Western Mediterranean Sea paleothermometry over the last glacial cycle based on the novel RI-OH index

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RI-OH (Ring Index of hydroxylated tetraethers) has recently been proposed to reconstruct paleotemperatures in mid-to-low latitude marginal seas. However, RI-OH has barely been tested in marginal seas under substantial terrigenous inputs. Here, we analyze tetraether lipids in two adjacent marine cores from the Gulf of Lions. We then test for the first time the RI-OH paleothermometer from 160 to 9 ka BP in the western Mediterranean Sea. The study site was chosen for its relatively small water depth (presently 300 m) and high accumulation rates during glacial periods (about 1 m/kyr). While terrigenous inputs prevent TEX_{86} (TetraEther indeX of tetraethers consisting of 86 carbon atoms) from behaving as a paleothermometer, RI-OH is generally consistent with other paleothermometric proxies ($\delta^{18}O$ of planktic foraminifers and C_{37} ketone unsaturation ratio $U^{K'}_{37}$). RI-OH also responds systematically and coherently to glacial-interglacial transitions as well as to abrupt climatic events. The average difference between RI-OH-temperatures and November–May $U^{K'}_{37}$-temperatures is –2.0 °C with a standard error of 0.4 °C based on 249 RI-OH-$U^{K'}_{37}$ comparisons. This systematic difference suggests that hydroxylated tetraethers and alkenones record different temperatures, for instance winter and/or subsurface temperatures for RI-OH. Another source of bias could be linked to the available RI-OH-temperature calibration, which clearly needs more work at the global and regional scales, notably for semienclosed basins such as the Mediterranean Sea. Nevertheless, our RI-OH-based interglacial – glacial anomalies are of 10 °C, a value within the high end of anomalies from previously published temperature records in the western Mediterranean Sea (from 3 to 13 °C). The RI-OH-based temperature anomalies also confirm the regional differences and seasonal contrasts in interglacial – glacial anomalies produced by models.