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Interactive comment on "Seasonal cycling of zinc and cobalt in the Southeast Atlantic along the GEOTRACES GA10 section" *by* Neil J. Wyatt et al.

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Please find our response to RC1 comments attached as a PDF.

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Authors response to interactive comments on "Seasonal cycling of zinc and cobalt in the Southeast Atlantic along the GEOTRACES GA10 section" by Neil J. Wyatt et al.

The authors of this manuscript would like to thank the reviewers for their well-considered review and advice on preparing our manuscript for publication in Biogeosciences. We believe the reviewers present extremely valid comments, particularly on the 'interpretation of data', that has led us to reconsider how we approach certain aspects of the data. Specifically, we acknowledge and agree with the suggestion that the use of slopes of regression to infer biological uptake and remineralisation is flawed by the varying influences of other sources on the correlation, most notably water mass mixing of deeper waters that have the potential to alter slopes of regression. Secondly, we acknowledge that the important influences of water mass mixing and/or various other influences on our trace metal distributions had not been fully explored.

To address these concerns the slopes of regression between metals and PO4 are now used to investigate the influence of water mass mixing, and other biogeochemical factors, on our upper water column metal distributions as part of section 3.2. Importantly, concentration inventories for the set water masses STSW and SASW are now utilized to calculate surface water ecological stoichiometry.

Using water masses instead of slopes of regression has not largely changed our interpretation and we still observe decreasing the same pattern of Zn:Co stoichiometry between early, late and summer transects in STSW. At the same time, this new approach has allowed us to separate out the water masses more effectively. We feel our trace metal ecological stoichiometry section 3.4 is now better aligned to the spatial and depth changes we observe in STSW and SASW between the three transects.

Reviewer 1

General comments:

My main problem with the stoichiometry section is the use of regression slopes that are not presented as such, nor is it reported on how many data points the regression is based or whether the correlations are significant. The influence of mixing or the varying influence of other sources (as detailed by the authors in section 3.3) on the correlation is not considered. Including of data to a certain depth (rather that a water mass or density gradient) is very likely to lead to artefacts, especially given that the sampling resolution (number of stations and depths) as well as oceanographic conditions changed between occupations. Please see the detailed comments below, but I would recommend the authors base this discussion on upper water column inventories and changes therein rather than slopes of regressions.

We agree with reviewer 1 that the use of regression slopes to determine metal/PO4 and Zn:Co ratios is subject to artefacts arising from water mass mixing and that these artefacts are not thoughtfully discussed. The important influence of mixing on regression slopes has been documented in a number of recent publications for the Atlantic Ocean (e.g. Middag et al., 2019; Middag et al., 2020; Middag et al., 2018). We acknowledge therefore that we cannot assume a slope is only the result of uptake and remineralisation without considering mixing or other processes.

Following the suggestion of reviewer 1, we have changed the way we approach these ratios and now use concentration inventories for STSW and SASW to calculate these ratios for the different transects. We now use the potential temperature of 15 C to identify STSW during all three transects and use this isotherm to inform the presence and depth of STSW at each station. For SASW, we calculate the concentration inventories over the upper 85 m. This is the mean depth of the 15 C isotherm for STSW

Fig. 1.

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