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Spatial distribution of organic matter composition at aggregate and biopore surfaces for explaining local differences in wettability

Ruth Ellerbrock, Martin Leue, and Horst H. Gerke
ZALF, Inst. of Soil Landscape Research, Müncheberg, Germany (rellerbrock@zalf.de)

Soil wettability is controlling many processes including water flow and solute trans-port in soil. For soil organic matter (OM), the potential wettability depends on amount and type of hydrophobic (A) and hydrophilic (B) functional groups. Since OM is mostly not distributed homogeneously in soils, mixed samples cannot account for characterizing the locally relevant effects of OM on wettability. In situ techniques for determining the local distribution of OM-properties at intact surface are missing and need to be developed. Effects of the locally distributed OM composition on flow and transport processes are highly complex and scale dependent.
This presentation attempts to describe and discuss the 2D local distributions of OM composition at intact aggregate and biopore surfaces using general concepts based on molecular chemistry. The discussion is based on comparisons of maps of the A/B ratios with local wettability characteristics. The 2D maps of the OM composition at intact surfaces are determined using Fourier transform infrared spectroscopy in dif-fuse reflectance mode (DRIFT) in terms of the A/B ratios. Wettability in terms of the contact angle is observed using a Goniometer coupled with a high-speed camera. The contact angle of certain regions/subsamples was found to increase with the A/B ratios in DRIFT mapping. The spatial distributions of A/B ratios, which could be dis-tinguished for crack and biopore (i.e., root channels, earthworm burrows) surfaces, reflect complex interactions between OM and minerals as well as and the effects of dynamics in solute composition and water content. Results will allow adopting models of the OM composition for improved descriptions of functions and properties of struc-tural surfaces at intermediate scale. In case of preferential flow, the composition and properties of these surfaces are of key importance for transport of reactive solutes such as agricultural chemicals.