Referee Comments on os-2013-50 Experiments with the Secchi disk

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Experiments with the Secchi disk addresses relevant scientific questions within the scope of OS. The paper is based on (historic) data obtained in the Oslofjord and Skagerrak with the Secchi disk. Secchi disk depths were related to other optical and bio-optical properties. The motivation of the study is to clarify the usefulness of specific relationships within marine-optical research and perhaps even to guide water management directorates to select (new) methods for water quality monitoring.

1. Does the paper present novel concepts, ideas, tools, or data?   YES/NO
2. Are substantial conclusions reached?   YES
3. Are the scientific methods and assumptions valid and clearly outlined?   YES
4. Are the results sufficient to support the interpretations and conclusions?YES
5. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?   YES
6. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?   YES
7. Does the title clearly reflect the contents of the paper?   NO
8. Does the abstract provide a concise and complete summary?   NO
9. Is the overall presentation well-structured and clear?   YES/NO
10. Is the language fluent and precise?   YES
11. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?
                                                                          YES
12. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?   YES
13. Are the number and quality of references appropriate?   YES
14. Is the amount and quality of supplementary material appropriate?   -

General comment:

A very interesting article and worth publishing. The Secchi disk more or less disappeared in oceanographic research due to the presence of hyper spectral radiometers. Therefore publications focussed on Secchi observations will contribute to a more frequent use of the disk to extend one of the oldest oceanographic data series (to facilitate climate research).

However:

The title does not cover the presented research.

- Perhaps: **Experiments with the Secchi disk and its derivatives**

- The abstract does not contains any conclusion. As a reader I would like to know the most important outcome of this investigation.

In the introduction under motivation for the presented study the authors mention the relation between Secchi depth and optical water properties and the usefulness of studying

such relationships. However, these remarks are directly followed by the sentence: 'Observations can never be satisfactory substitute recordings of other optical properties'.

- In that case, what's the point of doing this research at the first place? I would skip this remark and continue with: Secchi disk observations can serve as 'quick and dirty' (perhaps rephrase) checks of several optical and bio-optical parameters.

After 1.2, the history in a nutshell 1.2 and a well explained theory of the Secchi disk in Chapter 2 the authors describe in Chapter 3 the used datasets for the presented statistical analyses, instrumentation and environmental conditions.

- This chapter could be written more clearly; i) first description of datasets ii) description of instrumentation used (only spectral radiometer data is present in the second dataset) iii) environmental conditions: Especially this part is not well presented. Except some brief notes on salinity and the trophic state of the samples area and pycnocline. I miss remarks on sea state, meteorological conditions (especially remarks on cloud cover and/or sunny conditions. Were the observations performed on the shady side of the ship?).

Perhaps it would be better to rename this chapter into **Data and methods** as in between sentences suddenly HPLC and gravimetrical determined TSM is mentioned. Also some results are presented which do not belong in this chapter.

- I would suggest to rename chapter 4 (**Test of Eq. 21 in photopic units**) into the more general **Results**

Subchapters 4.1 to 4.7 are well explained. I do not understand the change in chapter number. 5 The monochromatic assumption could be a continuation of the sub chapter numbering under 4. More logical 5 becomes 4.8, <u>delete</u> 6 Further analyses (does not give the reader extra info), let 6.1 be 4.9 and so on until Summary and conclusions are reached.

The results (Chl as a function of 1/ZD show errors of 30-40% and TSM errors of 50%) presented in the small chapter **Chlorophyll *a* and total suspended material** are based upon only 19 stations. Why such a limited number of observations use in this correlation analysis? This outcome only hold for the investigated eutrophic area (see also comment at the end).

- Furthermore Tables 1a and b could better be replaced by graphs to facilitate the reader by presenting the spectral signatures instead of numbers. See Example below.
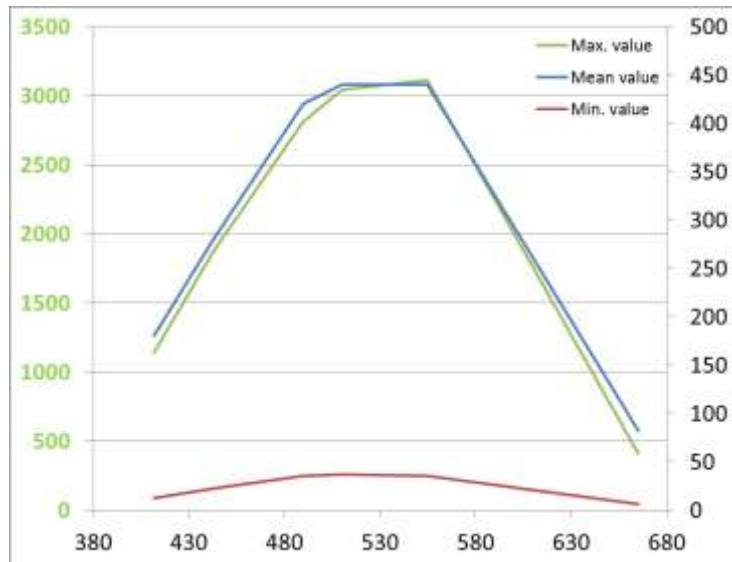
During a first reading of the paper the reader could easily be overwhelmed be the number of Tables containing lots of regression coefficients etc.. The authors should think of a way to either present the best results, not all and mention some in the text or should make use of graphs which makes the article much more comprehensible.

I miss **Recommendations**

The authors should point out that the found relations hold/are applicable for the Skagerrak and Oslo fjord only. It would be recommendable to repeat the analysis using a more varied dataset, i.e. a more balanced dataset based on different water types (including open ocean observations) . Especially the outcome of the investigated relation of Chl and TSM as a function of the reciprocal Secchi depth could benefit.

Small Remarks:

Page 1837: Eq.1 The threshold value is not well explained. Is this value 0.0066? (Holmes 1970)
Page 1840 top: vertical attenuation coefficient (delete s)
Page 1841: Eq.14 is the constant k 787ms^{-1}? Please check
Page 1845: The accuracy of the Secchi depth (add observation) mainly depends on the state of the sea ……….. The authors write: in our data the possible error will be in the range 0.2-0.5m. Please explain