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A new biomarker-derived paleotemperature record from Western Europe covering the last 160,000 years

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In the field of paleoclimatology, it is crucial to obtain new reliable paleotemperature records. While several paleothermometers such as the $U^{K'}_{37}$ (based on alkenones) and the TEX_{86} (based on archaeal membrane lipids named isoprenoid tetraethers) have been used since at least a decade, several new paleothermometers like the RI-OH (ring index of hydroxylated isoprenoid tetraethers) have been proposed only recently. Indeed, non-thermal effects can considerably bias the temperature proxies, which justifies the use of additional methods. Here, we present a new high-resolution paleotemperature record over the last 160,000 years in Western Europe. We have generated this new paleotemperature record using the recently-proposed RI-OH in two adjacent sediment cores from the Gulf of Lions (Western Mediterranean Sea). We have chosen the study site for four reasons. First, the new paleotemperature record addresses the rarity of continuous, high-resolution records derived from natural archives in Western Europe. Second, the study site is located in a paleoprodelta, resulting in accumulation rates of about 1 m/kyr during glacial periods. Third, the study site has a relatively small water depth, with paleodepths between 200 and 300 m depending on ice volume. Fourth, several paleotemperature records from the study site are published. These published paleotemperature records help us to validate the new RI-OH-derived paleotemperature record.

In general, the new RI-OH-derived paleotemperature record is coherent with a published $U^{K'}_{37}$-derived paleotemperature record from the same study site. The new paleotemperature record is also generally coherent with published records of planktic foraminifer assemblages and of *Globigerina bulloides* $\delta^{18}O$, all from the same study site. However, the global calibrations established to reconstruct paleotemperatures using the $U^{K'}_{37}$ and the RI-OH generate an almost systematic offset between the two biomarker-based paleotemperature records. Several mechanisms can explain the observed offset. For example, a potential bias towards a specific season exists for biomarker-derived temperature proxies. In addition, tetraether-derived proxies may record sea sub-surface paleotemperatures rather than sea surface paleotemperatures. Alternatively, the offset between the two biomarker-derived paleotemperature records could be simply due to calibration errors and/or the non-applicability of global calibrations to the Mediterranean Sea. Any possible source of bias on RI-OH-derived temperatures, more particularly in the Mediterranean Sea, should be considered and further investigated in the future.