

## ***Interactive comment on “Optical remote sensing of the Gulf of Gabès – relation between turbidity, Secchi depth and total suspended matter” by R. Katlane Essersi et al.***

**R. Katlane Essersi et al.**

katlanerim@yahoo.fr

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The responses are mentioned after each comment of Anonymous Referee #2

**GENERAL VALUTATION** The authors are approaching a very interesting topic, though the contents presented in the paper are quite poor and the presentation is not precise (i.e. a lot of typo). The main result is the validation of an existing empirical relationship, developed by Nechad et al. for the Belgian coastal waters, for the study site. On the other hand, no explanation is given on the choice of semi-empirical models rather than a radiative transfer modelbased approach. Even if more parametrization is required, a simple radiative transfer model can be calibrated with the data collected and a more

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reliable estimate of TSM can be computed. At least, it should be nice to see an argumentation, sustained by a literature overview, in the introduction. Moreover, the depth of the water column can be directly taken into account in these models, providing information on the interference of the bottom signal to the remote sensing reflectance. This is particularly important in coastal – shallow water, as it seems to be in your case.

**Response:** We do not believe that a simple radiative transfer model can be calibrated with the data collected here. In particular we do not have any in situ reflectance or specific inherent optical property data. In the original study of (Nechad et al) where in situ reflectance data was available, it was found that a full radiative transfer model approach provided no significant advantage over the simplified Gordon-type reflectance model. E.g. the scatter of data in Figure 3 of (Nechad et al) suggests that the main source of uncertainty is not the form of the relationship between reflectance and TSM (or backscatter albedo, which was used in a parallel approach in the Web Appendix of that paper). The main sources of uncertainty are the quality of the in situ measurements used for calibration and the natural variability of the mass-specific scattering properties. Since we cannot improve on either of these factors in this new region, our approach is to reserve the few measurements we do have for validation of the original algorithm of (Nechad et al) supposed, and indeed found to be, relatively general.

We agree that bottom reflectance might be important and could be considered in a future development of this kind of algorithm in combination with radiative transfer simulations. Such a study is in progress for Belgian waters. The originality in the current paper lies not in the basic methodology but in the fact that it can be used in an entirely new region with very little infrastructure and a very limited number of measurements made with a simple instrument (Hach turbidimeter).

Other approaches for TSM retrieval are given in the introduction of the revised version of the paper.

**SPECIFIC COMMENTS** - Citations: all the citations in the text should be changed: i.e.

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Burollet et al. (1979), and not Burollet AND al. (1979): this form is an abbreviation of the latin "et alii" (it means "and others").

Response: All reference list and short citation are corrected as Copernicus publications Reference Types

- page 1, line 31: you say that the study site is a shallow continental shelf. Please give quantitative information (i.e. mean, minimum and maximum water depth).

Response: yes this part was added as suggested

- page 1, line 41: The study of : : illustrateS ...

Response: Corrected as suggested

- page 2, line 7: reference of Morel et al., 1983, not found in the bibliography.

Response: Sorry this reference were corrected

- page 2, line 22: you say that MODIS derived TSM were compared and correlated. This is not shown after: indeed only MODIS turbidity derived (eq.2) is shown, and nothing on eq. 1 (TSM) is done. So, or you refer only on turbidity relationship and maps, or you show the analogous work done for TSM.

Response: The TSM and TU in-situ data in Gulf of Gabès presents a good correlation as shown in figure2, for this reason we can use only one band of MODIS to convert TSM to TU using the equations (1) and (2). Since the TSM and TU MODIS data correlates very well according to Nechad et al., 2009, 2010, we use the same band 667nm to retrieve both of them. In this work, the MODIS TU are based on Rrs 667 band and there's a relation between the TU and TSM algorithms (multiplication factor). In addition, we only have TU and very scattered TSM data. For all these reasons we presented in this work only the maps of TU. Obviously the maps of TSM look very similar.

- page 2, line 38: please specify which features.

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Response: This was reformulated for a better understanding

- page 3, lines 3,4,5: a lot of typo in the equations (parenthesis)

Response: Corrected as suggested

- page 3, lines 6â€18: here you mention TSM but then you don't show the results. Please refer to the previous comment for corrections.

Response: TSM and TU MODIS correlate very well. This part was added as suggested

- page 3, line 25: the citation of Doerffer R., 2010 should not be into brackets.

Response: This part of the text has been deleted as it doesn't provide any additional information and it's a source of confusions in the paper.

- page 3, line 32: please give the deññition of case II waters

Response: Yes this part was reformulated for a better understanding

- page 4, line 10: a "." is missing after "(Fig.2)

Response: Corrected as suggested

- page 4, line 14: here you measure the turbidity and say that also TSM is high. Can you give the value of TSM. Moreover, the values reported in Fig. 2 are not so high (TSM is almost always lower than 4.5 mg/l): with these concentrations I guess you should see the bottom.

Response: This site has a relatively high turbidity in the studied area and we can't see the sea bottom. The highest value recorded in the area is 5mg/l around the port of Ghannouche near the discharging site, however around the island of the golf we still can see the sea bottom.

- page 5, line 2: a "S" is missing: in ...shows

Response: Corrected as suggested

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- page 5, line 6: algorithm (1) (more appropriate is to say "relation") is not validated in this paper!

Response: Equation 1 was not validated for lack of TSM in-situ measurement

- page 5, line 12 (and Fig. 4): here you show the relationship between turbidity derived from MODIS (applying eq. (2)) and turbidity measured in situ. I agree there is a correlation, but if eq. (2) is correct for the Gulf of Gabes, I would expect a 1:1 correlation. I think this figure is tricky and you did not explained well the procedure you are doing. When then you create the turbidity maps, do you take into account this relationship for the correction or you just apply eq. (2)? This is not clear. I think you should do it! If the answer is YES, then you have just adapted relationship (2) to your study site, it's the same as doing a calibration of the parameters in eq. (2). Then, a validation with an independent dataset should be done, and you can't say that the same relation can be applied in the Belgium waters and in your case. If the answer is NO, then Fig. 4 should show a 1:1 line, as this is a validation, and you would expect the estimates to be equal to the measures. And, it is clear that this is not the case, if I have understood your work in the right way.

Response: Eq (2) is applied to this new region without recalibration. The TSM-turbidity relationship in this new region is not so different from that in the original region indicating similar mass-specific (side-) scattering properties of the marine particles. Since we do not have many in situ measurements we apply the original calibration and use the available measurements for validation.

- page 5, line 14: a "." is missing at the end of the paragraph.

Response: Corrected as suggested

- page 5, line 36: you have to clarify the procedure you have followed: algorithm (2) was adapted (re-calibrated) or just tested?

Response: In this work we are actually trying to test the algorithm (which worked well

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in our studied area).

- page 6, lines 3-4: : : : the algorithm... are (is?) : : : shows: please be consistent with single-plural subject of the sentence

Response: Corrected as suggested

- page 7, lines 21-23: please check this reference. The Italian does not make sense!

Response: This reference is deleted as suggested to last reviewer

- page 9, line 8: turbidity is an optical measurement, but not the TSM, you should rephrase "relationship between in situ measurements..."

Response: Yes this sentence was clarified

Please also note the supplement to this comment:

<http://www.ocean-sci-discuss.net/7/C804/2011/osd-7-C804-2011-supplement.pdf>

Interactive comment on Ocean Sci. Discuss., 7, 1767, 2010.

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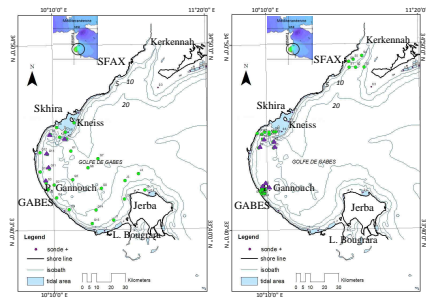


Fig. 1.

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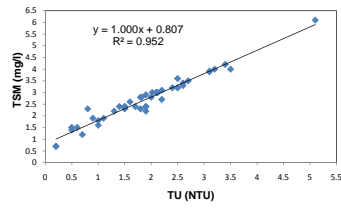


Fig. 2.

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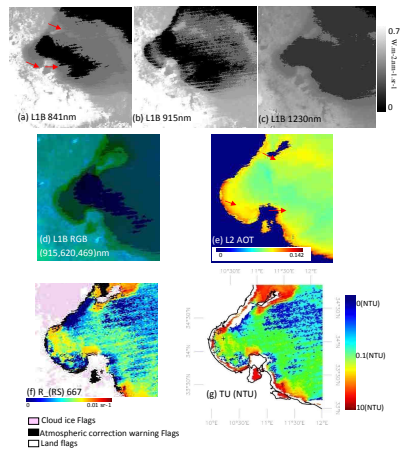


Fig. 3.

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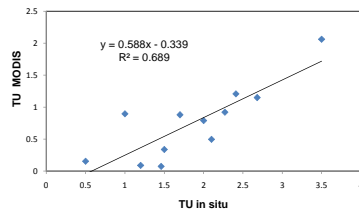


Fig. 4.

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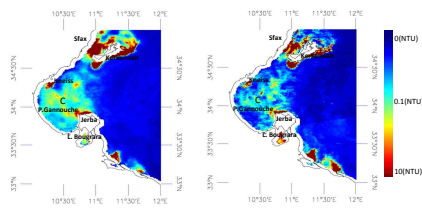


Fig. 5.

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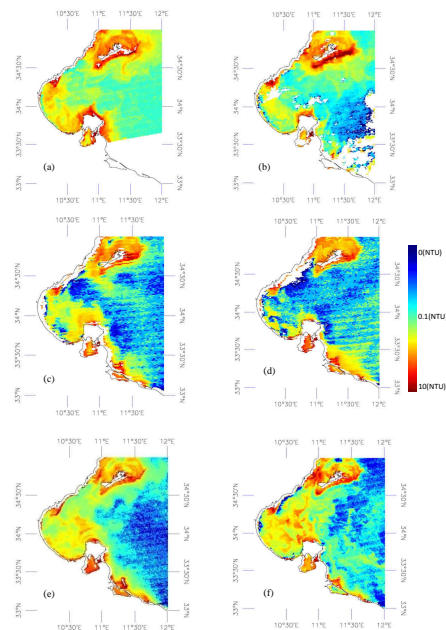


Fig. 6.

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