Re-Review of Saavedra-Pellitero et al.; ms re-submitted to EGUSphere

General comments:

This reviewer acknowledges that the authors have made an effort to tighten-up the manuscript from the first version and scaled back their conclusions accordingly. I note that due to the tightening of this manuscript, the stated impact of this paper has also beenscaled back but, at least, it is more realistic now. After re-reading the paper, there are still a few issues to attend to that I will discuss below.

The title could be honed even more to state <u>exactly</u> what you are showing in this paper. I would suggest something like "Mismatch between coccolithophore-based estimates of particulate inorganic carbon (PIC) concentration and satellite-derived PIC concentration in the Pacific Southern Ocean." I think this is more realistic about what this paper is actually about.

The revised paper explains that they used different types of satellite data to estimate PIC remotely, (level 2 and level 3). Each type of satellite data has a different space and time averaging. They should state emphatically that they compared these different time and space averages of satellite data to <u>the same ship data, (always collected at the same space/time scales)</u>. Note, these different space and time averages of the two data sets will affect any mismatch between the ship and satellite results, as well as the potential errors. Obviously, a lot can change in a coccolithophore population in +/- 8d or even +/- 1 month (see line 246) from a ship sample! It is still not really clear why they didn't simply use the level 2 data only (which would have less time and space errors but admittedly lower numbers of possible matchups due to the extreme cloudiness of the region). Did the authors ever use level 2 and level 3 satellite data in the same comparison with ship data? If so, those analyses cannot be used.

The estimates of PIC per coccolith that they cite regarding their model are huge. Beginning with lines 338-356 they discuss published estimates of calcite content per coccolith for *E. huxleyi*. They mention 0.015pmol per coccolith (Charalampopoulou et al., 2016), then they cite the author's own estimate of 4.64 pmol per coccolith as well as the calcite per coccolith used in this paper (of 1.66pg/coccolith [or at least I think those are their units!). This is an overall range in PIC per coccolith for *E. huxleyi* of over 300X! Using different PIC per coccolith values in their model could obviously affect the PIC concentration mis-match, too! The authors need to state why the calcite per coccolith values are so variable and how much of the magnitude of the mismatch is due to what value of the PIC per coccolith is used. (The 300X range in PIC per coccolith makes this reviewer suspect that there must be some mistake in the units of the calcite per coccolith being discussed in this paragraph).

They present discussion of the different morphotypes of *E. huxleyi* in this paper (lines 450-510). This reviewer is confused whether they are trying to connect the magnitude of the mismatch with the different morphotypes? The discussion seems more about simply presenting information about the different morphotypes that they encountered in the Southern Ocean. While interesting ecologically, does this have anything to do with the mis-match between SEM-based measurements of PIC and satellite measurements of PIC, the entire purpose of the paper? They could help this section by stating explicitly why they are presenting it at all. Only until I arrived

at the very end of the paper (line 536) did I see conclusion #4 stating "neither the slightly different carbonate masses nor the southward changes in morphotype composition had a decisive influence on the coccolith-estimated PIC, which is only determined by the abundance of *E. huxleyi* in this area".   This should be stated earlier in the discussion on morphotypes to tell the reader why you are including this morphometric data in the paper.

Specific comments:

L 1-2 See general discussion above regarding making the title more descriptive of the paper.

L 18-20 This sentence ("here we combine…") and the sentence in lines 21-23 ("We compare PIC estimates derived from…") are somewhat redundant. I'd eliminate the first.

L 29 Change the words "coccolithophore data" to "coccolithophore-morphometric-based data"

L34 The word "zooplankton" comes out of nowhere. Either eliminate altogether or state more carefully that you are referring to "calcifying microzooplankton."

L 41 Change "This process" to "Calcification"

L 54 Change "of the light backscattered…" to "of the total light backscattered.

L. 73 Understand the biological response to what?

L 94 Change "different calcification levels" to "degrees of calcification of coccolithophore cells".

L 102 "Here, we focus on the…"

L105 Change "outer bloom conditions" to "moderate bloom conditions"

L111-114 sentence beginning "The ACC…" This sentence is long-winded. Please divide it in two.

L149 The model of SEM is a Tescan Vega, I believe.

L202 exchange word "reproducibility" for "precision". Can you say anything about accuracy?

L223 Refer to coccolith-estimated PIC concentration not just PIC

L233 A zero SD could also mean there is only one measurement, right?

L239-242 Don't refer to general "data scarcity" but refer to the more specific "lack of cloud-free satellite images". Also, don't say "to increase data availability" but "to increase the possibility of a ship-satellite match-up"

L 239-249 See general comments on how they mixed level-2 daily satellite data vs level 3, 8-day and monthly Level 3 satellite data. Were Level 2 and Level 3 data used separately in different analyses or were they mixed in the same analysis?

L 339 Change "calcite weight" to "calcite mass per coccolith"

L341 State what the PIC per coccolith numbers were used by Poulton, as well as Rigual Hernandez.

L348 Change "we calculated PIC" to "we calculated total PIC concentration"

L379- As the handling editor mentioned, stay away from the word "validation" in this paper because you are not doing this!

L383 Too many uses of the word "estimated" in this sentence

L394 There is a need for both improved precision <u>and</u> accuracy!

L397- Get rid of sentence on validation of remote sensing data since this paper is not about that!

L435- You refer to "subfossil diatoms". Are these different from fossil diatoms.   Why not say "fossil diatoms in surface sediments"

Line 547- Instead of "zooplankton", do you mean calcifying micro-zooplankton like forams? Hard to imagine that your results will tell us anything about *Calanus*!