

Interactive comment on “Towards a merged satellite and in situ fluorescence ocean chlorophyll product” by H. Lavigne et al.

H. Lavigne et al.

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Response to reviewer #1 for the manuscript “Towards a merged satellite and in situ fluorescence ocean chlorophyll product” by H. Lavigne et al.

We have modified the manuscript according to your suggestions and those of the two other reviewers. We think that the new manuscript has accordingly improved.

In the following, we write each of the reviewer #1 comments and answer below:

General Comments

Point 1. My only reservation about the manuscript is that it doesn't state clearly enough that this method is not a way to actually calibrate, in a true sense, fluorometer measure-

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ments. While this method performs the important task of ‘correcting’ in situ data to a single ‘standard,’ satellite measurements, it should still be emphasized that this method does not produce truly calibrated results. The authors do a commendable job of discussing and quantifying sources of error, but their general conclusion seems to be that the resulting data can be viewed as independent, calibrated data (though with some error). This may simply be a problem of semantics, but it is very important that the authors clarify that the method does not produce independent data. The results from this method are unavoidably tied to the satellite sensor used for reference, and may or may not represent “true” chlorophyll concentrations. A sentence or two to acknowledge this point more explicitly is all that is needed.

Authors response: We agree with the referee that we improperly used the word “calibration” in our manuscript. The proposed method, as the referee rightly stated, is rather a “correction” than a “calibration” (or “vicarious calibration” as suggested by another reviewer). In the new version of manuscript, we replaced the word “calibration” (or “calibrated”) by “correction” or “re-adjustment”, each time we referred to our method (see at the end of the document the specific modifications of the manuscript). We also added a sentence in the Conclusion section: “Strictly speaking, the proposed method is not a calibration procedure, which should imply a more accurate evaluation of the sensor responses. In our approach, fluorescence profiles are only corrected and re-adjusted to be consistent with satellite estimations. Nevertheless, the resulting corrected profiles show lower errors than the initial fluorescence profiles, when compared with HPLC estimations.”

Specific Comments

Point 2. p 11901, lines 21-22: “fluorescence is undoubtedly the one which has been the least scientifically exploited.” Not sure what you mean here. Do you mean that despite the fact that nearly every ocean sampling program measures chlorophyll fluorescence,

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we as a community have not effectively used the data? What is your basis for that perspective? Please clarify.

Authors response: We agree with the referee that our sentence was misleading. We only wished to indicate that, among the three global existing data sets (ocean color, water samples, and fluorescence), the fluorescence data are not used in global re-analysis or climatology. The sentence has been rephrased accordingly: "Among the three main approaches that exist for measuring [Chl-a] (i.e. water sampling, ocean color and induced fluorescence, see later), fluorescence is the only one that has not been included in global re-analysis, as, for example, open ocean climatologies of [Chl-a] (i.e. Gregg and Conkright , 2001)."

Point 3. p 11903, lines 15-17: "Consequently, in situ fluorescence profiles are only used to indicate a "generalized" biomass index (Strickland, 1968), interpreted to decide the depths for bottle sampling during a cruise." While this may be true in your research group, my impression is that fluorescence profiles are used quite often (rightly or wrongly) in a wide variety of oceanographic studies. As above, what is the basis for your opinion here?

Authors response: Again (see previous point), our sentence was possibly equivocal and it didn't reflect our thoughts. We rephrased the whole paragraph: "During oceanographic cruises, in situ fluorescence profiles are generally used to indicate a "generalized" biomass index (Strickland, 1968), and then interpreted to decide the depths for bottle sampling. Occasionally, they are used to improve the interpolation between discrete [Chl-a] estimations (see for example Morel and Maritorena, 2001). However, extensive and global analyses, including several data sets of fluorescence profiles, obtained by different fluorometers, are lacking."

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Point 4. p 11911, lines 14-15: "the impact of satellite error on the final "satellite-corrected" [Chl-a] estimations is minimized." Not sure what you mean here. Minimized how? Please clarify.

p 11911, lines 16-18: "Standardisation of error could be ascribed to the smoothing effect relative to the utilization of integrated Chl-a contents instead of surface values in the determination of the parameter." This sentence is awkward. Recommend reworking to improve clarity.

Authors response: We simplified the whole paragraph, as also demanded by referee #3: "The impact of the error of satellite observations on the "satellite-corrected" profiles is different for the three test stations analyzed (Table 4). At DYFAMED and BATS, the error of the "satellite-corrected" profiles (when compared with HPLC estimations) is largest when the difference between satellite and HPLC surface values are greater than +/-35% (Table 4, the 35% threshold value has been used because it is the accepted averaged error of the satellite chlorophyll, McClain, C. R., 2009; Moore et al., 2009). Conversely, at the station HOT, the final error appears to be hardly affected by the accuracy of the satellite observations."

Point 5. p 11914, line 5: "points are aligned over the first bisector." Not sure what this means. Do you mean that the points are spread evenly around the 1:1 line?

Authors response: Yes. We have made the sentence more clear: "HPLC to "satellite-corrected" data spreading is also reduced, with most of the points concentrated around the 1:1 line."

Point 6. p 11916, lines 1-2: "Nevertheless, it is even more relevant within certain localised areas (i.e. the Mediterranean Sea ..." What is more relevant? The method? The errors? Please clarify.

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Authors response: The whole paragraph has been rewritten, as also requested by referee #3: "Our analysis demonstrated that when the error of satellite [Chl-a] is lower than 35% (i.e. the estimated averaged accuracy of ocean color mission, McClain, 2009), our method performs better. However, several studies indicated that ocean color [Chl-a] observations could have error greater than 35%, in particular over certain localised areas (i.e. the Mediterranean Sea, D'Ortenzio et al. 2002, the Antarctic or the Equatorial Atlantic, Gregg and Casey, 2004). In these situations, particular attention should be dedicated to the interpretation of our "satellite-corrected" profiles."

Point 7. p 11916, lines 5-6: "a narrower matchup protocol (i.e. 1-day and/or 0.1×0.1 box) does not significantly enhance the performance ..." This actually implies something very interesting. Inherent in your method is the assumption that chlorophyll is constant over the 8-day satellite window and area that includes your in situ profile. This result supports that assumption, within the 30%+ error.

Authors response: We agree with referee that this point is quite interesting. To be confident on the selected protocol, we performed several tests (not presented in this paper) that we plan to present in a short note in preparation. In the present paper, however, we reinforced the analysis on the sensitivity of the approach to the matchup protocol, by modifying Table 4 (see the new version of tables in annex) and by adding additional sentences in the "Results" and "Discussion" sections (see points 4, 5 and 6).

Technical Corrections 1) p 11907, line 25, and p 11908, line 28: Do you mean Table 4 from Uitz et al.? As also demanded by referees #2 and #3, in the new version of manuscript, we removed our Table 3 and directly refer to Table 4 from Uitz et al., (2006).

2) p 11918, line 24: I'm not sure if "homogenisation" is quite the right word here. Sug-

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gest something more like equalize, rectify, or coordinate. We changed to "uniforming".

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/8/C6173/2012/bgd-8-C6173-2012-supplement.pdf>

Interactive comment on Biogeosciences Discuss., 8, 11899, 2011.

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