I want to thank the editor and assistants for all your help and understanding in the process of getting this paper publishable. I'd like to express sincere thanks also to the reviewers for reading and commenting on the manuscript so thoroughly. The text that is colored in purple is the new text in the paper. I didn't know how to track changes in latex. I hope this is all right.

I have made one change in addition to what was mentioned by reviewers. After I submitted the manuscript last month I did some more analyzis on the mixed layer depth and so I have changed the text to reflect this new understanding. Lines 805-815 and figure 7 is changed slightly.

Comments from anonymous reviewer (in italics):
I think the presentation of the model and its results has become more readable, and I particularly like the concise presentation of the sensitivity experiments (although some introductory comments might help the reader to understand right from the start how these have been carried out). I have some few comments, however, that may improve the model description, and make the model setup more easily accessible:

- A table of default parameters, against which the sensitivity experiments have been carried out would be nice
-> I'm not sure a table is the best thing as the default parameters are all variables. At first I added a table (table 3) but then I took it out again as I don't think it adds anything to what is explained in the text and in the caption to figure .

- Section three: a few general comments about the setup of the sensitivity experiment (e.g., the scaling factor approach) would be nice -> OK, did this (first paragraph in section 3).
To understand the sensitivity of model to parameters not well constrained by experiments, we run the model where a particular parameter is multiplied by a scaling factor (figure 4). For stickiness, α (eq. 5) we look at 7 runs where α is multiplied by 1/8, 1/4, 1/2, 1, 2, 4, and 8 and plot the export (figure 4a) and flux to the seafloor (figure 4b). Similarly, we do 7 runs for rate of bacterial respiration, k(l, t) (eq. 32) and zooplankton fragmentation, R_{break} (eq. 35). The range of TEP production is from 1/6 to 16/6 of the default as the model does not handle well TEP values out of that range.

Minor comments:

p 2, lines 132: explain BI earlier -> spelled out the abbreviation here. bloom index

p 2, line 140: "understanding" - fixed this spelling error

p 2, lines 131-134: this rather seems to belong to the Model Description section - In theory I agree, but it doesn't seem to fit in there. No changes.

p 3, line 175: "its" - fixed.

p 3, line 194: "ensemble"? - yes, fixed.

p 3, line 267: "1 new aggregate" - aggregate, or aggregate class? Changed to: 1 new AC.

p 4, line 346: do you rather mean: "such that n_j>=n_i"? yes, fixed.

p 5, line 444: "i .... " - i is an integer; what exactly is sum of orgC - also an integer? I have changed the sum to reflect that we are summing over the set. Lines 440-445.

p 6, line 551: "aggregates" fixed

p 7, line 566: "zooplankton" fixed

p 7, line 586 "it is fragmented" - do you rather mean "will be fragmented"? yes, fixed.

p 8, eqn. 42: really 10^16? yes, it is equation (3) in Gnanadesikan, 1999.

p 9, line 760: "There, ..." - do you mean "In this experiment"? yes, fixed.

p 9, line 764: "figure 4c and d" - I could not find these figures. - Oops, I decided to combine the zooplankton results with the rest of the results at the last minute.. Thank you for spotting this.

p 9, lines 781-785: Why does the slope become more negative when stickiness is increased? This sounds rather counter-intuitive to me. Yes, it does. I'm not sure why the slope behaves like this in this case. Added to the text: This is counterintuitive, as more large particles should result in a less negative slope. When we increase the encounter rate of zooplankton, there number of large particles increases and the slope indeed decreases; Lines 797-800.

p 19, Figure caption 6: "bin". Also, explain more clearly what the symbols are - at first I thought, these were observations. Why take output from 10 depth bins? OK, fixed. In each panel, the output from a 100m deep column is plotted.

p 11, line 978: "predict" - I wonder whether at this stage we can really expect to "predict" direction and magnitude of the biological carbon pump; so far, the model depends on many assumptions, which are not well constrained by observations (as also stated earlier in the paper). I would therefore suggest to use more cautious wording. OK, I have done this. The mechanistic links between these climate-sensitive drivers

and the physics and chemistry of sinking particles in the ocean will allow us a better understanding of the direction and mag- nitude of an ocean biological pump carbon cycle feedback to climate change, both in the past and in the future. Lines 998-1002