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Sources and distribution of tetraether lipids in sediments from the Zhejiang–Fujian Coastal mud area, China, over the past 160 years: Implications for paleoclimate changes

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Proxies based on glycerol dialkyl glycerol tetraether (GDGT) lipids have been successfully used to reconstruct sea surface temperature (SST), mean annual air temperature (MAAT), and soil pH in the East China Sea and its adjacent ocean margins, particularly in surface sediments. In this study, two cores from the Zhejiang–Fujian Coastal mud area (ZFCMA) were studied in detail to investigate temporal changes in the source and distribution of tetraether lipids in the area, and the implications of such data for paleoclimatic change. The results indicate that isoprenoid GDGTs (isoGDGTs) in the ZFCMA were derived mainly from Thaumarcheaota, with a slight contribution from in-situ and allochthonous methanogenic archaea in upwelling areas, whereas branched GDGTs (brGDGTs) mostly originated from terrigenous bacteria and in situ organisms. However, the slight methanogen-derived and allochthonous isoGDGTs were considered to have had no effect on inferred SSTs in this study. The presence of brGDGTs produced in situ might corrupt the relationship between methylation index of branched tetraethers or cyclization index of branched tetraethers (MBT/CBT) and MAAT or pH, particularly in hypoxic areas. But #ringtetra, as an evaluation index on the sources of the brGDGTs, indicated brGDGTs buried in the cores sediments are predominantly derived from soil erosion. Furthermore, temporal changes in the GDGT-based proxy records indicate that climatic changes and events (e.g. relating to the East Asian Monsoon, Kuroshio/Pacific Decadal Oscillation intensity, and flood events), as well as anthropogenic influences (e.g. dam construction, soil conservation, fertilizer usage, and discharge of industrial waste water and domestic sewage) affect the signal in the core sediments. SSTs fluctuated over the past 160 years in the ZFCMA, with higher values in the 20th century than in the 19th century. In addition, humidity based on the relationship between precipitation/soil water content and pH and continental temperature in the mid–lower Yangtze River basin switched between dry-hot/dry-cool and wet-hot/wet-cool over the last 160 years. Our study also suggests that PDO/KC intensity may play a key role in temperature changes, and have a larger impact on terrestrial ecosystem than ocean ecosystem in the ZFCMA and its adjacent continent.