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Quantification of the soil pore network by 3D image analysis: three different approaches.

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X-ray micro-tomography in the last decade has become the most widely used tool to obtain 3D images of the pore network of undisturbed soil samples. The successive logical goal is the effective quantification of the pore space in order to link structural properties to soil functions, including water flow and solute transport processes. The pore network of two very different soil samples has been reconstructed using the x-ray desktop microtomograph Skyscan 1172 and the comparison of three different approaches of 3D image analysis has been done. The classical objects oriented image analysis approach has been compared with the pore-throat analysis based on the medial axis transform proposed by Lindquist and Venkatarangan (2000) and the successive opening algorithm (Serra, 1982) based on mathematical morphology. The three pore measurement procedures provide very different results in terms of physical meaning. The first one seems more suitable to identify soil pore genesis due to its possibility of accurate quantification of pore shapes. The pore-throat analysis shows strong linkage with behaviour of fluids in the pore network while the successive opening algorithm has allowed good interpretation of water retention properties. Differences also in terms of computation efficiency have been pointed out using a graphic workstation having two processors dual core with 8Gb RAM.