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THE C_{32} ALKANE-1,15-DIOL AS A TRACER FOR RIVERINE INPUT IN COASTAL SEAS

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Introduction

The occurrence and distribution of long chain alkyl diols (LCD) have been well studied in the marine environment (Versteegh et al. 1997; Rampen et al., 2012) and have shown great potential for reconstructing past sea surface temperature (SST) using the Long Chain Diol Index (LDI, Rampen et al., 2012). Recently, De Bar et al. (2016) observed in the Iberian margin that the C_{32} 1,15-diol and some, in lower relative abundances, other LCDs seem to originate in part from the continent and likely from rivers. To ascertain the origin of the C_{32} 1,15-diol in coastal marine systems we investigated the LCD distribution in four shelf seas located near major river outflows (Gulf of Lion, Amazon shelf, Kara Sea and Kalimantan delta) and the rivers themselves (Rhône, Amazon, Yenisei), covering different climate conditions. In addition, we analysed the LCD distribution in suspended particulate matter of the Rhine River during two seasons (spring and autumn) to investigate the spatial and seasonal variability of the C_{32} 1,15-diol.

Results

In all investigated regions, the relative abundance of the C_{32} 1,15- diol is consistently higher in the rivers as well as in the marine stations located the proximity of the river mouths, suggesting a partially terrestrial source for this LCD. This is supported by principal component analysis which points out a significant positive relation between the C_{32} 1,15-diol and the Branched and Isoprenoid Tetraether index, a proxy reflecting soil and river input (Hopmans et al., 2004). Furthermore, the C_{32} 1,15-diol was not detected in soils and is unlikely to be derived from vegetation, suggesting that the C_{32} 1,15-diol is mainly produced in rivers. This suggests that the C_{32} 1,15-diol can be potentially used as a proxy for riverine organic matter input in shelf seas. Comparison of satellite based SST and SST reconstructed via the LDI shows that, in coastal areas where the percentage of C_{32} 1,15-diol is high, the reconstructed SST is significantly different than the satellite SST. This deviation might be caused by riverine input of LCDs or by different LCD-producers in these coastal areas. In any case, it suggests that the LDI should be used with caution in coastal areas under the influence of rivers.

In order to increase our knowledge on potential LCD (and specifically of C_{32} 1,15 diol) producers in rivers, we determined the spatial and seasonal changes in the LCD abundance in five different locations of the Rhine river both in Spring and Autumn. LCD concentration, including the C_{32} 1,15-diol, varied spatially and seasonally, with higher values generally detected in autumn, which coincided with higher chlorophyll concentration confirming that the producers are phototrophic organisms. Significant differences in LCD distribution were detected between spring and autumn and at different locations. For example, the highest concentrations of C_{32} 1,15-diol were recorded upstream in Karlsruhe in March and downstream in Kleve in September. These changes are likely associated with spatial and temporal variations in the abundance of the freshwater eustigmatophyte algae. In order to shed light into the taxonomic affiliation of the LCD producers, we are currently conducting 18S rRNA gene sequencing on the Rhine river water samples.

Conclusion

Our study shows a likely riverine origin of the C_{32} 1,15-diol and is likely produced by phototrophic organisms. Furthermore, we show that LDI-derived SST can significantly deviate from satellite SST in coastal areas due to this riverine input.

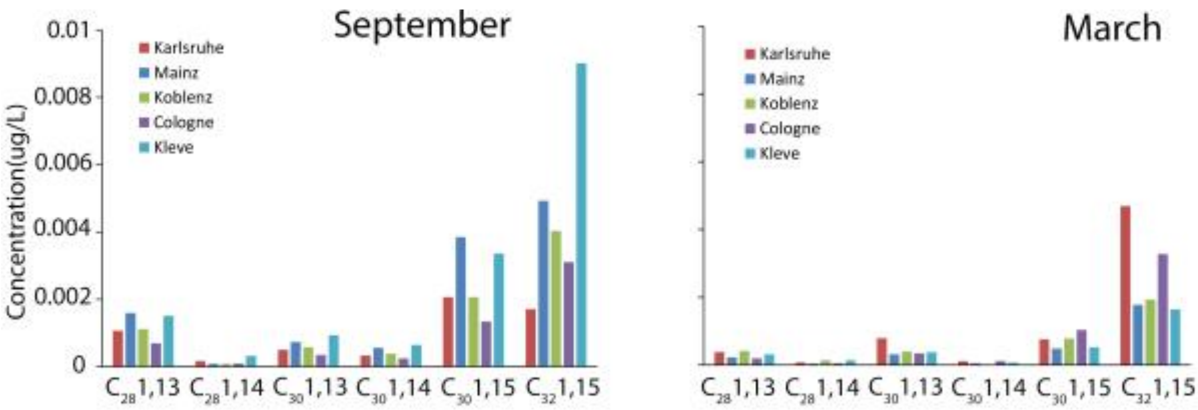

Figure 1 *Concentration of the diols during the two seasons in the river Rhine*

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