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# Soil water storage residence times and transit times of eco-hydrologic fluxes in the critical zone

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Quantifying the internal flow mechanisms within the critical zone relies heavily on interactions between vegetation usage of soil water; however, the sources and ages of many of the water fluxes remain uncertain. We adapted the StorAge Selection (SAS) function framework to estimate the water residence time of storages and transit times of soil and eco-hydrologic fluxes at multiple soil depths in the Scottish Highlands. The approach was applied to data from two podzolic sites with Calluna vulgaris (Heather) as the dominant plant species, and constrained drainage at one site and freely draining soil at the other site.
Rapid movement of young water through the soils occurred at both sites, with the youngest water moving faster during high saturation conditions. This faster movement of younger water resulted in relatively stable water residence times in the soils with depth and time. Estimation of the evaporation source from soil depth resulted in particularly high preference for near surface water (0 – 5 cm soil depth, long-term mean age: 50 – 65 days) with relatively limited temporal variability of the source due to relatively high soil moisture near the surface throughout the study period. The assessment of the root-uptake source with depth revealed more temporal variability, favouring deeper water sources (5 – 15 cm) during drier periods and near surface (0 – 5 cm) during wet periods (long-term mean age: 6 – 15 days older than evaporation). The temporal evaluation of the interaction of hydrologic and ecologic responses greatly aids in understanding how the catchment, soils, and vegetation, will respond to future climactic changes.