ARPHA Conference Abstracts 8: e146950
doi: 10.3897/aca.8.e146950

OPEN ACCESS

Conference Abstract

From canopy to bedrock: a 3D critical zone dataset to advance ecohydrological research in the Weierbach Experimental Catchment, Luxembourg

Laurent Gourdol‡, Jérôme Juilleret‡, Núria Martínez-Carreras‡, Christophe Hissler‡

‡ Luxembourg Institute of Science and Technology (LIST), Belvaux, Luxembourg

Corresponding author: Laurent Gourdol (laurent.gourdol@list.lu)

Received: 16 Jan 2025 | Published: 28 May 2025

Citation: Gourdol L, Juilleret J, Martínez-Carreras N, Hissler C (2025) From canopy to bedrock: a 3D critical zone dataset to advance ecohydrological research in the Weierbach Experimental Catchment, Luxembourg. ARPHA Conference Abstracts 8: e146950. https://doi.org/10.3897/aca.8.e146950

Abstract

Knowing the geometry and properties of the Critical Zone (CZ) from the treetops to the fresh bedrock in forested headwater catchments is essential. These characteristics play a key role in governing water movement and storage, the accessibility of nutrients and the energy fluxes that sustain forest ecosystems, regulate streamflow, and maintain downstream water quality and ecosystem functionality. Yet while the upper layers of the CZ are relatively accessible, the deeper regions, where many crucial processes take place, often remain difficult to reach.

This study introduces a novel dataset from the forested Weierbach Experimental Catchment (WEC) in Luxembourg, providing a comprehensive 3D representation of the CZ architecture both above and below ground. Existing LiDAR and aerial photography data was leveraged to characterize the WEC topography, vegetation composition, and canopy height. Additional complementary data was acquired to decipher the WEC's subsurface structure. This involved soil pit investigations, shallow and deep core drillings, borehole logging, hydraulic in-situ measurements, electrical resistivity tomography surveys, as well as the physical, optical and geochemical characterization of soil and rock samples.

© Gourdol L et al. This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Our work demonstrates how the generated multi-method / multi-scale dataset enables detailed mapping of the key compartments constituting the WEC's CZ, extending down to the unweathered bedrock. By delineating critical interfaces between these layers at the headwater catchment scale, this dataset lays a robust foundation to conceptualize and parameterize more realistic ecohydrological models aiming to elucidate how natural and anthropogenic changes affect forest ecosystem services.

Presenting author

Laurent Gourdol

Presented at

POSTER

Hosting institution

Luxembourg Institute of Science and Technology (LIST), Belvaux, L-4422, Luxembourg

Conflicts of interest

The authors have declared that no competing interests exist.