Reviewer 1

Suggestions for revision or reasons for rejection (will be published if the paper is accepted for final publication)

The manuscript has been improved, is up to date in references and reads well. I think it will make a great contribution to the literature and give many scientists new things to work on regarding the global biogeochemical Si cycle.

However, I am still not satisfied with the discussion regarding a possible steady state for the modern ocean Si cycle. Their expression of L55 "possible steady state scenario" and L84 "a possible scenario for the Si cycle at steady state" muddles the meaning of the text. I would like to suggest a few modifications of the text to use their data for both input and output, and to make their point clearer.

L54 - L56 "we address the steady state hypothesis of the Si cycle for past and modern oceans, and propose a possible steady state scenario for the global ocean (inputs = outputs = 15.6 Tmol-Si yr-1) and boundary exchange zone."
Rewrite to
"we hypothesize that the modern ocean Si cycle is at approximately steady state with inputs = 14.8 (± 2.6) Tmol-Si yr-1 and outputs = 15.6 (± 2.4) Tmol-Si yr-1."

-corrected

L 84 - L85 "and propose a possible steady state scenario for the modern ocean, with inputs balancing outputs at 15.6 Tmol yr-1 (Fig. 1)."
Rewrite to
and hypothesize that the modern ocean Si cycle is potentially at steady state with inputs = 14.8 (± 2.6) Tmol-Si yr-1 approximately balancing outputs = 15.6 (± 2.4) Tmol-Si yr-1." (Fig. 1).

-corrected

L562 - L564 "Fig. 1 shows a possible scenario for the Si cycle at steady state in the modern ocean, based on a balance of inputs and outputs at 15.6 Tmol-Si yr-1 , compatible with the geochemical and biological fluxes of Table 1."
Rewrite to
"Fig. 1 supports the hypothesis that the modern ocean Si cycle is at steady state, compatible with the geochemical and biological fluxes of Table 1."

-corrected

L570 "Fig. 4 shows a possible steady-state scenario"
Rewrite to
"Fig. 4 shows a steady-state"

-corrected

With these edits then the text in L565 - L569 should be deleted. Since the Total Input

and Output fluxes are within the stand of error there is no need to say that the input flux should be increased. There are a lot of values not well constrained and to point out one estimate is not valid.

-done

Small additional comments

L72 Rewrite ”N a bSi” to “N and bSi”

-corrected

L72 Delete “that has been named “dark silica.” Many sponges occur in the photic zone and have algal symbionts including diatoms. Calling it “dark silica” confuses the issue.

-done

L79 Delete “the reference value of”. A reference value is a known and correct measurement used for comparison.

-corrected

L587 - L606 I am not enamored by the discussion of the Chinese Seas (5.3.1). As the authors discussed earlier in the manuscript the flux from GW is poorly constrained, yet it is a large term here. In addition, there is very good discussion (5.4.1) later on river inputs which are also significant in this area. You could pick many coastal zones and regional seas and point them out for important additional studies that are needed. I still think this section, as well as (5.3.2) on the NE Pacific dSi anomaly could easily be deleted and not effect the manuscript.

-section 5.5 has been deleted

L730 Could use a concluding sentence here.

-done :

« Over the 21st century, the influence of climate change, and other anthropogenic modifications, will have variable impacts on the regional and global biogeochemical cycling of Si. The input of dSi will likely increase in specific regions (e.g. Arctic Ocean), whilst inputs to the global ocean might decrease. Global warming will increase stratification of the surface ocean, leading to a decrease of dSi inputs from the deep sea, although this is unlikely to influence the Southern Ocean (see Section 5.3.3). Model-based predictions suggest a global decrease in diatom production, with a subsequent decrease in export production and Si burial rate. Clearly, new observations are needed to validate model predictions.»

Referee 2

#Review comments on “Reviews and syntheses: The biogeochemical cycle of silicon in the modern ocean” by Tréguer et al.,

L48: 24 % change for 24%
-done

L53: 6 Tmol-Si yr-1, too many spaces
-done

L68-69: … with nitrogen (N), phosphorous (P) and inorganic carbon (C), …
-done

L92: did you mean “with an error of one standard deviation”?
-yes, done

L113: “processes at work mostly in deep waters” did you mean “processes that work mostly in deep waters”
-yes, modified accordingly

L121: no space between 5 and %, check in the rest of the manuscript. Also what do you mean with 0.5-5% yr-1? Is it a percentage per gram of sediment, per m2 of sediment?
-modified : « 0.5 – 5% of the Si originally present in the solid phase dissolved into the seawater during one year »

L143: need a space “. More”
-done

L157-158: did you mean “Fabre et al 2019 calculated that the potential flux of dissolution of siliceous sandy beaches is driven by wave and tidal action.”
-modified : « the potential flux of dissolution of siliceous sandy beaches that is driven by wave and tidal action. »

L159: too many spaces “. If, “
-done

L213: space after “of”
-done

L280: “using on a database”

-done

L344: Did you mean " The new best estimates (Maldonado et al (2019) for Fsp is …"
-done

L450: error in reference format (G+T, 1999)
-corrected
L514: In table 1B reference 1 correspond to Nelson et al 1995, did you mean Treguer et al 1995? If not it is confusing as the Nelson et al 1995 reference is not mentioned in this paragraph but the Gross bSi pelagic prod value of 240 TmolSi y-1 correspond to Nelson et al 1995.
-There is no ambiguity : this paragraph deals with tG so no need of reference about the production paper of Nelson et al. 2015 ; Table 1b give the references for the cycle paper (Tréguer et al ; 1995) et for the production paper (Nelson et al. 1995). The Nelson et al. (1995) paper was discussed previously in section 3.

L529: (Fig4)
-done

L531: 13.9/255=5.45%
-corrected

L544: The transition between Conley et al 2017 hypothesis and the sponges is not clear. Also
The sentence "Sponges exposed … Maldonado 2020." Needs to be rephrased. Here is a suggestion: A consequence of the dSi decline is observed on modern sponges that are exposed to relatively low concentrations (give a value) which is typical for most of the modern ocean. As a results modern sponges have a poor skeletal development () and low dSi consumption rates ().
-Rephrased as follows :

« There are further evidence that the existing lineages of sponges have their origin in ancient (Mesozoic) oceans with much higher dSi concentrations than the modern ocean. Some recent sponge species can only complete their silica skeletons if dSi concentration much higher than those in their natural habitat are provided experimentally (Maldonado et al., 1999). Also, all recent sponge species investigated to date have kinetics of dSi consumption that reach their maximum speed only at dSi concentrations that are one to two orders of magnitude higher than the current dSi availability in the sponge habitats, indicating that the sponge physiology evolved in dSi-richer, ancestral scenarios. »

L550-558:
L551: remove the brackets and replace with "… production rate of both pelagic and benthic silicifiers, as shown above"
-corrected

L554-558: It is not clear, why if there are no negative feedbacks between the supply rates

and production or burial rates will climatic changes or anthropogenic change it. This needs to be re-phrased, here is a suggestion: “Today, on short timescales the supply rates are balanced by the production or burial rates which suggest that the marine Si cycle is at steady state. However, climatic changes or anthropogenic impact that affect dSi input to the ocean… ocean.”
This paragraph has been modified :

« Silicic acid does not appear to be limiting in several zones of the world ocean, which include the coastal zones, and the HNLC zones (Tréguer & De La Rocha, 2013). Note that any short-term change of dSi inputs does not imply modification of bSi production, nor export, nor burial rate. For this reason, climatic changes or anthropogenic impacts that affect dSi inputs to the ocean by rivers and/or other pathways, could lead to an imbalance of Si inputs and outputs in the modern ocean. »

Section 5.3 has been deleted according to Refere 1’s request

L592-595: why are these bSi production data not included in figure 3
Figure 3 only gather production made by isotopic measurements.
L595: move the % after bSi
-not longer pertinent (section deleted)

L604-605: a word is missing in the sentence
-not longer pertinent (section deleted)

L740: did you mean “should be addressed to examine …”
-corrected

L757: The use of geochemical tools is emerging, there are to date a list of papers using stable isotopes to elucidate sedimentary processes such as Pickering et al., 2020, Geilert et al., 2020, Ehlert et al., 2016, Ng et al., 2019, Cassarino et al., in press.
(Cassarino, L., Hendry, K. R., Henley S. F., MacDonald E., Arndt S., Sales de Freitas F., Pike J., Firing Y. L. Sedimentary nutrient supply in productive hotspots off the West Antarctic Peninsula revealed by silicon isotopes. GBC, in press)

-corrected : « Careful use of geochemical tools (e.g.32Si, Ge/Si, 30Si: Pickering et al.,2020; Geilert et al., 2020; Ehlert et al., 2016; Ng et al., 2019; Cassarino et al., in press) to trace partitioning of bSi between opal and authigenic clay phases may further elucidate the magnitude of this sink, particularly in understudied areas of the ocean. »