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Linking earthworm activity and hydrologically effective macropores in space and time

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Earthworms create macropore systems through their burrowing activity. Preferential flow through macropores leads to increased infiltration and solute leaching. The hydrological effectiveness of these macropore systems varies in space and time depending on earthworm activity and their ability to refill their burrows to sustain seasonal or occasional drought periods. Thus, linking earthworm activity and spatiotemporal variability in hydrologically effective macropores in an ecohydrological framework yields crucial information for parameterization of macropore flow models.

We investigated earthworm abundances and macropore densities by rainfall infiltration experiments with six campaigns during one year at six field sites in Luxembourg in order to link earthworm activity and macropore effectiveness. We used correlative models to predict (i) spatiotemporal variability in earthworm abundances based on weather and topology-derived variables, and (ii) spatiotemporal variability in effective macropore densities based on the same set of predictors as well as earthworm abundances. In this presentation we will show one example for predicting a one-year, daily resolved time series of the earthworm species Aporrectodea longa showing the highest predictive value and the effective macropores of 2–6 mm diameter in 10 cm soil depth. From this time series we picked out four characteristic dates for which we predicted the spatial distribution of A. longa and the related effective macropores for a small-scale catchment at 5 m resolution. We discuss how the outputs of this study (macropore numbers and their uncertainties) can be used to parameterize macropore flow in hydrological models.