Authors' Response to Review Comments

(Manuscript Number: 'essd-2021-259')

We are very thankful to all the reviewers for their thorough and constructive reviews. We have addressed all the issues.

Reviewer #3

Here are very minor editorial remarks that would be good to correct

L254: you may use the term magnitude in addition to efficiency

Added.

L261: remove the dot before and

Removed.

L268: To the Pacific Ocean

Corrected.

L295: have

Corrected.

L368: not sure, but ranked instead of rank?

Checked and corrected.

L439: remove "the" before studies

Removed.

L647: remove one dot

Removed.

L651: choose between sampled and collected

Sampled chosen.

L657: remove while

Removed.

Table 2. Correct SOIREE experiment

Corrected.

Figure 4. Check the era number in Fig4 c and d

Corrected.

Reviewer #2

I am very pleased to see the changes done to this manuscript. I believe it has improved significantly. I particularly enjoyed the new Sections 5 and 6, which are very clear, to the point, and provide very interesting suggestions on how to improve future data sets and how to use this great compilation. Congratulations to the authors for the titanic effort in putting this data set together and for the beautiful description of the history of 234Th.

I still have some minor comments, which I hope the authors will consider addressing. Please find below a detailed review of the manuscript.

I will start with the two specific issues that I pointed out in my previous review:

1) The use, in some instances, of total particulate carbon instead of POC. The authors replied: "Only data reported as POC in the sources consulted have been reported as POC data. And equivalent for PIC data." I cannot find a column in the data set that refers to PIC, only to CHN analyses and then all the different possibilities of POC/Th ratios, so I am not sure what the authors mean by "and equivalent for PIC". Please see, for example, Owens et al. (2015), where total carbon is provided instead of POC.

The reviewer is right, not all studies provided POC but rather total particulate carbon, such as the example of Owens et al., (2015). For those cases, we have indicated it in the "comments" section of the "METHODS" in the metadata spreadsheet. This has been noted in the reviewed version of the manuscript (see lines 87-89).

We have reviewed all the datasets compiled and we have only found this to be the case for the study mentioned by the reviewer, Owens et al., 2915, and for an additional one: Puigcorbé, V. *et al.* (2015) 'Small phytoplankton drive high summertime carbon and nutrient export in the Gulf of California and Eastern Tropical North Pacific', *Global Biogeochemical Cycles*, 29(8), pp. 1309–1332. doi: 10.1002/2015GB005134.

Regarding PIC, the reviewer is right, no information of this parameter is included in the compilation. In the original version of the manuscript, this parameter was included in the "CHN" category, but after the first review, this criterion changed based on several comments by the reviewers and "CHN" was chosen to only indicate POC and PON data. The existence of PIC:234Th is indicated as extra information the "comments" section of the "METHODS" in the metadata spreadsheet when reported by the data authors, but it does not have a specific column for it. It was a mistake replying to the reviewer "…And equivalent for PIC data". We apologize for the confusion.

2) Regarding the addition of PAR or fluorescence data, I'm very happy to see that the authors have dedicated several lines to explain the importance of these parameters and to highlight the fact that this will be included in future versions of the data set.

We are very glad the changes made in review 1 please the reviewer. We agree with the reviewer that those changes improved the manuscript.

L15: Looking at the PANGAEA list of references, I found the 9 data sets but seems a repetition having those data sets together with the papers that actually published the data from those data sets. For example:

We appreciate the reviewer's thorough work checking the list of references in PANGAEA and the datasets published. A great effort has been devoted to 1) identifying datasets not published in papers and only available in repositories, and 2) acknowledging papers that published the same cruises but different stations and/or data points. Nonetheless, we acknowledge this effort does not prevent repetition in datasets happening by mistake. See detailed replies for each of the examples.

- California Current Ecosystem LTER; Stukel, Michael R (2019): This contains data from 2006 to 2017 that has been published in papers authored by Stukel.

Please not the repository has been cited as indicated by the author (i.e., *Total Thorium-234 (Th-234) taken from discrete water column samples collected during CCE Process Cruises (2006 - 2017)*), but this data set corresponds to a cruise in 2017 (P1706 on board R/V Roger Revelle), as indicated in the summary table provided in PANGAEA, that we have not found published in any article. If the reviewer is aware of an article containing this dataset, we appreciate communicating it to us so we can incorporate it to the compilation.

- Roca-Martí et al (2015) POLARSTERN cruise ANT-XXVIII/3 data set available in PANGAEA, the data has been published in papers authored by Roca-Martí et al (2015) and Puigcorbé et al. (2017).

The reviewer is right, cruise ANT-XXVIII/3 has been reported by in Puigcorbe et al., 2017, Deep Sea Research Part II (10.1016/J.DSR2.2016.05.016) & Roca-Marti et al., 2017 (10.1016/j.dsr2.2015.12.007). However, each author reported different stations between them, and also different to those reported in the dataset referred to by the reviewer. This is acknowledged in a comment in the 3 data sets that contains data from cruise ANT-XXVIII/3 (i.e., 0133, 0136, and 0193).

- Rutgers van der Loeff data sets from Antarctic cruises available in PANGAEA have also been published in papers authored by himself or others.

Same case as before, the data reported from repositories were not found in publications. In the case of Rutgers van der Loeff, the 3 datasets reported as found in repositories correspond to cruises PS58 in 2000, PS69 between 2005 and 2006, with this one split in 2 datasets, each one corresponding to each year. Data that can be found in a repository but also published is linked to the publication and not catalogued as "data from repositories", such is the case for the dataset 0142, which can be found in the repository https://www.bodc.ac.uk/data/documents/nodb/275768/ but also published in doi:10.1016/j.dsr2.2011.02.004.

Similar case for some PhD theses. I noticed that in Table 1 different sampling periods are chosen for those that seem to be "repeating" (i.e., Owens, 2013 vs Owens et al. (2015)). Does that mean that the repositories or PhD theses contain additional data that has not, indeed, been published?

Yes, that is what it means. Data reported from repositories has not been found in any publication, as clearly stated in the manuscript.

I didn't go in detail to check that in the actual data set in PANGAEA, but I would just like a confirmation, by the authors, that duplication has been considered and avoided.

We give our confirmation and hope that detailed explanations provided for the examples mentioned above by the reviewer are enough.

Also in the list of references presented in PANGAEA, I noticed that there Bhat et al. (1969) is cited as Bhat et al. (1968).

The reviewer is right. We identified the source of error being a mistake with the information provided in the website of ScienceDirect (https://reader.elsevier.com/reader/sd/pii/S0012821X68800834?token=CC3E25D891574BDB2CF57EE17B3C49DC3B7EF1FC953A5466363E1B39760BDE5486F60984002D1FAA658D0A9638A3B42F&originRegion=us-east-

1&originCreation=20220328112051). We have made aware both the ScienceDirect and PANGAEA and requested the changes.

I also saw that the personal communications and some reports (e.g., Kawakami, 2012) as well as some PhD theses (Owens, Pabortsava and Thomalla theses are included but Luo's thesis is not) are not included in the list of references. I believe they should all be shown there too since their data is included in the data set.

We agree with the review that all references should be included and this changes have been requested to PANGAEA. This includes datasets published in repositories by Turnewitsch 2001 and Kawakami, 2012, PhD dissertation by Luo in 2013, and the 9 datasets reported by personal communication.

L33: "half-lives" is plural, which "accounts" singular

Corrected.

L34: Transforming into

Corrected.

L36: radionuclides' distributions

Corrected.

L85-88: Adding the 5 different categories described results in 56631 data points instead of 56633, as stated. Please double check the numbers

Checked and corrected.

L96: Unless I missed one, I can only see 4 PhD dissertations in Table 1: Thomalla, 2007; Luo, 2013; Owens, 2013; Pabortsava, 2014, although Owens, 2013 is separated in 3 rows linked to 3 areas and/or sampling periods.

The reviewer is right the "T" used to indicate data extracted from a PhD dissertations was missing in Table 1. It corresponds to Lemaitre, N.: Multi-proxy approach (234Th, Baxs) of export and remineralisation fluxes of carbon and biogenic elements associated ith the oceanic biological pump. PhD dissertation, Joint PhD with Université de Bretagne Occidentale, Brest, France, Brussels, France. [online] Available from: https://we.vub.ac.be/en/phd-nolwenn-lemaître, 2017. The "T" has now been included.

L150: remove "in": "will be included"

Removed.

L154: "in future version"; change to "versions" or add an "a": "in a future version"

"a" added.

L253: Remove the dot after the Yool citation and make 15 a superscript (15N)

Removed.

L292-293: GA02 seems to be reported in a confusing way here. GA02 published by Owens et al. (2015) takes place in the South Atlantic, it goes from Punta Arenas (Chile) up to the equator, not from Denmark to South Atlantic as stated. Not sure why "Denmark" is specified for the Puigcorbé et al. (2017a) publication, when the authors already said it went from 64°N to the equator (it started south east of Greenland).

The purpose of the information provided in this part of the text was to indicate the country leading the cruise, which in the case of GA02 was Netherlands, not Denmark. Mistakes in reporting these cruises have been corrected.

L362: “the concept of scavenging by particles has really emerged”. The sentence should be in past tense. Remove “has”.

Removed.

L368: Not sure what “are rank” means in this sentence.

Corrected.

L376-379: “Several authors combined total and particulate 234Th concentrations (e.g., Minagawa and Tsunogai 1980; Santschi et al., 1979). While the sampling of the 234Th dissolved phase was initiated by McKee et al. (1984) …”. I don’t think this sentence is accurate. Santschi et al. (1979) publication already differentiates between total, particulate (>0.45 □m in this case) and dissolved (<0.45 □m) (see Fig. 2). Also, it is a bit confusing to say “combined total and particulate 234Th concentrations”, sounds like if they were adding both things together, while, what I think the authors mean, is that those authors published data for total and particulate, while not for dissolved. Is that correct?

The reviewer is right about publication by Santschi et al. (1979). This part of the text has been corrected.

L383: Use “that” instead of “this” to refer to Coale and Brunland (1985) study.

Corrected.

L407: The “)” after 2003 should be deleted

Deleted.

L408: Reconsider based on my comment above about Santschi et al. (1979) publication

Modified based on reviewer’s comment about Santschi et al. (1979) publication.

L415: Correct “field work” instead of “worked”

Corrected.

L427: “seawater” instead of “sea-water”

Corrected.

L428: “elements” instead of “radionuclides” since it is not a radionuclide selective technique.

Corrected.

L445-446: Santschi et al. (1979) work is actually cited here as one of the studies measuring the dissolved fraction, which does not agree with the previous statement (see comment L376-379)

This issue has been solved with the changes made and explained in comments for L376-379.

L456: it should be TSS

Corrected.

L474: Do you mean the “V” term in general (physical advection and diffusion) or just advection?

Yes, we meant that. This sentence has been rephrased for clarification.

L480: Correct “marked by a new approach was introduced”

Corrected.

L494: “element:234Th” should have a capital E

Corrected.

L499: It should be “advective” instead of “adjective”

Corrected.

L501-503: “In the open ocean, the most relevant physical process is vertical upwelling…” Well, that depends if it in that area there is upwelling or not. There are also areas with downwelling. Please rephrase to introduce the problematic of neglecting physical transport in certain areas of the open ocean.

Done.

L503-505: It seems very specific to talk about vertical and horizontal advections. Can this sentence be made a bit more general?

Sentenced modified to be more general.

L505: The jump to NSS seems a bit abrupt since we were talking about the physical part, not the temporal. The “alternatively”, refers to SS, which was mentioned 6 lines above, before talking about advection and upwelling.

Sentence rephased to make less abrupt.

L518: V term (singular)

Corrected.

L518-519: I am not sure it is necessary to explicitly say “without these components, the sinking flux would have been….”. There is no explanation of the impact of other milestones, e.g., L515 the authors don’t say: “Use of 210Pb-210Po which will allow to evaluate the POC export flux over longer timescales”. Plus, the importance of considering the V term in certain ocean settings is already described above in L500-505.

Sentence mentioned by the reviewer removed.

L523-527: Similar comment regarding the impact of a certain milestone. Maybe summarize it by saying something like: “… by Rutgers van der Loeff and Moore (1999) to allow particulate and dissolved concentrations to be analyzed from a single aliquot and to be measured by beta counting on board”. This explains what the milestone did without explaining the particular impact that it had (i.e., residence time calculations in two phases; increased temporal and spatial resolution). I believe the impact of certain milestones should be introduced/explained/presented in the paragraphs prior to the milestones bullet points. If the authors decide to keep the impact of these milestones, please review other milestones to add their impact.

Done.

L536-539: “Only 6 studies sampled 2 size fractions…” but there are 8 publications (studies) cited, plus 2 more that used 70□m instead of 53□m, so 10 publications (studies) in total. Please rephrase and check the numbers.

Numbers have been checked and sentence rephrased for clarification.

L539-540: “Additionally, to a lesser extent….by a total of 6 studies”. Why by a lesser extent if the number of studies that provides 2 size fractionations is also stated to be 6? If referring to all the studies that used pumps vs traps, then you should provide the number of studies using pumps to allow a proper comparison between both sampling methods.

We agree with the reviewer on his observation and “to a lesser extent” has been removed.

L569: “Pacific Ocean and had two…”. Change “and” by “which”

Corrected.

L571: DYFAMED has been sampled repeatedly, not just in 1987, within the years of this era. I understand that the sampling year does not determine the era, the publication does, but see comments below regarding Schmidt et al. publications, for consistency with prior statements.

We thank the reviewer for this observation and agree with him. New references has been included to acknowledge the repeated sampling of DYFAMED beyond era 2 (see response to next comment).

L571: 8) Should Schmidt et al. (2002)-Strong seasonality in particle dynamics of north-western Mediterranean surface waters as revealed by 234Th/238U as well as Schmidt et al. (2005) 234Th measured particle export from surface waters in north-western Mediterranean: comparison of spring and autumn periods, be cited here too, mentioning “extended in the next era” as done before in L560, 561-562, 565-566, 568-569?

We thank the reviewer for this observation and agree with him. The reference has been included.

L580: Should Schmidt et al. (2002)- Particle residence times in surface waters over the north-western Iberian Margin: comparison of pre-upwelling and winter periods, be cited here too, mentioning “extended in the next era” as done before in L560, 561-562, 565-566, 568-569?

We thank the reviewer for this observation and agree with him. The reference has been included.

L584: “increased” instead of “increase”

Corrected.

L605: “avoided” instead of “avoid”

Corrected.

L606: “along with other biogeochemical parameters”, this is not a direct consequence of the smaller sample volume used, meaning that the other parameters did not see their sampling resolution modified as a consequence of the small volume technique used for 234Th. I am not sure I am following what the authors mean with this sentence, but I believe the following paragraph talks about what the small volume technique allowed regarding the coupling with other parameters. I would delete the “along with other biogeochemical parameters” here since it is well explained and flows better in the following paragraph.

We agree with the review the sentence pointed out was out of context and it has therefore been deleted.

L614-615: This sentence reads a bit weird “by Pike et al. (2005) and Cai et al., (2006), marked the major milestones of this era, whose timeline summaries as follows”. Should it be “Pike et al. (2005) and Cai et al. (2006) works, which are major milestones of this era, whose timeline…”?

Corrected.

L619: Close the ( ) of the coordinates.

Corrected

L628: Here, but also seen in other cases, “in-situ”, but “in situ” is also used. The journal might have a specific criterion, but the authors should pick one of the two forms.

We have picked in-situ and corrected that throughout the entire manuscript.

L638 and 644: The Schimdt et al. (2002a,b) publications are in this area but the sampling took place during the previous era (1997-98 and 1994, respectively). This paragraph (L636-647) starts by referring to sampling “Sampling in the context of selected….”. I mentioned these studies before (comments to L571 and L580). I know eras use publication dates and not sampling dates, so maybe just rephrase slightly the beginning of this paragraph.

Rephrased.

L638: “And some other new…”. How about starting the sentence differently? e.g., “Other new studies, such as…. were also initiated”.

Sentence rephrased as suggested by the reviewer.

L640: There are 2 dots after (2004). Same for L647 after (2007)

Extra dots removed.

L649: Same comment regarding the reference to sampling instead of publication. Maybe say something like “The publications included in this era report data covering the entire ocean and with increased number of data points in all regions, except the Indian Ocean…”

Sentence replaced by the once suggested by the reviewer.

Maybe in L349-353, where the authors explain that the 4 eras are determined by publications, highlight the fact that that means that cruises that took place within the time frame of a previous era are included in the era of their publication. Also, maybe you could also mention the fact that, based on what it is shown in Table 1, if a later publication (from a later era) used data from a cruise that was already published in a previous era, that publication is included in the earlier era, despite of the year of the actual publication, correct? Examples: Stewart et al. 2011 is included in era 3 despite being published during the time frame of era 4; Murray et al. (2005) belongs to era 2 although based on the year of publication should be from era 3, same for Friedrich and Rutgers van der Loeff (2002b). By the way, in Table 1 this reference has a “b” after 2002, but there is only one publication by Friedrich and Rutgers van der Loeff in 2002, so the “b” should be removed from the citation in Table 1.

We consider this suggestion by the reviewer very useful and clarifying and it has been included in the reviewed version of the manuscript (see lines 354-359). The reviewer is absolutely right about the examples made regarding table 1.

The "b" in the reference Friedrich and Rutgers van der Loeff 2002 has been removed.

I think that the fact that publication dates are leading the eras is a very valid way to divide the history of 234Th. Based on that, when the authors say, for example "a total of 114 cruises…where compiled in era 4" that includes cruises that might have taken place before 2010, correct? I think this should be strongly highlighted (a bit stronger than it is already said) at the beginning of the discussion because I find myself thinking that 114 cruises in era 4 means 114 cruises between 2010 and present, but some go as far back as 1997. I believe the confusion makes sense because there are sentences such as L633: "…golden age of 234Th so far in terms of cruises carried out by year". Those cruises were not carried out all in this era, but reported, as stated afterwards. Similar with L654: "the large number of field expeditions carried out during this era", again, these cruises did not take place during this era, their data was reported during this era, which is different. I think the authors usually use "report" or similar verbs, but I would ask them to please be careful and double check that there are no sentences, like the two I just mentioned, that can lead to confusion. I have my doubts about considering the number of cruises included in each era as an indication of the "productivity" of the era, since there is a known delay between sampling and publication, maybe the number of publications would be more indicative of such "golden era", but I guess that is just my personal opinion.

As stated on a previous comment mentioning this issue, we consider this suggestion by the reviewer very useful and clarifying and new text has been included at the beginning of the discussion to emphasize the delay between sampling date and publication date, which determines to which era a data set belongs (see lines 354-359).

Additionally, all text has been reviewed to replaced "sampling" by "published" and "reported" when describing datasets within an era. And number of publications has been used as a indicative of productivity of the eras (see lines 646-647 and line 739).

L662: Delete one set of ( ) in the Kawakami et al. 2004 and Smoak et al. 2004 citation.

Deleted.

L668: Remove (before Lepore

Removed.

L670: "leagues" instead of "legs"

Corrected.

L678: "synthesis" should be plural, "syntheses"

Corrected

L690: I think the order should be (Oregon, USA)

Corrected.

L691: Change the comma for a dot after "sampling"

Corrected.

L692-694: Check the parentheses, there is a bit of everything in each of the IDP citations

Corrected.

L695: Mention that the shift that you are referring to is linked to 234Th, since GEOTRACES is much bigger than 234Th. The POC reference is only for Th while the reference to standards, intercalibrations, protocols, etc. applies to many other trace elements and isotopes. Rephrase a bit to clarify it.

Done.

L698-699: Check the parentheses

Corrected.

L706: "as part of the carried out in the context" – Correct it

Corrected.

L716: Missing a "has": "…technique has been recently carried out…"

Corrected.

L732: "published 4 years later", remove the "a"

Corrected

L743-746: The numbers don't match: 64 studies (out of 82) modeled 234Th, from them 60 used the SS approach + 1 NSS + 26 both (SS&NSS) = 87 studies total

We thank the reviewer for spotting this mistake, in the reviewed version of the manuscript it has been corrected.

L749: Add a space after (34%) and "of" after measurements or delete "measurements" and just say "reported CHN data"

Corrected.

L751-753: I am not sure the reference to studies that derive POC fluxes from Po and Th and compare them to sediment traps is necessary since that is not a data parameter reported in the data set (only if there is Po data or sediment trap data, but not if the authors derived POC fluxes from that and compared among the different approaches). It's ok if the authors consider it is valuable information for the reader but, is in this era the first time that this was done? If yes, say it, if not, then write a similar sentence on the previous eras were this sort of multiple tracer/direct measurements of POC fluxes was done. Note that Stewart et al. (2010) is not included in Table 1 because the 234Th data for that study are "presented elsewhere", which highlights what I was pointing out: having studies comparing POC fluxes obtained through Th-Po-Traps is not a variable of the data set. Therefore, highlight that this is something new seen in this era, but don't list it as if it was the last of the parameters gathered for the data compilation.

We consider the reviewer made a good point here and the reference to the studies mentioned has been deleted in the reviewed version of the manuscript.

L758: PICCOLO requires more information describing the goals, similar to the other projects.

Done.

L776-777: Delete the info about MOBYDICK, already shown in L767-769

Deleted.

L778-799: Fix singular and plurals; e.g “There is projects”, “that include”, “their methodologies”. Are you referring to one (APERO) or more (APERO and JETZON)? I would say just one, APERO, since JETZON is a network, and it includes APERO in it.

Corrected to singular.

L793: “version” should be plural

Corrected.

L833: remove “in”

Removed.

L843-844: Check parentheses for the Rosengard and Owens citations

Checked and corrected.

L846: “expect to resolve the mechanisms that control the transfer of carbon to depth” – It seems a bit vague and also quite bold to say that having the PAR or fluorescence profiles will tell us about the mechanisms driving the transfer of carbon to depth. What do you really mean?

Done.

L847-848: “However…..CTD (ref)”. This has already been said recently (L841). Missing the reference.

Sentence in line L841 has been removed to avoid repetition and missing reference has been added.

L849: Correct “Is that for reason that”

Corrected.

L850-851: There is an “and” and a verb missing: “…fluorescence and PAR data are crucial…”

Corrected.

L852-853: This sentence is exactly the same that the one at the end of the previous paragraph (L837-838). I would delete it in the previous paragraph (L837-838) and leave this one, but avoid repeating it, especially when they are so close together.

Sentence repeated removed when appears for the first time.

L854-859: Again, two exact sentences, in this case one after the other: “…overall, only a 36%....234Th fluxes.”

Sentence repeated removed when appears for the second time.

L863: Change “as” for “of” – “…as much of this information…”

Changed.

L864-866: I am not sure I understand exactly what that means. Do you mean that, regardless of the authors proving the bloom stage or not you will assess it somehow? Do you mean that you will provide what criterion was used when a bloom stage was reported? Will this be done for all the future publications/data sets that will be included? Could you please expand a bit or clarify what you mean?

Yes, we mean that in a future version of the compilation we would like to apply a standard criterion to the whole compilation to define the bloom stage, regardless of the authors proving the bloom stage. We plan to work on a criteria that takes into consideration the authors criteria, but most importantly, we plan to classify those dataset with no bloom stage assigned. The criterion used will be provided in the metadata information and will be added in addition to the classification provided by the data authors, when available. This will be applied to the datasets they are already present in the compilation and to those to be included in future versions of it. We have clarified this point in the reviewed version of the manuscript since it was not clear before.

L875: "ratios in the upper 100 m" which would include all the samples from surface to 100 m. But then in L879-880 "…probability of 234Th reaching equilibrium (or not) with its parent at 100 m", which sounds like only data at 100 m is being compared. I think it makes sense to do the second option, because we usually observe a deficit above 100 m, which would bias the histogram. Later on in L883 "…reach equilibrium around 100 m depth". What is the reference depth used? If you only plotted data collected at 100 m, please make it clear, if you used 100 m +/- 10 m (or similar) it is ok, just say that, but avoid saying "within the upper 100 m" because that includes all the data points collected from 0 to 100 m.

The reviewer made a really good point here. This part of the text has been rephased to clarify that only data at 100 m +/- 10 m is being compared.

L912: Correct the reference to Buesseler 2020

Corrected.

L913: It should be "BCP strength"

Corrected.

L921-922: Not sure what the authors mean by "major features…with an average of 2.03+/-0.18 dpm/L". This seems the average Th-234 concentration in surface waters…. Is this the "major featureS" (notice that features is plural)? I think the sentence needs to be clarified.

Sentence rephrased for clarification. Features removed.

Table 1: Remove the "-" from Matsumoto, 1975 sampling period.

Removed.

I just realized that PON:234Th ratios are only considered for filtration methods. Is that because there were no studies providing such data for sediment traps?

Only 10 dataset out of the 223 compiled reported PON:234Th data from sediment traps (in comparison to the 64 studies that reported POC:234Th with traps). Regarding datapoints, there are 196 PON:234Th data from sediment traps (in comparison to the 1244 datapoints of POC:23Th reported with sediment traps). So, we did not consider PON:234Th ratios measure in traps relevant enough to be included in the Table, which already contains lots of information.

Check the title for era 3, it says 2001-20010, there is an extra 0 in 2010.

Corrected to 2009.

Figure 2: The labeling of the panels based on the information provided in the caption is incorrect since panel c) should be panel b).

Corrected.

Figure 4: It took me a while to understand the M#. There is not reference to that in the list of milestones below each era, and I think that would make it easier. What I mean is…Would it be possible to have the "arrow" with the year and next to it the M#? Right now, for example for the 1989 I see grey xxxxxx in front of what would be M11 and M12. By the way, shouldn't 1989 have 3 milestones? 1) BATS, 2) Th as tracer of export production and 3) OSP-PAPA? In the timeline 1984 has 3 milestones (M4, M5 and M6) but in the list shown below era 1 for 1984 we can only see one, "concept of great particle conspiracy" [2]. The opposite happens in 1977, where there is only one milestone in the timeline (M3) but in the list below era 1 it looks like there should be 2 milestones: 1) the beginning of JGOFS program and 2) the Mn-cartridges [3]. Please review the figure and consider my suggestion of including the M# in the listing below each era.

We agree with the reviewer that including the milestone number (M#) after the arrow with the year make the reading of the figure easier and we have included it in the reviewed version of the figure.

We also would like to apologies to the reviewer for the many mistakes in the previous version of Figure 3 in era 1 which complicated the understanding if it. We have carefully reviewed the figure and we believe all mistakes are solved and both the timeline and the list with the items describing the milestones match the text in Section 4.

For example, for the case of era 1 where we spotted several mistakes, there are now 10 relevant years within the era, each one of them has a milestone, expect for years 1984 and 1988 which has 2 milestones. This results in a total of 12 milestones in this era (from M1 to M12, as plotted in the timeline and indicate in the itemized list of this era in the figure).

In era 2 we identified a mistake in the last 2 years with milestones in the timeline, which we indicated as 1997 and 1998 but are actually 1998 and 1999. See it corrected now.

In the rest of eras, we have not identified mistakes.

Again, tank to the reviewer for helping us clarifying this figure, which is crucial for the manuscript.

Figure 4: This comment is related to that long one I made before about the confusion between eras linked to publications and not to cruises. Saying "…sampling stations during era 1" can lead to think that those stations were sampled between 1969 and 1991. Maybe add something like "sampling stations considered (or reported) within era 1".

Corrected as suggested by the reviewer.

The type of data "iii) total 234Th not sampled" in panels b), c) and d), means that just one fraction of 234Th (i.e., either dissolved or particulate, or both maybe both, but not added by the authors) was sampled?

The reviewer is right. The "no 234Th" category referred to by the reviewer means that from the 234Th data gathered in the compilation (i.e., dissolved, particulate and total 234Th, and POC:234Th ratios and PON:234Th ratios from both filtration methods and sediment traps) total 234Th has not been reported in that dataset but at

least one of the other parameters has been reported. Same reasoning for the "POC:234Th ratios" category. This has been clarified in the caption of the figure.

Is it correct to assume that those stations in the north east of Greenland in panel b) are plotted twice because they belong to two of the categories (i.e., no total 234Th and no POC/Th ratios)? Similar to those in the Caribbean? This means that one study can be in two categories, correct? If that's the case, maybe it could be useful to have a note in the caption mentioning it. If that is correct, however, I'm not sure being part of category ii) as stated, means that it can be used to estimate POC fluxes because a study could be part of category ii) "no 238U" but also be part of category iv) "no POC/Th ratio", correct? If that's the case, being part of category ii) does not imply being useful to obtain POC fluxes.

The reviewer is again absolutely right in his reasoning and therefore, only datasets in category i) can be used to estimate POC fluxes. This has been corrected in the caption of Figure 4.

Figure 5: Similar comment. Please rephrase to ensure clarity: "…annual field expeditions reported within eras…."

Corrected.

Figure 7: Similar to comment from L875 et al.: Maybe it is better to say "at 100 m" instead of "within the upper 100 m"

Corrected.

Cite Davidson et al., (2021) for panel b)?

Citation included.