



Constructing paleoclimate networks from annually laminated lake sediments – the VARDA database

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Reconstructing global patterns of past climate change requires large-scale networks of paleoclimatic archives. Generating paleoclimatic networks relies on precise synchronization of individual records with robust age control. The detailed age constraints of continuous varved lake sediments and the good preservation of isochrones from supra-regional extreme events make these records ideal for constructing large scale continental paleoclimatic networks. Yet, a global synthesis of varved lake archives is missing.

Here we present the VARved sediments DAtabase 1.0 (VARDA 1.0), the first global data compilation for varve chronologies and associated palaeoclimatic proxy records. VARDA 1.0 uses a connected data model provided by a state-of-the-art graph database, enabling custom generations of synchronized paleoclimatic networks. We report on compilation strategies for the identification of varved lakes and assimilation of high-resolution chronologies. Existing chronologies have been re-assessed and harmonized using a novel approach that infers information on sedimentation rates enclosed in varve thickness records. This information provides detailed information on the priors required for Bayesian age-depth modelling and strongly improves these results. Additionally, a synthesis of tephra layers from volcanic eruptions provides supra-regional isochrones for synchronizing even distant varved lake records. The current version (VARDA 1.0) comprises 261 datasets from 95 varved lake archives, including chronological information from ¹⁴C dating and varve thickness measurements, but also palaeoclimatological proxy data. We further explore potential applications of such networks in paleoclimatic studies, such as identifying leads and lags of regional climate change, large-scale model-data comparisons or differentiated proxy responses between archives. The VARDA graph-database and user interface can be accessed online at <https://varve.gfz-potsdam.de>.