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An improved chronology for the Lateglacial palaeoenvironmental record of Lake Haemelsee, Germany: challenges for independent site comparisons

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Exploring temporal and spatial variability of environmental response to climatic changes requires the comparison of widespread palaeoenvironmental sequences on their own, independently-derived, age models. High precision age-models can be constructed using statistical methods to combine absolute and relative age estimates measured using a range of techniques. Such an approach may help to highlight otherwise unrecognised uncertainties, where a single dating method has been applied in isolation. Radiocarbon dating, tephrochronology and varve counting have been combined within a Bayesian depositional model to build a chronology for a sediment sequence from Lake Haemelsee (Northern Germany) that continuously covers the entire Lateglacial and early Holocene. Each of the dating techniques used brought its own challenges. Radiocarbon dates provide the only absolute ages measured directly in the record, however a low macrofossil content led to small sample sizes and a limited number of low precision dates. A floating varved interval provided restricted but very precise relative dating for sediments covering the Allerød to Younger Dryas transition. Well-spaced, visible and crypto- tephra layers, including the widespread Laacher See , Vedde Ash, Askja-S and Saksunarvatn tephra layers, allow absolute ages for the tephra layers established in other locations to be imported into the Haemelsee sequence. These layers also provide multiple tie-lines that allow the Haemelsee sequences to be directly compared at particular moments in time, and within particular intervals, to other important Lateglacial archives. However, selecting the “best” published tephra ages to use in the Haemelsee age model is not simple and risks biasing comparison of the palaeoenvironmental record to fit one or another comparative archive. Here we investigate the use of multiple age models for the Haemelsee record, in order to retain an independent approach to investigating the environmental transitions of the Lateglacial to Early Holocene.