

## ***Interactive comment on “Summer and winter living coccolithophores in the Yellow Sea and the East China Sea” by X. Y. Gu et al.***

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Dear reviewers and editor:

The authors of the manuscript “Summer and winter living coccolithophores in the Yellow Sea and the East China Sea” really appreciate your helpful and instructive comments and suggestions, which greatly improved the manuscript. According to the reviewers’ comments, the manuscript has been thoroughly revised. The responses to the reviewers’ comments and questions are as followings.

**Reviewer 1:**

**Introduction:**

C6236

1. p7679 L17-18 “but few studies on modern coccolithophores had been carried out in these areas.”: “these areas” to be replaced by “Chinese sea areas”.

This has been revised according to the comment.

2. A Google Scholar search came up with the following, apparently relevant references to the sea areas in question.

Tien-Nan Yang(1), Kuo-Yen Wei(1, 2) and Li-Ling Chen(1) 2003. Occurrence of Coccolithophorids in the Northeastern and Central South China Sea, Taiwan, 48: 29- 45 NOT CITED

Tien-Nan Yang1,3, Kuo-Yen Wei1,\* , and Gwo-Ching Gong2 2001. Distribution of coccolithophorids and coccoliths in surface ocean off northeastern Taiwan. Bot Bull Acad Sin, 42: 287-302. CITED

KEN FURUYA\*, KIYO KURITA and TSUNEO ODATE\*\*, 1996. Distribution of Phytoplankton in the East China Sea in the Winter of 1993. J Oceanogr, 52: 323-333. CITED

Tien-Nan Yang, Kuo-Yen Wei, Min-Pen Chen, Su-Jen Ji, Gwo-Ching Gong, Fei-Jan Lin and Teh- Quei Lee, 2004. Summer and Winter Distribution and Malformation of Coccolithophores in the East China Sea. Micropaleontology, Vol. 50, Supplement 1: Advances in the biology, ecology and taphonomy of extant calcareous nannoplankton, pp. 157-170 NOT CITED

Sun, Jun, 2007. Organic Carbon Pump and Carbonate Counter Pump of Living Coccolithophorid. Adv Earth Sci, 22(12) (in Chinese) CITED

The suggested relevant references not cited in the previous version now have been cited in the manuscript in order to provide a comprehensive review of relevant studies in this area.

**Materials and Methods:**

C6237

3. *Coccolith data analyses and statistical methods* (“Coccolith” should be “Coccolithophorid”) “*ni* is the number of cells of the species” should be “*ni* is the number of cells of the species *i*” “*fi* is the frequency of occurrence of the species in each sample” should be “*fi* is the frequency of occurrence of the species *i* in each sample”

“Coccolith” has been revised to “coccolith and coccosphere” in order to be consistent with the text. The other changes have been made according to the reviewer’s suggestion.

4. *The CCA technique described is a standard and useful way to analyse such data. It should be stated whether or not any transformation was done (for example to normalise the data) before applying CCA.*

There was no transformation of data before applying CCA, which has been clarified in the manuscript.

**Results:**

5. L 16 “*absolutely*” should be “*overwhelmingly*”

The word “absolutely” has been replaced with “overwhelmingly”.

6. L 17 “*sum*” should be “*summed*”

“sum” has been revised to “summed”.

**Horizontal distribution of common species**

7. P7684 L 19 “*off-sea*”: *Does this mean “off-shore”?*

The word “off-sea” has been replaced with “off-shore” throughout the manuscript.

8. *Vertical distribution of LCs at different sections Vertical distribution of LCs at section A Same linguistic comments, as above. Otherwise fine.*

**Vertical distribution of LCs at section F**

C6238

*The remarks on layering are a good feature. Same linguistic comments, as above. Otherwise fine.*

The English language has been thoroughly checked and improved in the revised manuscript.

9. *Vertical distribution of LCs at section P L 7, L 15: “*plaque distribution*”. Do you mean “*layered distribution*” L8, L 17 “*off-sea*”. Do you mean “*offshore*”?*

“Plaque distribution” has been revised to “layered distribution”, and “off-sea” has been changed to “offshore”.

10. *Vertical distribution of LCs at section E Same linguistic comments, as above. Otherwise fine.*

The English language has been thoroughly checked and improved in the manuscript.

11. *LC species in survey area L 16 “*absolutely*” should be “*overwhelmingly*” L 17 “*sum*” should be “*summed*” It is a notable point that species found in winter are the same as those found in summer. The English is still a bit curious in places, but otherwise the section is OK.*

“absolutely” has been revised to “overwhelmingly”, and “sum” has been revised to “summed”.

**Discussion:**

12. P 7687 L 15 “*dominated*” should be “*dominant*”. (*Dominated is the opposite of dominant!*)

“Dominated” has been revised to “dominant”.

13. P 7688 L 7-8 “*These differences with the coccoliths were possibly caused by the sampling season, station locations or sample numbers.*” *Say what you think more clearly or don’t say it at all.*

C6239

The sentence has been deleted.

14. *P 7688 L 19 to P7689 L 8: All this is a good point. The other studies cited concerned very different, mostly tropical and/or deep-ocean ecosystems. I think it is useful that the authors have briefly summarised the conclusions (or opinions) of other authors considering the associations of CPs in other areas with different oceanographic parameters. Even though it seems we have a long way to go, this may help slowly the science community to understand the driving forces and life cycles of the different CP species and strains/populations.*

We really appreciate the comment. We also think this is the highlight of this manuscript to provide some important information on helping understand the driving factors of the coccolithophore distribution in the ocean.

15. *Last paragraph: Linguistic improvements needed, as mentioned for previous sections.*

The English language has been thoroughly checked and improved in the revised manuscript.

**Tables figures:**

16. *F 1 is very nice, and it is good to have an idea of the bathymetry. It would be easier for the reader, however, if sections A, F, P and E were labelled the same (A, F, P and E), rather than A, B, C and D, as now.*

The changes have been made accordingly.

17. *Figs 2-24 are all very beautiful, didactic, and an important contribution. Congratulations! Figs 25-28 are very valuable, but I needed to enlarge them and peer at them, as they are a bit faint.*

Figs 25-28 have been enlarged to be clearer.

18. *T 3: "Furaya" should be "Furuya" (3 times) (spelt correctly in the refs.)*

C6240

This has been corrected.

**Statistical treatment**

19. *State if any prior transformation was done before applying CCA.*

There was no prior transformation before applying CCA, which has been also stated in the manuscript.

20. *CCA treatment:*

*In summer, most spp. (liths and LCs) were negatively related to temperature with notable exceptions of G. oceanic (positive relationship) and E. hux (neutral). (figs In winter, most spp. showed a positive correlation with a swathe of related parameters, T, S, NO3, and depth. Figs 25-28 all show axis 2 longer than axis 1, even though in CCA, axis 1 generally extracts more information than axis 2. It would be more appropriate that the presentations give axis 1 and axis 2 of equal length. (The information extracted by each axis is not given, but this is probably not needed.)*

The summer CCA result (liths and LCs) shows temperature is the major factor controlling the distribution of G. oceanic. One possible reason could be that the LC community was composed by at least two groups: one group from warmer oceanic waters, the abundance of which correlates with temperature change negatively (in continental shelves or coastal regions), especially in summer; another group from the coastal regions, such as G. oceanic, usually has a wide temperature niche, so that they are able to adapt to temperature changes well in summer. However, the responses in winter are different: the water temperature is always below 10 °C, under which most of the LCs including G. oceanic are not able to survive, and only few intrusive warm-water species can survive, with a positive relationship with temperature. As for the lengths of the axes 1 and 2, it is only because such layout looks better. Our CCA results showed good constriction of CCA statistical factors at axis 1, and the cumulated percentage of the variance at axis 1 was 84%, 66%, 93%, 80% in fig. 25 28 in turn.

C6241

## 21. "Depth"

*Make it perfectly clear throughout the manuscript whether "depth" means, "water-column depth" or "sample depth" (E.g. "Species A showed a positive relationship with depth.")*

All the word "depth" mentioned in the manuscript has been checked and clarified as suggested.

## 22. Biovolume and biomass

*The last author is a renowned authority on conversion of phytoplankton cell counts to biovolume and biomass. It would therefore be a valuable addition to present the biovolumes and biomasses of the LCs, as well as cell numbers. This should not be too much extra work.*

The coccosphere carbon biomass along the four sampling sections in both summer and winter have been calculated and added into the manuscript as the following additional figures (please see the attached file for new figures):

Figure 6b the water column vertical integrated carbon biomass distribution of coccosphere in summer.

Figure 8b the water column vertical integrated carbon biomass distribution of coccosphere in winter.

Figure 10b. Vertical distribution of coccosphere carbon biomass along the section A in summer.

Figure 12b. Vertical distribution of coccosphere carbon biomass along the section A in winter.

Figure 14b. Vertical distribution of coccosphere carbon biomass along the section F in summer.

C6242

Figure 16b. Vertical distribution of coccosphere carbon biomass along the section F in winter.

Figure 18b. Vertical distribution of coccosphere carbon biomass along the section P in summer.

Figure 20b. Vertical distribution of coccosphere carbon biomass along the section P in winter.

Figure 22b. Vertical distribution of coccosphere carbon biomass along the section E in summer.

Figure 24b. Vertical distribution of coccosphere carbon biomass along the section E in winter.

## **Reviewer 2**

### **Introduction**

1. (p7678 L4) *What is the difference between "LCs" and "LC (Line 8)" ? Is this a misspelling?*

LC is the abbreviation of "living coccolithophore" and LCs is the plural form of LC.

2. (p7679 L12) *Check the position of "-" in "eutrophic-water" and "oligo-trophic water"*

This has been checked and revised as "eutrophic water" and "oligotrophic water".

3. *Recheck the reference and citation.*

The references and citations have been thoroughly checked and new citations have been added.

### **Material and methods**

1. (p7680 L8) *CTD (conductivity temperature device) => (conductivity temperature depth)*

C6243

This has been changed accordingly.

2. (p7680 L14) *Coccolith data analyses => Data analysis*

The change has been made according to the suggestion.

3. *What is your method for identification of coccolithophorid species ? Please add the identification method (method and references).*

The method has been stated in the manuscript as "The samples were investigated using a Motic polarizing microscope (PM, BA300) under 1000× magnification with more than 300 coccoliths or 100 coccospheres being identified and counted per filter according to Bollmann et al. (2002)".

## **Results**

1. *What is the difference between "off-sea" and "off-shore"?*

The word "off-sea" has been replaced with "off-shore" throughout the manuscript.

2. (p7682 L7) *is formed => was formed*

This change has been made accordingly.

3. (p7682 L7) *Section A => section A (change a lower case letter)*

The previous "Section A" has been revised to "section A".

4. (p7682 L17) *sum => summed*

This change has been made accordingly.

5. (p7681 L24 p7682 L3) *Thus both the East China Sea areas. I think this sentence needs reference with supportive reasons.*

The supporting reference "Su et al, 1994" has been added.

## **Discussion**

C6244

1. (p7687 L15) *dominated => dominant*

This change has been made accordingly.

2. (p7691 L1) *en- vironmental factors => environmental factors*

This change has been made accordingly.

3. *It will be best discussion and conclusion if you add the opinions from the point of climate change view into your discussion and conclusion.*

Some sentences for conclusion have been added to the revised manuscript.

## **Figures**

1. (p7699) *In caption of fig. 1, A section => section A (turn around the order in other sections)*

The original "A section" has been revised to "Section A" in Fig. 1 (please see attached file for new figures).

2. *In all of contours in your figures, it is difficult to recognize the difference of data level (in higher part – red and orange color part) by your color index set. Generally the red color represents higher level than the orange and yellow color in a contour map or plots. I suggest the change of color scale in the contour plots of your figures.*

The colour scale and quality of most of the figures (attached) have been changed for a better visual effect.

We would like to thank you again for your efforts on improving the manuscript. We look forward to hearing back from you again.

Sincerely,

Jun Sun

Please also note the supplement to this comment:

C6245

<http://www.biogeosciences-discuss.net/10/C6236/2013/bgd-10-C6236-2013-supplement.pdf>

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Interactive comment on Biogeosciences Discuss., 10, 7677, 2013.

C6246