CHARACTERIZATION OF PORE-STRUCTURE PARAMETERS FOR UNDISTURBED AND REPACKED SAMPLES AT FIELD WATER CONTENTS

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Mass transport in soils occurs through the soil pore network, which is highly influence by pore structure parameters (i.e. pore size distribution, porosity, pore tortuosity and pore coordination number). Micro-focus X-ray computed tomography (CT) has emerged as a powerful non-destructive tool for the direct visualization and better understand soil pore geometry. However, there have been few studies on visualization and quantification of soil pore network and soil pore networks linked to indirect pore parameters for gas flow based on measured gas diffusion coefficient and air permeability. In this study we visualized soil-pore networks for different soils, a sandy loam from Saitama, Japan and silty clay loam from Hawke’ s Bay, New Zealand. The study aimed to identify pore structure parameters using a microfocus X-ray computed tomography (MFXCT) system and compare indirect pore parameters such as tortuosity-connectivity parameter and equivalent pore diameter for gas flow. Undisturbed and repacked samples were used for characterizing soil pore networking and structure. For repacked soil samples, particle size (d<2mm) with field water content were used with different dry bulk densities by hand compaction. Soil samples were scanned by MFXCT system with different scanning resolutions of 12,30 and 50 μm/voxels. Then, 3-dimensional models were reconstructed with different regions of interest (ROI) of 50, 100, 200 and 300 voxels. Finally, soil pore-structural parameters such as effective pore radius, coordination number, and tortuosity in z direction were analyzed. With increasing ROI, the pore structure parameters of undisturbed and repacked samples showed less variation. The pore connectivity-tortuosity factors derived from MFXCT were well correlated with the indirect connectivity tortuosities from measured soil gas diffusion. However, it was observed that there were some variations between effective pore diameters from MFXCT and equivalent pore diameters for gas flow estimated by gas transport parameters depending on scanning resolutions (ranging from 1:1 to 1:3 for SR =12 μm/voxels and 1:1 to 4:1 for SR = 30 μm/voxels).

Keywords: Microfocus X-ray Computed Tomography (MFXCT), Gas Transport Parameters, Pore structural parameters

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