Biogeosciences
Discussions

Interactive comment on "Factors challenging our ability to detect long-term trends in ocean chlorophyll" *by* C. Beaulieu et al.

C. Beaulieu et al.

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Manuscript # bg-2012-501 "Factors challenging our ability to detect long-term trends in ocean chlorophyll"

Response to anonymous referee #2

We wish to express our appreciation to the reviewer for his or her valuable comments and suggestions, which greatly helped to clarify the paper, and for the time he or she took to thoroughly review this paper.

Comment: Abstract, line 12: OLCI will not be launched before the end of 2014, at the best.

Response: According to the International Ocean Colour Coordinating Group, OLCI was scheduled to launch early 2013 on Sentinel-3 (see: http://www.ioccg.org/sensors/olci.html). This is where we previously took this information, but this page may not be up-to date. Therefore, we updated the abstract as suggested by the reviewer. The ESA website also confirms that the first Sentinel-3 satellite is expected to launch in 2014 (http://www.esa.int/Our_Activities/Observing_the_Earth/GMES/Sentinel-3).

Comment: Page 16423, lines 18-22 (and page 16437, lines 21-23): the issue with biases is maybe somewhat overlooked here. I'm not sure what the authors mean actually by "reducing a bias". Does this mean forcing one time series to agree with another one on average because the latter is considered closer to the truth? Or bringing both time series to a common "average" or any other possibility? The question behind this comment is: do we have to remove biases or do we "simply" have to characterize them as accurately as we can? (and then we can incorporate the knowledge about these biases in the process of detecting long-term trends). Authors should say something here about this (this might be done in the summary of hypotheses at the end of the paper).

Response: We clarified that what we meant here is to characterize the discontinuity and incorporate this in the regression model to detect long-term trends. The new text that replaced page 16423 lines 18-23 is: "Discontinuity can be introduced in the satellite records when a change of instrument occurs without an overlapping period during which the sensors in orbit may be cross-calibrated. While not ideal, the discontinuity due to a change of sensor might be estimated with some degree of uncertainty even without a period of overlap through careful calibration in orbit. However, with a period of overlap in orbit, discontinuities between sensors could be more accurately characterized by cross-calibration. Then, the magnitude and uncertainty of the discontinuity can be incorporated in the regression model used to detect long-term trends."

Comment: Section 2.2: I would like to see here better statements of hypotheses un-

derlying selection of the equations. This is partly done in the summary of hypotheses at the end (for instance point 4), but readers who are not fond of statistics might better understand what's behind all this if some more explanations would be given. For instance, authors should clearly say that they assume here that the average seasonal cycles are identical year after year (as far as I have well interpreted their paper). Violation of this hypothesis might confuse trend detection, again. In other words, translate some of the statistical jargon into geophysical considerations.

Response: We agree with the reviewer that a discussion about a constant seasonal cycle assumption was missing. We added a point to discuss the seasonal cycle in section 4: "The results are based on the assumption that the average seasonal cycle remains the same year after year. Violation of this hypothesis might confuse trend detection. Some studies have suggested that the seasonal cycle in chlorophyll concentration may be changing with time in some regions (Vantrepotte and Mélin, 2009; Henson et al., 2013). However, since we do trend detection on biomes means, the changing seasonal cycle seems to be cancelling out when averaging and it seems reasonable to assume that it approximately repeats itself year after year."

As for the general comment about statistical jargon, we think there must be a balance between being accurate and explaining the terminology into geophysical considerations. There is a certain level of statistical terminology necessary to be accurate here. We think we already put a lot of efforts into explaining the statistical terminology into geophysical context. However, we went through the manuscript in search for sections where it can be improved and made a few additional changes: P. 16426, lines 17-18: we replace "However, in time series of environmental records, there is often red noise in the regression residuals." with "However, it is often not reasonable to assume that successive observations of monthly chlorophyll concentration are independent from each other since there is memory being carried from month to month (red noise)". P. 16427, line 4: we added "The first-order autocorrelation expresses the strength of the memory being carried from one month to the other. The decorrelation time (or the

time it will take in months to forget the current state of the process) is a more tangible measure of the strength of the memory and a function of the first-order autocorrelation value ."

Comment: Page 16436, line 26: what authors mean by "persistent" here? There are currently very few floats equipped with the necessary sensors, and the plans for developing a global network of these "bio floats" are far from established. In addition, such networks will undoubtedly be useful for many purposes, but I doubt they can be of any help in this search for long-term trends. This should be discussed a bit further.

Response: The point we wanted to make here is that trend detection in ocean chlorophyll using bio floats could complement satellite data in the search for long-term trends as they provide measurements at greater depths and are not affected by clouds. We removed the word "persistent" and added at the end of the paragraph: "A global network of bio floats could provide additional opportunity to detect long-term trends in ocean chlorophyll concentration."

Comment: Appendix B: a 4-line appendix is quite useless. You should reincorporate this in the main text.

Response: We merged Appendix A and B together and renamed it "Additional details on the data and models and additional results". Figure B1 is now Figure A4.

Comment: Note sure all acronyms are properly expanded when they first appear in the text. A general check for this is needed.

Response: We double-checked all acronyms and symbols and they are all explained when first introduced in the text.

Comment: I'm not sure how figures will be eventually reproduced in the published paper. In their present form they have ridiculously small size for labels etc.. This is really poor-quality figures, and should be improved.

Response: We increased font size for the labels in the figures and resolution for the

final version of the manuscript.