EGU2020-14451
https://doi.org/10.5194/egusphere-egu2020-14451
EGU General Assembly 2020

Dynamics of seepage mobile inventory in forest and agricultural soils - Results from a comparative multi-year lysimeter study

Katharina Lehmann, Robert Lehmann, and Kai Uwe Totsche
Friedrich Schiller University Jena, Institute of Geosciences, Department of Hydrogeology, Jena, Germany
(katharina.lehmann@uni-jena.de)

The mobile inventory in soil seepage is of fundamental importance for soil development and for functioning of subsurface ecosystem compartments. The mobile inventory may encompass inorganic, organo-mineral and organics, dissolved and colloidal, but also particulate matter and microbiota. Still unknown are the conditions and factors that trigger the release and export of seepage-contained mobile matter within soil, and its translocation through the subsurface of the critical zone. Long-term and high-resolution field studies that includes the mobile particulate inventory are essentially lacking. To overcome this knowledge gap, we established long-term soil monitoring plots in the Hainich Critical Zone Exploratory (HCZE; NW-Thuringia, central Germany). Soil seepage from 22 tension-supported lysimeters in topsoil and subsoil, covering different land use (forest, pasture, cropland) in the topographic recharge area of the HCZE, was collected and analyzed by a variety of analytical methods (physico-/chemical and spectroscopic) on a regular (biweekly) and event-scale cycle. With our study we proved that substances up to a size of 50 µm are mobile in the soils. The material spectra comprised minerals, mineral-organic particulates, diverse bioparticles and biotic detritus. Atmospheric forcing was found to be the major factor triggering the translocation of the mobile inventory. Especially episodic infiltration events during hydrological winter seasons (e.g. snow melts) with high seepage volume influences seepage hydrochemistry (e.g. pH, EC) and is important for transport of mobile matter to deeper compartments. Seasonal events cause mobilization of significant amounts of OC. On average, 21% of the total OC of the seepage was particulate (>0.45 µm). Furthermore, our results suggest that the formation environment and the geopedological setting (soil group, parent rock, land use) are controlling factors for the composition and the amount of soil-born mobile inventory. Our study provides evidence for the importance of the mobile inventory fraction >0,45 µm for soil element dynamics and budgets and highlights the role of weather events on soil and subsoil development and subsurface ecosystem functioning.