Response to referee #1

Review: This manuscript investigates long-chain diols (LCDs) in sediment trap time series from five tropical sites (tropical North Atlantic, Cariaco Basin, Mozambique Channel) to assess seasonal variations in fluxes of LCDs and associated proxies (Long chain Diol Index and Diol Index). These data are compared with other lipid proxies (alkenones and GDGTs) and previous published data (primary production, SST,..). Results show that surface sediment LDI temperatures in the Atlantic and Mozambique Channel compare well with the average LDI-derived temperatures from the overlying sediment traps, as well as with decadal annual mean SST. In the Mozambique Channel and the tropical Atlantic, the LDI temperatures reveal minimal seasonal change although there are clear seasonal SST contrasts, which is likely due to lateral advection of re-suspended sediment. In the Cariaco Basin, a strong seasonality in the LDI is observed, which is linked to the upwelling season and stratification of the water column. In addition, in the Atlantic, the Diol Index reflects a pre-upwelling signal, whereas in the Cariaco Basin, the Diol Index seems to be an indicator of upwelling intensity. This paper is a valuable contribution to the understanding of the seasonal production of LCDs in marine environments and how it is translated in the temperature proxy LDI and the Diol Index (upwelling proxy). A strength of the paper is that the LCD data has been compared with other available data for each site (primary production, SST, alkenones, GDGTs,…), which gives a broader picture and supports the interpretations based on LCDs. The writing style is clear and precise and the interpretations are generally supported by the data. This manuscript is thus suitable for Biogeosciences. However, the current manuscript could be improved before publication. Please find my comments below.

We thank the referee for the positive assessment and for the comments, which we will discuss below.

General comments:

Diol index and upwelling: The authors argue that, in the Cariaco Basin, the Diol Index is an excellent indicator of upwelling intensity (Lines 476-480). However, when looking at the 1999-2000 time series, high values of the diol index actually occur when the primary production decreases. What are the R2 values (and p values) that justify "a strong correlation with primary production rates"?

We agree with the reviewer that for the 1999-2000 time series there is a disagreement during January/February when the diol index increases and primary production rates decrease. We will mention this in the revised version of the manuscript. The 'strong correlation' between the diol index and primary production is based purely on the visual agreement between both time series. We were not able to perform a correlation analysis since the data are differently spaced in time. We will also emphasize this in the revised version manuscript.

In addition, for the eastern Atlantic (M1 trap), the authors argue that the Diol Index reflects a preupwelling signal, consistent with the current knowledge on Proboscia ecology (Lines 509-526). I would like to see more discussion that explains why at one location the Diol index indicates preupwelling conditions, whereas it seems to be an indicator of upwelling intensity at another location.

We agree that this seems contradictory and requires more discussion, which we will implement in the revised version of the manuscript. The Diol Index is an upwelling indicator based on the assumption that *Proboscia* diatoms generally thrive in upwelling regions. However, the index is in fact an indicator for *Proboscia* productivity, and whether it reflects upwelling/pre-upwelling/stratification/etc. conditions will depend on the region and the local ecological dynamics determining the role of *Proboscia* diatoms (e.g., Rampen et al., 2014; de Bar et al., 2018). Studies

have shown that *Proboscia* diatoms are often more dominant during early/pre-upwelling because they need relatively little silica and they are able to migrate to deeper waters to obtain nutrients (Koning et al., 2001) and sediment trap data from Wakeham et al. (2002), Prahl et al. (2000), Sinninghe Damsté et al. (2003) and Rampen et al. (2007) show that *Proboscia* lipids (diols and/or hydroxyl methyl alkanoates) are highest during early upwelling. Therefore, we hypothesize that this Diol Index maximum during spring which we observe for station M1 in the Atlantic might be a pre/early-upwelling signal since the upwelling in the Guinea Dome often occurs between July and October (Siedler et al., 1992). Indeed, *Proboscia* diatoms do not reflect early-upwelling in every region. Reports of *Proboscia* spp. blooms vary from stratification to early-upwelling to postbloom, and from high nutrients to low nutrients (see Rampen et al., 2014; references in Table 1). Apparently, in the Cariaco Basin, *Proboscia* diatoms bloom relatively synchronous with general productivity, as evidenced from the agreement between the Diol Index and primary production time series, emphasizing the value of sediment trap studies like this in revealing regional differences in proxy signals.

Keto-ols as oxidation products (Lines 578-586): An alternative explanation for the non-detection of 1,14-keto-ols would be that keto-ols are not oxidation products of LCDs, but rather produced by unknown organism(s) (Versteegh et al., 1997). Previous studies have indeed shown the absence of evidence of conversion of diols into their corresponding oxidized keto-ols (Jiang et al., 1994; Méjanelle al 2003; Shimokawara et al., 2010). I think the authors should acknowledge this.

We agree, and we will mention this hypothesis as well.

References:

Jiang, S.C., O'Leary, T., Volkman, J.K., Zhang, H.Z., Jia, R.F., Yu, S.H., Wang, Y., Luan, Z.F., Sun, Z.Q., Jiang, R.H., 1994. Origins and simulated thermal alteration of sterols and keto-alcohols in deepsea marine sediments of the Okinawa Trough. Organic Geochemistry 21, 415-433.

Méjanelle, L., Sanchez-Gargallo, A., Bentaleb, I., Grimalt, J.O., 2003. Long chain n-alkyl diols, hydroxyl ketones and sterols in a marine eustigmatophyte, Nannochloropsis gaditana, and in Brachionus plicatilis feeding on the algae. Organic Geochemistry 34, 527-538.

Shimokawara, M., Nishimura, M., Matsuda, T., Akiyama, N., Kawai, T. 2010. Bound forms, compositional features, major sources and diagenesis of long chain, alkyl mid-chain diols in Lake Baikal sediments over the past 28,000 years. Organic Geochemistry 41, 753-766.

Versteegh, G.J.M., Bosch, H.J., de Leeuw, J.W., 1997. Potential palaeoenvironmental information of C24 to C30 mid-chain diols, keto-ols and mid-chain hydroxy fatty acids; a critical review. Organic Geochemistry 27, 1-13.

Figures: I think the current order of the figures does not necessarily follow the logic of the results/discussion. For more clarity, I would suggest modifying the order as follows: Fig. 2 should be Fig. 9; Fig. 3 should be Fig. 2; Fig. 4 should be Fig. 8; Fig. 5 should be Fig. 3; Fig. 6 should be Fig. 4; Fig. 7 should be Fig. 5; Fig. 8 should be Fig. 6; Fig. 9 should be Fig. 7.

We will reconsider the order of the figures.

Specific comments:

Line 25: specify “with emphasis on the temperature proxy Long Chain Diol Index”.

We will adjust this.

Line 27: specify “similar to the two other lipid-based temperature proxies TEX86 and UK’37”.

We will adjust this.

Line 27: “In addition” instead of “However”.

We will adjust this.

Line 29: Could be rephrased as: “In contrast, the LDI in the Cariaco Basin shows larger seasonal variation”.

We will adjust this.

Line 48: Need references.

We will add references.

Lines 48-50: Could be rephrased as: “However, research showed that despite their highest abundance being recorded in the upper 100 m of the water column, Thaumarchaeota can be present down to 5000 m depth (Karner et al., 2001; Herndl et al., 2005)”.

We will adjust this.

Line 69: “for autumn to summer” should be “for autumn and summer”.

We will adjust this.

Figure 1: indicate in the caption what NEC, NECC, SEC, MC, GD, NBC and GC stand for. Is it possible to add the position of the ITCZ during the boreal winter?

We will clarify the abbreviations and indicate the position of the ITCZ during boreal winter.

Line 200: What are CTD measurements?

We refer here to temperature measurements of seawater at 1m water depth sampled by CTD. We will clarify this.

Line 256-258: Could diols be found in the DCM:MeOH (1:1; v/v) fraction? Have you checked?

We thank the reviewer for noticing this, since the sentence is incorrect: not the MeOH fractions were analyzed for diols, but the DCM:MeOH (1:1) fractions. We will correct this.

Line 369: Should be as: “C28 and C30 1,13- (0–3 %), the C30 1,15- (44–99 %), and the C32 1,15-diols (0–7%)”.

We will adjust this.

Lines 367-376: I think a table showing the presence/absence for each diols (and the % of total LCDs) at the different traps (M1, M2,...) and different sites (Atlantic, Mozambique Channel, Cariaco Basin) would be useful to clearly see which diols are detected for each location. The Figure 2 is used to discuss the preservation between traps and sediments rather than showing the diols detected.

We are not sure whether we agree, since the number of figures is already extensive, as is the result section, and we consider this relatively detailed.

Line 392: Fig. 5 is cited before Fig. 4. I think the order of the figures should be changed (see previous comment).

We will adjust the order of the figures.

Line 397: cite Figure 7.

We will cite Fig. 7 here.