Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences

SLUkurs

Syllabus

PNS0115 X-ray image processing and analyses, 3.0 credits

Syllabus approved

2014-08-27

Subjects

Soil Science/Technology

Education cycle

Third cycle

Grading scale

Pass / Failed
The requirements for attaining different grades are described in the course assessment criteria which are contained in a supplement to the course syllabus. Current information on assessment criteria shall be made available at the start of the course.

Language

English

Prior knowledge

The course is open to any interested PhD student but members of the "Focus on Soils and Water" PhD school will be prioritized in case of overbooking.

Objective, including learning outcomes

The course objectives are to
- introduce X-ray image processing and analyses to PhD students

- give the students skills in processing and analysing X-ray images

After the course the student will be able to
• understand, discuss and evaluate several of the measurement techniques that are used today for analyzing X-ray images.
• identify what method is appropriate for various research questions.
• extract relevant morphological information from 3-D images with FIJI (ImageJ).
• understand and appraise the uncertainties in measures extracted from X-ray images.

Content

X-ray imaging provides the means of significant advancements in life and geosciences since it allows for non-invasive structural investigations of opaque objects and systems, of which soil is a prime example. Prices for industrial X-ray scanning systems have decreased in recent years while their imaging performance has improved. X-ray imaging will therefore likely become a standard method in many subject areas of relevance to SLU. A state-of-the-art industrial X-ray scanner is also available at the Department of Soil and Environment at the SLU campus in Uppsala. Although the techniques taught in the course are general, all examples will be on undisturbed soil samples.
3-D image reconstruction from raw X-ray data is largely standardized and automatized. Instead, it is the extraction of information from the X-ray images which requires training. This PhD course will present, discuss and give hands-on training in common techniques needed to evaluate 3-D high-resolution image data. The main topics are i) artifact and noise removal from X-ray images, ii) image segmentation methods, and iii) morphological measures for characterizing 3-D structures. The course will rely on the open-source software bundle FIJI (ImageJ). Software specific features such as creating 3-D animations and automation of operation with macros will also be covered.
In the last third of the course, the participants will apply the techniques they have learned to investigate the relationship between the pore morphology quantified on individual soil samples and their measured hydraulic conductivities.

Requirements for examination

Active participation in all seminars and exercises including group work and presentation of group work.

Additional information

The course is given by the research school Focus on Soils and Water

Responsible department

Department of Soil and Environment