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Hydraulic functioning of degraded peat soils

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Peat soils comprise a divers group of organic substrates with a wide range of hydro-physical and bio-geochemical properties depending on the type of peat forming plants. Agricultural use and artificial drainage additionally alter the ecological services peat soils provide in lowland catchments. In opposite to mineral substrates, peat soils often have a high porosity of up to 90 Vol% in their pristine state. Porosity is decreasing and bulk density increasing upon drainage and the subsequent mineralization of organic matter. This process of peat degradation modifies pore structure and pore size distribution with consequences for the hydraulic properties. In this presentation, we present the current knowledge of key physical and hydraulic properties related to the structure of peat soils and discuss their implications for water storage, flow and the migration of solutes. A bulk density of approximately 0.2 g cm-3 was identified as a critical point. Above and below this value, the macroporosity and hydraulic parameters follow different functions with bulk density. Predicting hydraulic properties from independent variables such as bulk density and soil depth can be substantially improved if pedo-transfer-functions are separately derived for different peat forming plants. Depending on the peat forming plants, anisotropy may have important impact on water flux and solute transport. Electron microscope and computer tomography imagery reveal the complex pore structure of peat soils including dual porosity and dead-end pores. Studies on degraded fen peat show that the solute transport regime shifts from a more equilibrated situation towards preferential flux with increasing mineralization. Such a separation in mobile and immobile water phases may create bio-geochemical hot-spots acting as reactors for green-house gas production and denitrification.