



Structure formation and its consequences for soil strength and mass flow processes in unsaturated arable and forest soils

R. Horn,

Institute for Plant Nutrition and Soil Science, Christian Albrechts University zu Kiel,
Olshausenstr.40,24118 Kiel, Germany,

The aim of this lecture is to clarify the process of aggregate formation and the following effects on physical and chemical properties of structured soils both on a bulk soil scale, for single aggregates, as well as for homogenized material. Aggregate formation and aggregate strength depend on swelling and shrinkage processes and on biological activity and kinds of organic exudates as well as on the intensity, number and time of swelling and drying events. Such aggregates are denser than the bulk soil. The intra-aggregate pore distribution consists not only of finer pores but these are also more tortuous.

Therefore, water fluxes in aggregated soils are mostly multidimensional and the corresponding water fluxes in the intra- aggregate pore system are much smaller. The aggregate formation also affects the aeration and the gaseous composition of in the intra- aggregate pore space. Depending on the kind and intensity of aggregation, the intra-aggregate pores can be completely anoxic, while the inter-aggregate pores are already completely aerated. The possibility to predict physical properties on these various scales depends on the rigidity of the pore system. In general this rigidity depends on the above-mentioned physical and chemical processes both with respect to intensity and frequency. The consequences of aggregate formation on soil strength can be quantified by frame shear as well as rheometrical tests.