Ocean Sci. Discuss., 6, C847–C851, 2009
www.ocean-sci-discuss.net/6/C847/2009/

Ocean Science Discussions

Interactive comment on "Comparative analysis of the multi-sensor global ocean colour data record" *by* S. Djavidnia et al.

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Received and published: 1 December 2009

Review #1

R: Responses to each comment are provided below (after each R:). They describe the major changes brought to the manuscript. Other minor changes in wording have been carried out. Figure 2 (now 1) has been corrected and completed with a cumulative frequency distribution (to support the description of results in the related section), and Fig. 9 and 10 have been redrawn with different symbols for clarity. Page/paragraph/line numbers refer to the revised manuscript.

Minor critical comments:

– The title could be worded better to reflect more explicitly the overarching goal, namely, assessment of compatibility of data from different ocean colour sensors

R: A simplified title is proposed: “Comparison of global ocean colour data records”. In our opinion, compatibility implicitly contains a notion of criteria, for instance, an analysis and recommendations on whether Level-3 products could be merged, or an assessment of the possibility to transform the data as to reach common standards, etc. . . The present work is essentially restricted to the assessment of the differences (comparison) of Level-3 products.

– On p.1615 it is indicated that the work has been inspirated by the MERSEA project with the European Marine Area in focus. However the results of analyses are explicitely indicative of significant discrepances between SeaWiFS, A-MODIS and MERIS data in case 2 waters, i.e. European coastal waters and semi-closed seas. It appears more appropriate for the authors to give a more concrete corollary concerning these specific areas.

R: Even though it had a global dimension for many aspects (including the ocean colour activities), the MERSEA project bears in its acronym a European dimension. Besides the description of results for the European seas that can be found in various Sections, a paragraph of summary/synthesis for these regions has thus been added in Section 4.5 (2nd paragraph of Section 4.5, page 19).

– p. 1617. It is known that MERIS data are frequently contaminated with sun-glitter. Nothing is said how the authors have been dealing with this problem when performing the comparative analyses.

R: Due to an early time of overpass, sun glint is indeed a factor that affects the coverage of the MERIS data record, and, if conditions of sun glint are not excluded or are insufficiently corrected, possibly contaminates the data set. However, we are not aware of a quantitative study addressing the inpact of sun glint on the final MERIS Chla product, so that it is hard to make a definitive statement. On the other hand, even if sun glint is a lesser problem for SeaWiFS and MODIS, it might also have an impact on the re-

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spective Chla product for these missions. Sun glint, particularly in the case of MERIS, is now specifically mentioned in a lengthened paragraph in the Conclusion (Section 6) that discusses sources of discrepancies (last paragraph, page 26). In any case, the approach followed in the present study is to analyse the monthly Level-3 Chla products as distributed by the space agencies to the user community, and for these products, it is no longer possible to assess the impact of glint conditions that affect single satellite images. This framework is now clearly underlined in the introduction to Section 2 (page 5, lines 9-11).

– p. 1618. a) assuming the log-normal distribution of chl-a, the authors refer to respective reports in the literature. It is evident that the data collected by them provide enough evidence for such a conclusion without resorting to someone's data

R: The choice of a log-normal distribution as an appropriate statistical model for Chla is now supported by the provision of skewness and kurtosis statistics in Section 2.2 (1st paragraph of Section 2.2, page 8). These are respectively one and two orders of magnitude lower for log-transformed Chla distributions than for untransformed data. The figure with the frequency distributions of Chla (now becoming Fig. 1) is also referred to in this paragraph. Note: even though the text was mentioning that Chla values were weighted by the surface associated with each grid point (i.e., changing with latitude), the histogram did not plot the Chla frequency distribution in an appropriate way. The figure and related statistics have now been updated (giving more weight to oligotrophic waters). This change does in no way affect the rest of the analysis.

– b) what is the threshold for considering the coinsident pairs of data from two different sensors? it is would be good to specify this threshold. Indeed, on page 1634, the authors presume that the varying overpass times might be among the resons of mismatches. The validity of such a conjecture is certainly dependent on the chosen threshold.

R: The approach followed in the present study is to analyse the monthly Level-3 Chla products as distributed by the space agencies to the user community, and for these products, the different times of overpass for single satellite images are integrated by the process of monthly compositing. This framework is now clearly underlined in the introduction to Section 2 (page 5, lines 9-11). Additionally, the fact that a different temporal sampling contributes to differences in the monthly products (whereas averaging might reduce differences due to noise) is acknowledged in Section 2.2 (2nd paragraph, page 8). Finally, the discussion on the various sources of differences has also been slightly extended in the Conclusion Section (last paragraph) with appropriate references. Particularly, differences due to noise and environmental variations (including those due to changes between successive overpasses) have been estimated by Mélin (2010) to account for a median value of 0.074 (log-scale) in the overall error budget associated with SeaWiFS and MODIS Chla records.

– ps. 1619-1620. The threshold of 10 percent needs to be justified.

R: A threshold of 10% is selected for two typse of calculations, and in both cases, it is an arbitrary choice (as now acknowledged in the text). The first calculation applies to the display of the global distribution of statistics (maps on Fig. 4 and 5). Varying the threshold only changes the surface with displayed information, essentially at high latitudes. This threshold should allow a large spatial coverage of the statistics while excluding grid points with statistics constructed with only a few months. A test with an increase of the threshold (to 20%) is briefly discussed in the text (3rd paragraph of Section 2.2, page 10), documenting the surface lost in the process ($\sim$6% for the multi-annual average of Delta). The second calculation is to construct time series of information averaged over specific provinces. In that case, the question is: what is the minimum surface of a province with valid information necessary to define a representative province average for a given month? A change of threshold does not strongly affect the results. Considering the pairs (S:A), (A:M) and (S:M), raising the threshold to 20% decreases the number of months with valid comparison information for 16 to 20 provinces (mostly at high latitudes), by an average of 4.2 months. The change in average Delta is 0.003 on average for these provinces. Acknowledging the arbitrary character of the threshold and the results of this test have been included in the text (last paragraph of Section 2.2, pages 10-11).

– p. 1633. It would be good to explain in a more substative way why the authors presume that the discrepences between the SeaWiFS and MODIS data on the one side and MERIS on the other in the case of large subtropical gyres " indicate a sensitivity of the final product to the geometry of illumination".

R: The existence of seasonal variations in the bias between MERIS Chla and SeaWiFS/MODIS Chla in the subtropical gyres suggests that a different sensitivity to the geometry of illumination might exist for these products. These regions do not display a strong seasonal cycle in Chla or aerosol, so that differences in water type or atmospheric conditions are unlikely to fully explain these variations in bias. The seasonal variations in solar illumination (solar zenith angle) are to be considered as an explanatory factor because they systematically modulate the conditions encountered by the atmospheric correction schemes, and possibly their outputs (through the treatment of multiple scattering, polarization, or even sun glint). The particular observation of seasonal variations for RMS difference and/or bias is certainly worth a dedicated study which is out of scope of the present work. These points are now included in Conclusion (Section 6, end of 2nd paragraph, page 24).

Interactive comment on Ocean Sci. Discuss., 6, 1611, 2009.