

Interactive comment on “Reviews and syntheses: The biogeochemical cycle of silicon in the modern ocean” by Paul J. Tréguer et al.

Anonymous Referee #1

Received and published: 13 September 2020

The manuscript describes the next iteration of the Si budget of the global ocean by Tréguer with a diverse cast of collaborators. It is a major revision of the global budget identifying new sources and sinks of dSi and aSi to the ocean. The authors come to the conclusion that the revised inputs and outputs are approximately balanced suggesting that the modern ocean is at steady state. The discussion contains an extensive discussion on unresolved questions and potential anthropogenic impacts.

The manuscript provides a substantial contribution to our understanding of the Si budget of the global ocean and is a welcome overview summarizing much recent literature. In the first part of the manuscript the writing is crisp and clear presenting the revised budget. However, the discussion addresses a variety of diverse issues and lacks the precision of the first part of the manuscript.

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1) Steady-state assumption. The authors make value judgements on the data used to calculate fluxes sometimes discarding studies, sometimes averaging a wide range of numbers, although this reviewer feels comfortable with their calculations. However, after a large number of assumptions the authors arrive at a “balanced budget” interpreted that the global Si cycle in the oceans is at a steady-state. I am not sure the success of achieving a balanced budget warrants the conclusion that the budget is in steady state especially because there is a large range of input and output fluxes, many of them uncertain, contributing to this revised budget. Are there fluxes that are underestimated (a la Jeandel) or estimates of fluxes that are over-stated (sponge BSi deposition) that could put the budget far away from an apparent balance?

2) Specific unresolved questions (starting at line 537). The manuscript presents two case studies (Chinese Seas and The North-East Pacific dSi Anomaly) that add little to the main theme of the manuscript. The conclusion of this section starting at line 581 “a process that requires further studies” could be used on many of the processes contributing to fluxes. I do not know if these case studies are important to have as part of this manuscript.

3) A discussion of the uncertainties and how changes in the ocean Si cycle would be affected by global change (Section 5.4) is important to include, however, this section needs to be more coherent and better presented.

A carefully revised manuscript would greatly increase our knowledge of the global Si cycle and would provide new hypothesis and assumptions to be examined by the community.

Comments

Line 157 “this represents a realistic upper limit” – What is the justification for this statement?

Line 168 “Only one value currently exists” – See Hirst et al. published on 26 June 2020

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and Hatton et al. published on 14 July 2020 in Frontiers that have new numbers for Antarctica.

Line 232 and 233 - Why are you using units of "g yr-1" instead of "Tmol yr-1" as in the rest of the manuscript?

Line 235 Changed "determined" to "calculated"

Line 337 "canonical" is used several times in the manuscript. I have looked up the word and it has many meanings depending on the field of study. I looked in the original citation and "canonical" is not there either. Can you please use a less ambiguous word?

Line 455 Change "do" to "does". Fix the rest of the sentence "being little reliable"

Lines 504 (Section 5.2.2) I do not really understand what you are trying to say here, especially the last sentence. You state that climate change or anthropogenic impacts affect dSi (Bernard et al. 2010, 2011) leading to an imbalance. Do you mean there will be no changes in ocean production of siliceous organisms if the Si balance in the oceans change? If so, is that only speculation or is there evidence?

Line 542 I would add "particulate Si inputs" to needing a better understanding

Line 552 "unusual" – Why is it unusual for coastal systems?

Line 563 "recommend additional attention" – Why?

Line 580 Need reference to these numbers presented.

Lines 590, 598, 600 Should be "precipitation"

Line 601 Spell out what you mean by "contradictory impacts"

Line 616 Why use the word "corroborated"?

Line 652 "These uncertainties suggest" – If we can not use models to help us understand how the silica biogeochemical cycle will change in a future ocean, then what do

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we use? Seems like it was written by someone who does not like models.

Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2020-274, 2020>.