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Seasonality of the long chain diols fluxes: implication for the paleotemperature proxy in the East Sea

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Long chain diols (LCDs) were reported for the first time in the Black Sea sediments (de Leeuw et al., 1981). Generally, C_{28}-C_{32} diols which have alcohol groups at C_1 and a mid-chain position (e.g. carbon number 13, 14, 15) are dominantly observed in the various marine environments. Rampen et al. (2012) showed that the fractional abundances of C_{30} 1,15-diols were positively correlated with sea surface temperatures (SSTs) in the globally distributed sea surface sediments. In contrast, the fractional abundances of C_{28} 1,13-diols and C_{30} 1,13-diols revealed the negative correlations with SSTs. Based on this observation, the long chain diol index (LDI) was proposed as a paleotemperature proxy. However, there applicability of this proxy has not been tested in the East Sea yet. Hence, we deployed a sediment trap in the Ease Sea (37.33°N, 131.45°E; 2300 m water depth) for the time period of March 2011-Feburary 2012 and analyzed alkenones and LCDs. The fluxes of alkenones and LCDs showed the seasonal variations with the higher fluxes of alkenones at the period of spring(April) and early summer(June) while the fluxes of LCDs were higher at the period from summer(July) to early autumn(September). The estimated SSTs based on the $U^{K'}_{37}$ and the LDI from the 1000 m samples also showed the seasonal variations between 6.8 ˚C and 22.7 ˚C for the $U^{K'}_{37}$ and between 2.4 ˚C and 24.7 ˚C for the LDI with a time lag of satellite-derived SSTs. The flux-weighted SST based on the $U^{K'}_{37}$ was 11.4 ˚C while that of the LDI was 17.3 ˚C. Accordingly, the $U^{K'}_{37}$-based annual mean SST was 4.9 ˚C lower than the in-situ annual mean SST (16.3 ˚C), while the LDI-based SST was 1˚C lower. In summary, our results indicate that the LDI-based SSTs might be warm-biased than the $U^{K'}_{37}$-based ones in the East Sea.

References

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