Geophysical Research Abstracts
Vol. 20, EGU2018-10053, 2018
EGU General Assembly 2018

Improving water sorption-based clay prediction models for swelling and non-swelling clay soils

Emmanuel Arthur (1), Markus Tuller (2), Per Moldrup (3), and Lis de Jonge (1)

(1) Department of Agroecology, Aarhus University, Tjele, Denmark (emmanuel.arthur@agro.au.dk), (2) Department of Soil, Water & Environmental Science, The University of Arizona, Tucson, (3) Department of Civil Engineering, Aalborg University, Aalborg

Determination of soil clay content is crucial for characterizing several engineering, agronomic and environmental processes. Due to the laborious nature of conventional measurement methods (e.g., use of hydrometer or pipette), several approaches exists for rapid determination of clay content. Use of soil water vapor sorption as a proxy for clay content is one of such approaches. One limitation of this method is the inability to predict accurately clay content for soils dominated by swelling clay or highly weathered non-swelling clays such as kaolinite. We propose modifications to existing water sorption-based clay prediction models to account for dominance of 2:1 swelling or 1:1 non-swelling clay minerals. Compared to the pipette method, the clay content obtained from existing water sorption models at 50% relative humidity (RH) prominently overestimated (RMSE=23.7%; bias=19.7%) and underestimated (RMSE=28.8%; bias=-17.0%), respectively, for swelling clay and non-swelling clay soils. The proposed modification involved correcting the estimated clay content with a "slope factor", S for RH values ranging from 30 to 90% for both adsorption and desorption. For non-swelling clay soils, S averaged 2.24 and 2.10 for adsorption and desorption, respectively. Average S values for swelling clay soils were 0.76 and 0.72 for adsorption and desorption, respectively. Comparison of the estimated clay content from the modified models showed markedly improved estimation of the measured clay content (For RH of 50%, RMSE=10.9%; bias=4.2% for swelling soils and RMSE=12.4%; bias=-4.2% for non-swelling soils).