

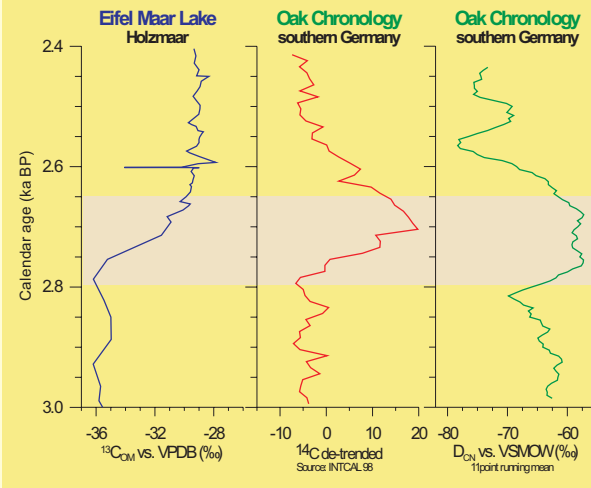
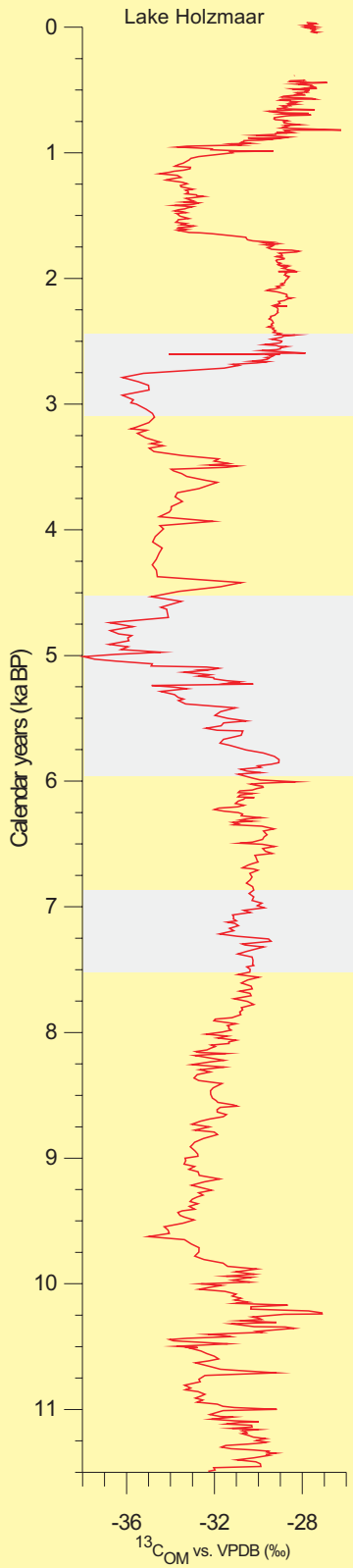
New Evidence for a Variable Holocene Climatic Extremes in European Lacustrine Calendar Year Chronologies

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INTRODUCTION & OBJECTIVES

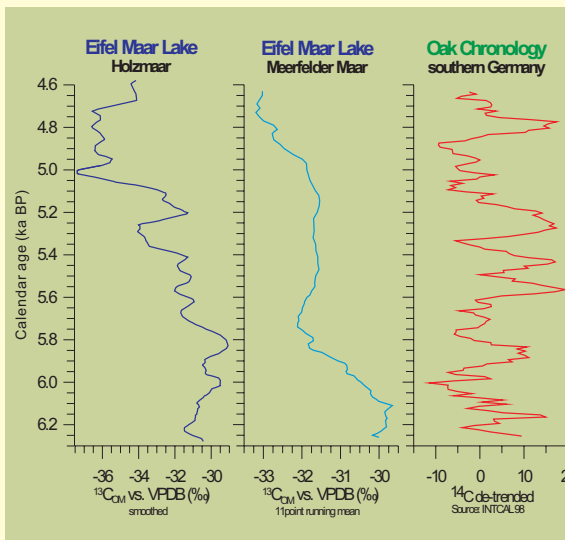
Small lakes are very sensitive to changes of external environmental factors. Important causes of ecosystem variability are changes of solar activity, reorganisations of the atmosphere/ocean circulation, anthropogenic impact and internal ecodynamics. In a novel and unprecedented approach we are now able a) to directly compare isotope proxies from two different maar lakes of the Eifel, b) to verify the identified signals with isotope parameters from tree ring chronologies on a calendar year time scale and c) to relate the so found patterns to the above mentioned supra regional forcing factors. Despite some uncertainties and open questions about the significance of single signals, this is a very promising way to receive a regional and time consistent picture of the environmental development in Europe with implications for further work in the field of palaeoclimatic research.

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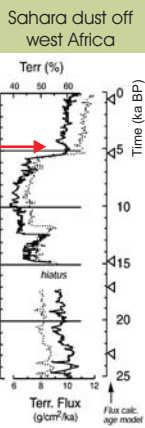
Solar activity and men

Around 2650 BP the carbon isotope record of Lake Holzmaar is characterized by the first of three very rapid (ca 70 years) and massive isotope shifts (7‰). Pollen analysis reveal a change in terrestrial vegetation to more open vegetation which has been ascribed to logging and forest clearance by human settlements. However, uncertainties still exist concerning the relative timing of events. Other workers (van Geel et al. (1996). J. Quat. Sci. 11, 451-460) found a solar minimum exactly matching with the Holzmaar signal. The direct comparison with ¹⁴C data (INTCAL 98) reflect this finding. Further evidence of climatic influences on the lake can be drawn from D values of wood cellulose from the German oak chronology.

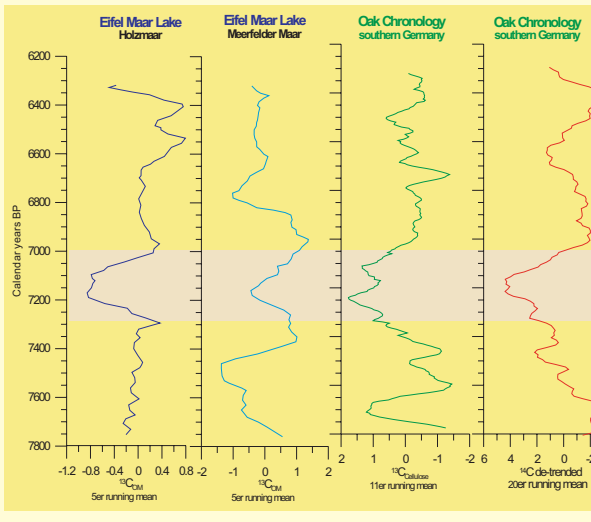


Circulation pattern

A long lasting and severe transition is shown by the Holzmaar record from 6.0 till 5.0 ka BP. In the ¹³C record of the Meerfelder Maar a similar two-fold transition can be seen. Climate model results indicate a severe deforestation and drying of the Sahara during that time interval due to weak insolation and, more important, severe vegetation-atmosphere feedbacks (Claussen et al. (1999). Geoph. Res. Lett. 26,2037-2040). This is shown also in the dust record of a marine sediment core off west Africa (deMenocal et al. (2000). QSR 19, 347-361).



Changes of atmospheric circulation patterns induced by this massive vegetation decrease can be the relevant teleconnection mechanism leading to synchronous climate change in Africa and Europe.



7.2 event / cooling anomaly

Within a phase of more or less constant isotope ratios a significant depression characterizes the time interval between 7.2 and 7.0 ka BP. The comparison with the Meerfeld record reveals anomalies in the same interval. Carbon isotopes and ¹⁴C data from cellulose and wood from the German oak chronology confirm, that this feature might describe the reaction of the lacustrine systems in the Eifel region on a phase of reduced solar insolation. However, it is yet not clear how this relatively small insolation change is translated into the lake ecosystems, i.e. the primary producers. Another still unclear observation is an approx. 50 year shift between the lacustrine and the "dendro" data. If this is a true shift or a dating inaccuracy has to be investigated in future work.

CONCLUSIONS & OUTLOOK

Lacustrine archives from the Eifel region, Germany clearly reflect climate related changes as specific isotope patterns typical for different forcing factors. Amplitudes of lacustrine isotope variations observed in the Holocene are equivalent to those occurring in the same lakes during the Lateglacial or even in the course of the last deglaciation. As demonstrated above our capability to retrieve relevant environmental information from terrestrial archives can massively be improved by a) combining regional lacustrine archives on calendar year time scales and b) comparing them with other regional calendar year chronologies. Further improvements regarding the significance of our proxies together with the development of new proxies are necessary in the future.

