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How well do testate amoebae transfer functions relate to high-resolution water-table records?

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Testate amoebae (TA) community composition records from peat cores are often used to infer past water-table conditions on peatland sites. However, one of the problems is that validation of water-table depths used in such work typically comes from a one-off water-table measurement or a few measurements of water-table depth from the testate amoebae sample extraction point. Furthermore, one value of water-table depth is produced by the transfer function reconstruction, with sample-specific errors generated through a statistical resampling approach. However, we know that water tables fluctuate in peatlands and are dynamic. Traditional TA water-table data may not adequately capture a mean value from a site, and may not account for water-table dynamics (e.g. seasonal or annual variability) that could influence the TA community composition. We analysed automatically logged (at least hourly, mainly 15-min) peatland water-table data from 72 different dipwells located across northern Sweden, Wales and the Pennine region of England. Each location had not been subject to recent management intervention. A suite of characteristics of water-table dynamics for each point were determined. At each point surface samples were extracted and the TA community composition was determined. Our results show that estimated water-table depth based on the TA community transfer functions poorly represents the real mean or median water tables for the study sites. The TA approach does, however, generally identify sites that have water tables that are closer to the surface for a greater proportion of the year compared to sites with deeper water tables for large proportions of the year. However, the traditional TA approach does not differentiate between sites with similar mean (or median) water-table depths yet which have quite different water table variability (e.g. interquartile range). We suggest some ways of improving water-table metrics for use in Holocene peatland hydrology reconstructions.