

Carbon isotope and biomarker records of climate and ecosystem change: Extracting the most out of Cenozoic records

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Terrestrial biomarkers, and their carbon isotopes, provide unique insights to ecosystem and climate change ranging from local to global scales and at ever increasing temporal resolution. Over the past decade, considerable efforts have been made to constrain carbon and water cycling, especially during periods of rapid climate change, such as the Eocene hyperthermal events. Global and regional replication of time intervals of great interest has expanded the information available, but has also complicated interpretations due to ‘disagreement’ between records. This has led to questions regarding the fidelity of isotope records, the sensitivity of the isotope record to climate, and the best practices to reconcile records. But, at the same time, this has led to new exciting information on ecosystem response to climate change. Modern biomarker and isotope calibrations provide means to reconcile and improve records and to place quantitative constraints on their interpretations, by removing competing influences of climate, ecosystem, and biology, but calibration generation has considerably lagged record generation.

We provide a summary of the insights from modern calibrations and best practices for reconciling biomarker carbon isotope records for interpreting ecosystem change and carbon cycling in the geologic past, especially during time intervals that deviate from present day. Future studies must reduce the biological ‘noise’ to further improve the quantitative nature of biomarker and isotope records to continue expanding the information available in the geologic record.