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Is there an imprint of preferential degradation in UK'37? Towards reconciling multiproxy estimates of past marine temperatures

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The alkenone-based UK'37 index is a key proxy to reconstruct past ocean temperatures on a wide range of time-scales from interannual to millions of years, and forms the backbone of many landmark paleoclimate studies. However, in some cases, sea surface temperature as derived from UK'37 shows a different behavior than expected from other evidences such as nearby records, independent temperature proxies or climate model simulations. Examples include strong cooling trends in the mid-late Holocene, not reproduced by Mg/Ca based SST reconstructions or climate model simulations, cooling trends in the last decades opposing the ship-based temperature records and warm glacial temperatures which are in conflict with independent proxy evidence. While local explanations are often invoked to explain these differences, there is also a possibility of systematic non-temperature effects on the UK'37 proxy. Quantitative interpretation of these effects have been challenging, in part due to the difficulty in applying findings from laboratory culture studies and indirect field observations to the sedimentary systems.

Analyzing a large number of multiproxy records of marine temperatures and including total alkenone records in the analysis, we find evidence for a systematic non-temperature bias on UK'37 records potentially caused by preferential degradation of the more labile alkenone.

We show that a first order correction of this effect leads to a more consistent picture of the paleoclimate evolution on centennial to multimillenial time-scales between different proxies in the same core, between multiple nearby climate records and between SST reconstructions and simulations from climate models.