions, please contact Triven Koganti, e-mail: [triven.koganti@agro.au.dk](mailto:triven.koganti@agro.au.dk)

**PLEASE NOTE**

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