

Scale Dependency of Gas Transport Parameters in Undisturbed Soils

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Accurate description of soil-gas transport parameters (soil-gas diffusivity and soil-air permeability) in unsaturated soil profiles is needed when investigating the emission of greenhouse gases to the atmosphere and transport of gaseous phase contaminants of VOCs (Volatile Organic Chemicals) in the vadose zone. Knowledge of gaseous behavior in soil is useful in relation to improvement of contaminated soil and estimation of risk from contamination. Movement of gas in soil is largely governed by advection and diffusion. Advection and diffusion are expressed in terms of soil-air permeability and soil-gas diffusivity respectively.

In this study, we investigated the Scale dependency of gas transport parameters such as soil-air permeability and soil-gas diffusivity using two different size cores (2120 cc and 100 cc) with repacked sandy soil and undisturbed lowland soil. Sandy soils were repacked using two methods: normal-packing and wet-packing. And both large and small undisturbed samples were taken at three different depths (10 cm, 40 cm and 90 cm). In addition, we measured in situ soil-air permeability using shape factor expression by Liang et al. (1995) under field condition.

There was only little scale effect between large and small cores on repacked sandy soil especially with wet-packing. With normal-packing, however packing effect affects soil-air permeability between different size cores. In undisturbed soil samples, gas transport parameters with small cores yielded lower values than large cores at depths of 10 and 90 cm. These differences might have caused by easily broken structure at surface and presence of macropore in soil. Therefore in structured soil as clay soil, the choice of an appropriate representative elementary volume (REV) is important for studies of gas transport parameters.