EGU22-2182
https://doi.org/10.5194/egusphere-egu22-2182
EGU General Assembly 2022

Spatial and temporal variability of soil moisture in land-use legacy forest soils in Brandenburg, Germany

Anna Schneider, Alexander Bonhage, Alexandra Raab, and Thomas Raab
Geopedology and Landscape Development, BTU Cottbus-Senftenberg, Cottbus, Germany

Soil physical properties can show high heterogeneity in forest soils, implying a high spatial variability of soil moisture and plant water availability. Legacy effects of past land use, resulting in a small-scale mosaic of anthropogenically modified and unmodified soils in forest areas, further increase this spatial heterogeneity. The soils associated with relict charcoal hearths (RCH), most prominently characterized by a technogenic layer rich in charcoal fragments, are a widespread example for such land use legacy soils in forest areas.

The objective of our study was to characterize the soil moisture regime of forest soils and RCH soils on sandy substrates in the northeastern German lowlands; and in particular to assess the long-term effect of the prolonged summer drought period in 2018 on spatial and temporal variability of soil moisture. We monitored matric potentials, soil water contents and soil temperature from June 2018 in forest soils in the Tauersche Forst (Brandenburg, Germany). Three soil profiles (one reference forest soil profile and two characteristic RCH soil profiles) were instrumented, sampled for laboratory analyses of bulk density, pore size distribution, saturated hydraulic conductivity, and persistence of water repellency; and root density distribution in the profiles was recorded.

The soils in all profiles show low porosity and plant available water contents. On RCH soils, overall porosity is clearly higher compared with the reference soils, mainly related to larger volumes of coarse and fine pores. Soil moisture monitoring shows very high spatial and temporal variability of the recorded data after the prolonged dry period in 2018, with gradual rewetting over the winter periods and only short-term fluctuations of soil moisture in reaction to high-intensity precipitation events in the summer periods. The comparison of in-situ and laboratory-based water retention data shows strong hysteresis effects during the rewetting, with increasingly clear reactions of soil water contents to precipitation events over the years following the dry period, especially in the charcoal-rich substrates. The differences in soil moisture between the dry and the wetter periods were clearly higher in the RCH soils, which, compared with the reference soils, showed higher water contents under wet conditions and lower water contents under dry conditions. The results affirm that land use legacies can clearly increase the spatial and temporal variations of soil moisture in forest areas.