RESPONSE TO REVIEWER 2

I thank the reviewer, Dr. Nicola Wiseman, for the constructive comments and suggestions, which have helped me to improve the manuscript. I have provided responses to the comments; the reviewer comments **(RC)** appear as normal font, my response **(AR)** in *italics* below the respective comments and I have used *blue italics* to quote the changes in the revised manuscript.

RC: In this article, Dr. Banerjee utilized the CESM ocean and marine ecosystem model components to investigate the contributions of various iron sources to the Indian Ocean. This model is well suited for the study due to its complex iron cycle representation and robust ecosystem parameterization. The author specifically investigated the relative contributions of each soluble iron source to the total dissolved iron budget as well as biological productivity on a seasonal basis. The author concludes that atmospheric iron is the primary contributor to the dissolved iron budget and fuels productivity in much of the Indian Ocean, while sedimentary iron follows second, and has impactful contributions in continental shelf regions, as well as where dust deposition is at its minimum. This study clearly defines the role of each iron source to biological productivity and concludes by highlighting the uncertainty of atmospheric iron deposition in a changing climate.

Overall, the author performed a well through out series of experiments that clearly defines the interactions between iron supply and physical drivers in multiple regions of the Indian Ocean. I endorse this paper for publication with the following minor questions/comments for clarification below:

AR: *Many thanks for endorsing the paper for publication. My responses to the specific comments are provided below.*

RC: Lines 197-199: You mention that freshwater fluxes are calculated from monthly stream flow observations and CLM model. Do you mean from CLM5? What specific output from CLM5, if that is what you are referring to, are you using to derive freshwater fluxers?

AR: *The input file for monthly streamflow is based on the river-based estimates of continental freshwater discharge which was originally produced by Dai and Trenberth (2002) based on Bodo et al. (2001) and later extended by Dai et al. (2009). The data contains monthly station-based streamflow for the world's 925 largest rivers and is supplemented by data from several sources as outlined in Dai et al. (2009). Additionally, missing data in the resultant streamflow time-series have been filled with streamflow simulated by CLM3. For this, a linear regression equation has been employed for each river with the CLM-simulated flow as input to obtain streamflow estimates for years without observations. This has been clarified in the revised version of the manuscript as: "Monthly streamflow since 1948 used in this study has been previously derived from gauge data, where linear regression was also employed using CLM3 model streamflow to fill-in missing data (Dai et al., 2009)."*

RC: Lines 293-295: What type of correlation coefficient are you utilizing here? It is the Pearson product-moment correlation coefficient or a rank correlation? How are you calculating this statistic?

AR: *Pearson product-moment correlation coefficient is used here. Significance of correlation is calculated using Student's t-test with n-2 degrees of freedom, where n is the sample size. This information has now been included in the revised version of the manuscript.*

RC: Lines 378-379: Do you have maps showing the iron inputs for each field (atmospheric (with black carbon separated), sedimentary, river, vent)? While Fig. 3 shows the contribution to the total DFe averaged over the upper 100m, a supplementary figure with of each input would strengthen the conclusions made regarding the spatial distributions of the sources in the first paragraph of section 3.2.

AR: *Thank you for this suggestion. I have now included a figure showing iron input fluxes for each field as Supplementary Figure S1. This is also shown below.*
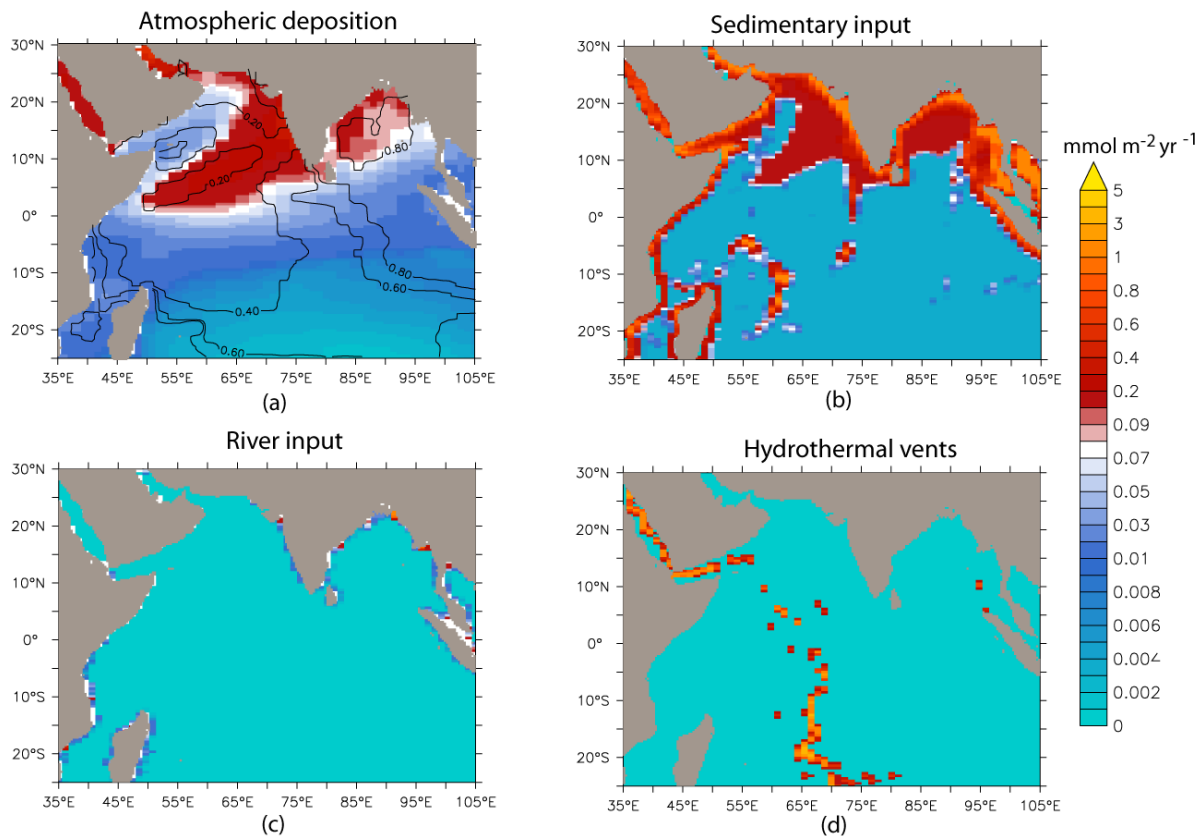

***Fig. S1** Iron fluxes from the various sources considered in CESM-MARBL over the northern Indian Ocean. Contours in (a) show the fractional contribution of black carbon to atmospheric iron flux.*

RC: Lines 528-534: Cellular Fe:C ratios are reported as Fe:C, not DFe:C. Diatom observations have also been expanded since de Baar et al., 2008 and can be greater than 2.00 x 10-4.

AR: *Thanks for pointing this out! I have corrected DFe:C to Fe:C in the revised manuscript. I have also included the suggested citations and have recalculated N:Fe ratios based on the suggested citations. This is reflected in the revised manuscript as follows:*

"Over the world oceans, a wide range of cellular Fe:C ratios has been observed for diatoms, ranging from 100 µmol mol^{-1} for DFe-replete conditions (Twining et al., 2015; 2021) to 2 µmol mol^{-1} for DFe-deplete conditions (de Baar et al., 2008). Assuming a C:N ratio of 117:16 (Anderson and Sarmiento, 1994), the range of N:Fe ratios obtained are ~1000 and ~68000, respectively, for DFe-replete and DFe-deplete conditions."

Suggested citations: Twining BS, Rauschenberg S, Morton PL, Vogt S (2015) Metal contents of phytoplankton and labile particulate material in the North Atlantic Ocean. Progress in oceanography, 137:261–283.

Twining BS, Antipova O, Chappell PD, Cohen NR, Jacquot JE, Mann EL, Marchetti A, Ohnemus DC, Rauschenberg S, Tagliabue A (2021) Taxonomic and nutrient controls on phytoplankton iron quotas in the ocean. Limnology and oceanography letters, 6(2):96–106.

Additional references

Bodo, B. A.: Annotations for monthly discharge data for world rivers (excluding former Soviet Union). NCAR Rep., 111 pp., 2001.

Dai, A., and K. E. Trenberth: Estimates of freshwater discharge from continents: Latitudinal and seasonal variations, *J. Hydrometeor.*, 3, 660–687, 2002.

Twining, B. S., Rauschenberg, S., Morton, P. L., and Vogt, S.: Metal contents of phytoplankton and labile particulate material in the North Atlantic Ocean, Progr. Oceanogr., 137, 261–283, https://doi.org/10.1016/j.pocean.2015.07.001, 2015.

Twining, B. S., Antipova, O., Chappell, P. D., Cohen, N. R., Jacquot, J. E., Mann, E. L., et al.: Taxonomic and nutrient controls on phytoplankton iron quotas in the ocean, Limnology and Oceanography Letters, 6(2), 96–106, https://doi.org/10.1002/lol2.10179, 2021.