# 3D RECONSTRUCTION OF SOIL POROSITY: TWO DIFFERENT APPROACHES

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## ABSTRACT

Pore geometry imaging and its quantitative description is a key factor for advances in the knowledge of physical, chemical and biological soil processes. More specifically it is a powerful tool for evaluating changes in soil structure due to different irrigation and soil tillage practices.

Earlier 3D representations of the internal structure of the soil have been obtained using medical tomographic systems (NMR and X-ray CT). However, images obtained by such equipments show strong limitations in terms of spatial resolution. In the last decade very good results have been obtained using imaging from very expensive systems based on synchrotron radiation.

More recently X-ray Micro-Tomography resulted to be the most widely applied in scientific community, since the technique provides the best compromise between costs, resolution and size of the images.

Conversely, the conceptually simpler but destructive method of “serial sectioning” has been progressively neglected because of technical problems in sample preparation and time consumption to obtain an adequate number of serial sections for correct 3D reconstruction of soil pore geometry.

In this work a comparison between the two methods above has been carried out in order to define their advantages and shortcomings, and to point out their different potential.

A cylindrical undisturbed soil sample 6.5 cm in diameter and 6.5 cm height of an Ap horizon of an alluvial soil collected in vineyards at EER-INTA in Luján de Cuyo, Mendoza, has been reconstructed using both a desktop X-ray Micro-Tomograph Skyscan 1172 and the new automatic serial sectioning system SSAT (Sequential Section Automatic Tomography) set up at CNR ISAFOM in Ercolano (Italy) with the aim to overcome most of the typical limitations of such a technique.

Image best resolution of 15 µm per voxel has resulted using X-ray Micro CT while 35 µm was the best value using the serial sectioning system but on less noisy images.

SSAT system showed more flexibility in terms of sample size although both techniques allows investigation on REVs (Representative Elementary Volumes) for most of macroscopic properties describing soil processes. Morover, undoubted advantages of not destructivity and ease sample preparation for the Skysan 1172 are balanced by lower overall costs for the SSAT and its potential of producing 3D representation of soil features different from the simple solid/porous phases.

Both approaches allow to use exactly the same image analysis procedures on the reconstructed 3D images

**Key Words**: Porosity, X-ray microtomography, serial sectioning.