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Interactive comment on "Performance evaluation of ocean color satellite models for deriving accurate chlorophyll estimates in the Gulf of Saint Lawrence" *by* M. Montes-Hugo et al.

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Reviewer The Authors propose that their evaluations can be used to make statements about atmospheric and in-water algorithms independently. Given that no radiometric satellite- to-in situ comparisons are shown, I'm not sure this is truly the case.

Author In terms of water contributions to radiance, we don't have in situ measurements of Lw or Rrs to compare with AC results, however we can understand the impact of different AC on aph in relative terms by using the same inversion model Also, we are not validating any sensor, thus our results about using different AC and ocean color inversions are always referred to already validated TOA.

Reviewer but broader comments about the quality of the AC and the in-water algorithms themselves are unjustified

Author we agree with the reviewer and we don't talk anymore in terms of 'quality' of the algorithm or model. Our intention was to talk about the most accurate approach

Reviewer The manuscript would be greatly served by teasing apart the components of the AC and in-water algorithms that succeed and fail in the GSL. Without doing so, the results are neither portable to other regions or to updates to the AC and in-water algorithms (both of which are often improved routinely).

Author Our intention is to evaluate the performance of each algorithm in our study area. Conversely, we do not try dissecting each technique in order to improve each method and become available to be applied in other environments. This out of the scope of the present contribution.

Reviewer The Authors show a general misunderstanding of atmospheric correction. The most critical component of AC is the selection of aerosol models and magnitudes. The standard NASA approach still uses Gordon and Wang 1994 (and Kuchinke et al. 2009 uses a modified version of Gordon and Wang 1994).

Author We are aware about the importance of aerosols for obtaining accurate Lw estimates. We clarified the origin of SA and KU following reviewer's suggestion

Reviewer Bailey et al. 2010 is not an atmospheric correction method, nor is Stumpf et al. 2003 (see e.g., the text on page 4, lines 1-11 and the first paragraph of Section 2.4). These are simply mechanisms to account for non-zero nLw(NIR)

Author Now is corrected and we say: The SA approach is based on the atmospheric correction scheme originally proposed by Gordon and Wang (1994) and modified afterward by Bailey et al. (2010) and Stumpf et al. (2003) to account for non-zero nLw(NIR) values

Reviewer Bailey et al. 2010 does not "constrain atmospheric parameters such as aerosol concentration and type" (page 4, line 11).

Author Bailey et al. (2010) reference was deleted

Reviewer The Authors repeatedly suggest that NASA has a "default a*ph curve" (see, e.g., page 10, line 3 and Section 3.4.1). This is not the case – there is no default NASA a*ph spectrum.

Author Sorry about the confusion, we thought that GSM curve for aph* was the SeaDAS default. Now we eliminate NASA and we talk about constant aph* and GSM default that correspond to GSM curve.

Reviewer Page 5, Line 4: "t_a-w/n_wËĘ2 approximates to 1" is not true. If, for example, t_a-w = 1 and n_w = 1.334, then t_a-w/nwËĘ2 = 0.56

Author That was a typo. Now is corrected, we referred to ta-w and not to ta-w/nwˆ2

Reviewer Section 2.5: The description of GSM is inaccurate.

Author We improved according to reviewer's suggestions Also we included the definition of aCDM (CDOM + non-algal particles)

Reviewer Correct the reference "Levender et al. 2005" to "Lavender et al. 2005".

Author Done

Reviewer Other comments Page 3, Line 3: Reword first sentence. The "concentration" is not a pigment.

Author done

Reviewer Page 3, Line 25: The mention of both 443 and 440 nm in the parentheses is confusing.

Author We only centered band at 443 nm

Reviewer Page 4, Lines 12-21: Most of this is true, but the paragraph is not easily

read. Suggest adding a supporting figure to demonstrate the "spectral overlap between constituents".

Author No need for a figure, but the sentence was rewritten for easy reading as: "increases, the overlap between optical signatures from different components becomes more severe. Thus, a major overestimation (e.g., mineral-rich waters, Balch et al., 1989; Wozniak and Stramski, 2004) or underestimation (e.g., CDOM-dominated waters, Montes-Hugo et al., 2005) on satellite-derived chl values occur.

Reviewer Page 5, Lines 22-24: I would argue that Bricaud et al. 1995, 1998, 2004 can be modestly used to estimate a*ph from remotely-derived Chl.

Author Sorry, but we do not talk about a*aph estimates from chl as used by Bricaud in page 5 line 22-24 .

Reviewer Page 6, line 27: Change "GLS" to "GSL".

Author done

Reviewer Page 9, line 19: Were sums of pigments used to calculate a total Chl, such as MV + DV + allomers + epimers of Chl?

Author We used total chlorophyll a (Chl a + epimers and allomers of Chl a + chlorophyllide a) as computed in Roy et al. 2008

Reviewer Section 2.3: What version of SeaDAS was used?

Author Version 7.0

Reviewer Does "6 h of the satellite overpass"

Author That means ïĆś 6 h

Reviewer Were any flags and masks applied?

Author Yes, we added, 'Several masks (clouds, glint and land) and flags (brdf_opt = 7, glint_opt = 1, outband_opt = 2, pol_opt = 0, rad_opt = 0) were applied during the processing of each L1 satellite scene'.

Reviewer Section 3.1: What statistic is being shown in Fig. 2 and how does that statistic relate to those proposed in Eqs. 6-8?

Author The error bars correspond to 2 standard errors of satellite data computed within for 3x3 pixels. We clarified that in the legend Fig. 2, Error bars symbolize two standard errors as computed from a 3x3 mask of pixels

Reviewer Page 15, line 8: It's been shown many times that spectral matching algorithms such as GSM suffer from fewer retrievals than empirical approaches and QAA. Recommend the Authors comment on this or at least mention how their results fit within a broader community context.

Author We added text and references supporting these results We say: "A consistent pattern during the two surveys was the greater accuracy of KU-QAA with respect to KU-GSM calculations of aph(443). This was attributed to two main differences between inversion models in terms of aph(443) calculation and type of AOPs used to carry out the optical inversion…" "Second, GSM retrievals have a large noise than those obtained from inversion models based on Rrs ratios due to a greater influence of atmospheric correction and radiometric calibration in the former model (Siegel et al., 2013)"

Reviewer Page 16, line 14: I disagree with the statement "not clearly related to variations on time difference". Fig. 3B appears to show a clear trend for the April 2001 data.

Author We agree with the reviewer and we complete the sentence "Although largest biases (i.e., > 0.1 or < -0.1 m-1) were either associated with relatively small (2.2 h) (e.g., sta. 4, April 2001) or large (5.3 h) (e.g., sta. 13, April 2001) temporal offsets (Fig. 3B), data comparisons during April 2001 also suggest a trend consisting of larger discrepancies between field and satellite estimates as the temporal lag increases"

Reviewer Page 22, line 18: Recommend adding a discussion of what in situ data was used to parameterize the EC model. Doing so might reveal why it performed well in the GSL.

Author We don't think is necessary to include that into discussion since it does not provide further insight regarding performance differences.

We checked again the datasource for the EC and we found that samples were derived from west Florida Shelf and Bayboro Harbor. These environments encompass case I and II waters but a narrower range of aph values with respect to the other inversion models. These differences do not explain the better performance of EC over the other models (see Carder et al., 2006).

However, we found that the better performance of EC during April 2001 was related to the greater influence of phytoplankton on IOPs during April 2001. We wrote: "The superior performance of EC in April 2001 with respect to May 2000 was mainly attributed to the greater contribution of phytoplankton to IOPs. In fact, further analysis of ac-9 measurements in the GSL showed that aph(440)/a(440) during May 2000 and April 2001 varied between 9.8 and 34.8%, and 20.3 and 92.9%, respectively. Thus, as waters become less optically complex due to a greater influence of phytoplankton on underwater light fields, accuracy of empirical inversion models improves"

Interactive comment on Biogeosciences Discuss., 11, 9299, 2014.