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Ocean Science Discussions

Interactive comment on "In situ determination of the remote sensing reflectance: an inter-comparison" *by* G. Zibordi et al.

G. Zibordi et al.

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The Reviewer suggests a few Major and several Minor Changes/Revisions. They are hereafter individually addressed (see the REPLY following each COMMENT).

MAJOR CHANGES/REVISIONS

COMMENT: A table or list of all variables and abbreviation used would be useful. I got often confused by a variable used with different subscripts and had to look back for to check the meaning, consulting a table would make this more easy. REPLY: Tables presenting variables and abbreviations have been included in the revised manuscript.

COMMENT: The summary of the source of uncertainty for each system is often nearly the same for very similar systems (e.g. TACCS-S and TACCS-P, and TRIOS- E and

TRIOSB, and hence redundant.) The descriptions can be done more efficiently by avoiding recapitulations; this would also reduce the number of pages considerably. REPLY: The current work aims at presenting and discussing results from the inter-comparison of different measurement systems and methods thoroughly accounting for uncertainties of derived quantities. This is not a consolidated scheme, in fact radiometric inter-comparisons are frequently not supported by comprehensive investigations on uncertainties. Because of the similarity of the systems/methods evaluated in the work, some of the sources of uncertainty are identical. However, several others differ. Because of this, in view of stressing the importance of uncertainties for each different system/method independently determined by the scientists contributing to the inter-comparison, it is believed that independent tables for each system/method are important regardless of the close uncertainty budgets. As pointed out by a different Reviewer, the manuscript is organized in very modular sections which can be either considered or waved depending on the interest of the reader.

COMMENT: The same recapitulation can be found in the tabulated uncertainty values for each system. Very often the tables even show the same values as the instruments have the same source of uncertainty. This could also be done more efficiently. In the extreme case all values of all systems could be presented in one table. But at least the values for the same infrastructure could be combined, e.g. one table for TACCS and one table for TRIOS. REPLY: Restating the importance of presenting a comprehensive uncertainty budget for each system/method in view of later discussing results from the inter-comparison (e.g., results in table 13), any lessening of details is considered to decrease the value of the inter-comparison. It is believed the current level of detail is fundamental for a reader interested in marine field radiometry and in the quantitative use of absolute radiometric data. Because of this, despite of the request of the reviewer, little changes were made to the section on uncertainties. However, when uncertainties are identically computed, the applied method is described once and successively simply referred to.

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MINOR CHANGES/REVISIONS

COMMENT: Page 789, line4-5: not sure what “satellite ocean color” mean (semantically), just say “ocean color” REPLY: The term “ocean color” is generally used to indicate any measurement methodology exploiting the reflectance of the sea. The term “satellite ocean color” is more and more used to indicate the application of “ocean color” from space.

COMMENT: Page 793, line11: the meaning of Kl(lambda), as well as Ku.. and Kd.., are not described here. REPLY: The three quantities are now explicitly declared by making reference to the source data.

COMMENT: Page 795, line 1: how are R(..,W) and R0 calculated, or give a reference. REPLY: A reference has been added.

COMMENT: Page 795, line7: ta (aerosol optical thickness) is derived from what? Later in the text (page 799) you mention that it was measured by the sun photometer. Is this true here as well? REPLY: The aerosol optical thickness is generally determined from measurements of the direct sun irradiance through a sun-photometer. In this section of the manuscript the aerosol optical thickness is simply introduced as one of the quantities affecting the Q-factor. It is now made explicit that a constant value of the aerosol optical thickness was used for the computation of the theoretical values of Q and Qn used to perform the viewing angle corrections in off-nadir above-water radiometric measurements.

COMMENT: Page 795, line 18: do you mean “at a distance of 7.5 m away from. . .” or such? REPLY: The text has been revised.

COMMENT: Page 796, line 11-14: What is the influence of taking a and c into account for the calculation? How big would be the error when this would be ignored? REPLY: The scheme proposed for correcting WiSPER data for superstructure perturbations requires knowing “a” and “c”, while that for self-shading requires only “a”. These schemes

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were detailed in comprehensive publications (Doyle and Zibordi 2002 and Zibordi and Ferrari 1995) were the effects of input variables are discussed or can be easily derived. It is considered out of the scope of the present work evaluating the effects of a change in the correction schemes (e.g., producing a correction without knowing one of the input quantities).

COMMENT: Page 797, line20-21: correct to read either " an Lu sensor", or " an upwelling radiance, Lu, sensor", and, correct to read " at a depth z0 of 0.5m and a chain. . .." REPLY: The correction has been made.

COMMENT: Page 798, line 6: do you mean the variability "of Ed is no greater than 2.5%", instead of range? REPLY: The text has been revised.

COMMENT: Page 798, line 9-10: Use of "respectively"! Flip Lu and Ed! At the moment you are saying averaged Lu is determined from Ed values! REPLY: The text has been revised.

COMMENT: Page 798, line 9-17: To be consistent with the description of TACCS, see line 3 this page, use always zi instead of just z for Ed values when appropriate. REPLY: The text has been revised.

COMMENT: Page 798, line 12: What is Kl? REPLY: Kl is now better defined in Section 3.1 making explicit the source data.

COMMENT: Page 798, line 18: Do you mean "deeper" depths?, Not sure what is correct English here. REPLY: The text has been revised.

COMMENT: Page 799, line 8: you mean "ed(zi, lamda, t), "zi"! REPLY: The text has been revised.

COMMENT: Page 799, line 19: How were a and c measured? REPLY: The instrument utilized to measure "a" and "c" has been made explicit.

COMMENT: Page 799, line 23: You mean "phase function of scattering"? REPLY: The

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text has been revised.

COMMENT: Page 800, line 18: change to read “geometrical effects estimated from simulations, assuming:” REPLY: The text has been revised.

COMMENT: Page 800, line 18: Do not understand what “ relative sun-sensor of 180_” means ! REPLY: It refers to the sun-sensor relative azimuth. The text has been revised.

COMMENT: Page 801, line 5-9: 1) These sentences need to be corrected. 2)Was there a tilt sensor on the TACCS-P? REPLY: Yes, a tilt sensor is part of the TCCS-P system. The text has been revised.

COMMENT: Page 801, line 20 ff: To make it more easy to read change to: “where Ed(. . .) indicates data uncorrected for tilt, and f(..) is given by” REPLY: The text has been revised.

COMMENT: Page 802, line 1: change to read “the apparent angle of the sun to the collector plane of the irradiance sensor” REPLY: The text has been revised.

COMMENT: Page 802, line 2: Change to read “This correction, however, only applies to a tilt less than 8_. . .”. REPLY: The text has been revised.

COMMENT: Page 802, lines 6-25: This is very much the same as on page 800 and should be shorten considerably. REPLY: An effort has been made to avoid duplication of text. However, uncertainties for each different system/method are essential elements of the work and require detailed descriptions. In fact, while there is significant convergence on protocols, at present there is no common consensus on how to quantify uncertainties. Therefore, the uncertainty estimates were made using the best judgement of the scientists concerned, with convergence on some points and diversity of opinion on others.

COMMENT: Page 803, line 20: What is D? From where did you get it (reference?) REPLY: A reference has been added for the quantity D indicating changes in the Sun-Earth distance.

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COMMENT: Page 803, line 20: What is Lwn(lambda)? Lw was introduced earlier, but not Lwn. REPLY: The text has been revised.

COMMENT: Page 805, line 8-9: should this be “and consequently do not significantly impact. . ..” REPLY: The text has been revised.

COMMENT: Page 805, line 14-15: omit “radiance” and “irradiance”! REPLY: The text has been revised.

COMMENT: Page 806, line 16: What is alpha? Just a correction factor. REPLY: Conflicts suggested by the use of “alpha” for two different quantities have now been solved.

COMMENT: Page 809, lines 11-15: Again this is the same as on page 807. Please shorten. REPLY: An effort has been made to avoid duplication of text. However, uncertainties for each different system/method are essential elements of the work and require detailed descriptions.

COMMENT: Page 813, line21: Change to read “High-Performance Liquid Chromatography”. REPLY: The term “Pressure” has been replaced with “Precision”.

COMMENT: Table 2-7: Table 2-7 can be combined to either one or two (1. in water, 2. above water systems) tables. REPLY: The objective of the manuscript is not that of providing “generic uncertainty tables” for the considered systems/methods. Because of this, it is essential providing uncertainty tables for each system/method even though the overall uncertainty budgets might appear sometime very close.

COMMENT: Figure 2-4: the results might look better and closer to the 1:1 line if a compact symbol (small filled circle, or dots) is used instead of an open circle. REPLY: The current solution of using colored circles was adopted after many trials. It allows for distinguishing each individual data point and wavelength. For instance point-symbols may not be clearly visible, while bullet-symbols associated to a wavelength may mask those from another wavelength (depending on which ones are printed first).

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