

General comment:

This is a very interesting article concerned with a probabilistic assessment of calcium carbonate export and dissolution. The probabilistic assessment chosen by the authors is very promising and approaches like this are urgently needed in order to arrive at a better model presentation of CaCO_3 . The article is therefore definitely worthy of publication.

Specific comments:

- The regional skill assessment seems to be problematic. Figure 8 shows clear inconsistencies for the median CaCO_3 export, especially when considering the Southern Ocean. There is a visible mismatch between the Atlantic, Indian and Pacific part of the CaCO_3 export of the Southern Ocean, generated by the regional skill assessment. The credibility of the solution is therefore questionable. I advice to shift the focus of this paper from the regional skill assessment to the global skill assessment. This includes a significant re-write and different illustrations.
- Throughout the whole paper, there are barely any time periods mentioned. Yet, the knowledge of the considered time periods is of importance, especially when mentioning mean concentrations and when comparing the model results to observations. Please add the considered time periods whenever necessary.
- Further, Figure A2 & A3 and page 20244 refer to the year 1994. Here, it would be preferential to at least compare to a ten-year average in order to analyse a more robust model result.

Technical comments:

- The figures and tables seem to appear in random order. Please fix this, so that Figure 1 is the first figure referred to in the text, Figure 2 the second one and so forth.
- page 20224, line 4: Correction: "... CaCO_3 export fluxes ..."
- page 20224, lines 11-17: Please mention at least once that these are simulated results.
- page 20224, line 11: Correction: "... that is within the lower half ..."
- page 20225, line 10: Correction: "... coccolithophorids, which ..."
- page 20226, line 7: Correction: "... range over several orders ..."
- page 20226, line 16: Correction: "... this method ..."
- page 20227, line 27 + page 20228, line 3 & line 25 + page 20229, line 11: Which time-periods and products are these mean concentrations from? Please denote.
- page 20229, line 19: Correction: "... in some places ..."
- page 20230, lines 21-22: Is this resolution valid for all components of the Bern3D model?
- page 20233, lines 9: Please explain the variable k_{eff} earlier in the text, i.e. directly after equation (4).

- page 20235, line 18: Correction: "... (calculated from GLODAP (Key et al, 2004) and World Ocean Atlas 2009 (WOA09) (Locarnini et al., 2010; Antonov et al.,2010)) ..."
- page 20237, line 19: Correction: "... to the part of ..."
- page 20240, line 26: Is that the export flux at 75m depth? Please specify.
- page 20241, line 27: Correction: "... are associated ..."
- page 20242, line 7: Correction: "... are dissolving ..."
- page 20245, line 5: What about changes in the TA*-profiles?
- page 20246, line 15: Correction: "... observation-based TA* ..."
- page 20246, lines 15-20: Correlation is just one measure which is not very informative in itself. What about standard deviation and the bias?
- page 20247, line 23: Correction: "... a global CaCO₃ export ..."
- page 20247, lines 7-11: What are the error-estimates of Sarmiento and Gruber (2006) and Lee (2001)?
- Table 2: Please refer to the depth of the export flux.
- Table 5: Correction: "... are estimated ...".
- Figure 1: The bottom row should rather be displayed in a separate figure.
- Figure 2 & 4: Please enlarge the font - the labelling of the axes is not readable.
- Figure 3: What time period is depicted? Further, the western/eastern boundaries of the arctic part of North Pacific and North Atlantic are missing.
- Figure 7, 8, A1, A2: What time period is depicted?
- Figure A1: The references for the World Ocean Atlas should be bracketed.