Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2018-441-RC2, 2018


Biogeosciences Discussions

# *Interactive comment on* "Multi-trace element sea surface temperature coral reconstruction for the southern Mozambique Channel reveals teleconnections with the tropical Atlantic" *by* Jens Zinke et al.

**Anonymous Referee #2**

Received and published: 22 November 2018

Zinke et al. assessed how reliably Sr/Ca, Li/Mg and a combination of both trace element-to-Calcium ratios measured in two (tropical) Indian Ocean Porites sp. colonies serve as SST proxies. In addition, the authors conducted spatial correlation analysis of proxy SST data with instrumental SST.

I have enjoyed reading the ms and – as a non-coral-sclerochronologist – learned a lot. The paper is well-written and organized and certainly merits publication. Data and overall conclusions are fine, but I feel that the presentation and data treatment should be revised (between minor and major revisions).



(1) In my opinion, it is circular to reconstruct SST from trace element-to-Ca data of the same time interval and specimens that were used for proxy calibration. The calibration (+ verification) and reconstruction intervals must be separate, or at least this approach would require different colonies (of both species) for calibration/verification and reconstruction, respectively. One possibility is to limit the calibration interval to 2003-2012 and apply the resulting model then just to the pre-2003 section of core EU3. You could also limit the reconstruction interval to 1970-1980 of EU3, because this time interval was – according to Figure 4 – not used for calibration; both options would still miss a verification interval though. Another possibility is to just present regression models spanning the entire lengths of the cores. Alternatively, the authors use the calibration model by D'Olivio et al. (2018) to estimate SST and compare those data to instrumental SST.

(2) I am missing details on how exactly the Sr/Ca and Li/Mg data were combined. Is the composite Sr/Ca-Li/Mg SST proxy based on a multi-regression model? The equation for this regression model should be provided.

(3) There is some inconsistency regarding the statement on proxy reliability of Sr/Ca and combined Sr/Ca-Li/Mg (compare, e.g., L461-463a and L508/9). Authors should say more clearly (in the main text and in the Abstract) that relative SST changes are reflected equally well by both proxies, but Sr/Ca is still superior to quantify SST. The current Abstract is too vague as the main findings are concerned. It also remained unclear how a combination of Sr/Ca and Li/Mg can "improve SST reconstructions". Table 3 does not support this claim, because RMSE errors are, on average, lower for Sr/Ca-based SST estimates than for those computed from combined Sr/Ca-Li/Mg.

(4) The authors need to better describe the innovative aspect of the study. In particular, they need to highlight (in the Introduction) how their work differs from D'Olivio et al. (2018) and Montagna et al. (2014) (e.g., how much longer were the new coral records in comparison to previous studies; which species were used here and in previous works; how compare the results?).

(5) Linear regression equations may have been the most obvious to use in a mathematical sense, but the actual relationships between trace element-to-Ca ratios (or TE/TE) and SST are nonlinear (compare Gaetani & Cohen 2006; Montagna et al. 2014 etc.). Would it not be better to work with non-linear equations?

(6) I may be worth mentioning somewhere in the Discussion that the Li/Mg serves a more robust thermometer at low temperatures because of the non-linearity of Li/Mg vs. SST relationship.

Other issues: L22: It should read “temperature proxy”

L25-26: Coral = archive, Sr/Ca etc. = proxy. Rephrase sentence accordingly.

L51-53: It should read “The oceans respond”. If two full sentences are linked by conjunction, a comma must precede “and”.

L54: replace semicolon by comma

L55-58: This sentence needs to be rephrased. Three times “climate” in one sentence. Complicated phrasing.

L76-78: Here you list the slope ranges, but not provide the values revealing the different strengths of the correlations.

L81: “bio-smoothing effects”: Explain. Has this expression been used in cited papers?

L201: Tell the reader how long were the calibration intervals in EU3 and EU2.

L226: I would not call 9 years “long-term”.

L228/9: "record’s lowest ratios" or just "lowest ratios"

L232: I do not understand what you mean: "showed higher values between 2003 and 2012"? Offset relative to what? Why "absolute"?

L233: “Li/Mg between EU2 and EU3. . .”: Replace “between” by ”of”



L237: “EU3 showed larger amplitude seasonal variations”: Delete “amplitude”

L262/3: “The Sr/Ca and Li/Mg time series of cores EU3 and EU2 were highly consistent in the period of overlap. . .”. What does “consistent” mean here? Rephrase.

L264 (and other occasions in ms): “Li/Mg performed equally well”. Odd phrasing; unclear what you mean exactly.

L285: “AVHRR-OISST2 display a more limited seasonality. . .”: Delete one “S” in “OISST”; replace “more limited” by “truncated” or “attenuated”.

L291: “reference period” should read “reference periods”

L295: Following Table 2, Sr/Ca-SST slopes are lower than the average reported in Corrège (2006); so this sentence needs to be rephrased.

L321: replace “cooler temperature anomalies” by “smaller anomalies”

Table 2 and elsewhere: Use consistent number of decimals throughout ms (including Figures and Tables), i.e., instead of a slope of "-0.04", write "-0.040".

Figure 2: Comparison would be facilitated if scaling of the y-axes was the same.

Figure 4: ditto for x and y-axes. Also check all other figures.

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