Air Conductivity in Undisturbed Japanese soils: Development and tests of predictive models

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Soil vapor extraction technique is commonly used for cleaning up soil sites contaminated with volatile organic chemicals (VOCs). Accurate understandings advective air flow due to air pressure differences and soil-air conductivity must be needed to analyze and optimize the soil vapor extraction systems. Moreover, accurate description of air conductivity is also useful to simulate soil-atmosphere gas exchange such as greenhouse gases from forest, agricultural and peat soils, and toxic gases at waste disposal landfill sites.

In this study, we measured air conductivities for 6 natural field sites (three forested, two pasture and one lowland soils) in Japan. The measurements were done on undisturbed $100cm^3$ soil cores at different matric potentials from near water saturation to air-dry condition. The Air conductivity measured by an air permeameter composed of differential pressure gauge, flow meters, and compressor.

Based on the measurements, we developed new models which predict air conductivity as a function of air-filled porosity considering soil physical properties such as total porosity, pore size distribution, pore tortuosity, and clay content. The newly developed models together with existing models were tested against measured data.