Review
Estimation of upward radiances and reflectances at the surface of the sea from above-surface measurements

Overall
The manuscript is of major relevance to the ocean color remote sensing community. With the technology getting affordable, smaller and better in terms of spectral resolution there is need to improve accuracy in observations and obtain optical closure. However, in this work several aspects need to be addressed to make this manuscript a useful contribution to the community in my opinion.

The authors need to be consistent with NASA protocols in terms of abbreviations e.g. spectral irradiance is commonly defined as E_d or E_s, radiance is L_w or L_u as given in a previous publication by one of the co-authors (Aas, 2010) and also feel there are too many equations which are basic in the ocean color. Due to variable environmental conditions it is best to carry out such a study at optimal conditions and maybe non optimal conditions to fully address possible uncertainties as it is well known that at sea conditions can change and are dynamic. In the methods section, I feel the authors can make it brief and provide only relevant information to what they did in this study and maybe provide a sketch of the setup. In my opinion you can replace Maybe replace "in air" with above-water since in protocols it is widely known that you measure radiometric quantities from in-water, above-water, airborne and satellite platforms. In my opinion to determine if the approach is robust the manuscript should showcase that the method used here provides comparable observations with other platforms or have a reference measurement for the uncertainty check see for example (Garaba and Zielinski, 2013a; Hooker et al., 2002; Lee et al., 2013; Zibordi et al., 2011). The authors should also state in the methods how they determine uncertainty see e.g.(Hooker et al., 2002). I also suggest the authors provide only the most relevant equations, also because of the notations you use different from standard ocean color notations it is difficult to follow your many equations and steps see for example (Aas et al., 2009; Mueller et al., 2003; Zibordi et al., 2011).

Specific comments
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Line 1 – I am not sure I understand what you mean by series is it time series or number of repetitive observations
Line 2 – maybe add the country or region for clarity
Line 5 – would be nice to define MERIS and add the wavebands just a suggestion
Line 7 to 8 - maybe rephrase this because it is not clear what the message is here, it is well known that you can determine radiance in-water or above-water.
Line 12 – '..by the two methods..' which methods can you state them here?
Line 15 – in ocean color see works on MOBY the uncertainty is less than 5 %
Line 20 - maybe you can provide the full definition of ESA since in the text you provide definitions for other abbreviations?
Line 24 which directive can you provide a citation? Is it the (WFD, 2000)
Line 25 – which recordings ocean color or water quality?

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Line 4 to 5 – I suggest this can be moved to be part of the methods section

Line 6 to 8 – suggest you add a reference here see for example see these works (Bissett et al., 2004; Hestir et al., 2015; Zibordi et al., 2015)
Line 6-23 the aspects you explain have been reviewed or explained in e.g. (Garaba and Zielinski, 2013b; Hooker and Morel, 2003; Mueller et al., 2003)
-maybe I did not understand it here, but your message is observations need to be made at optimal sensor geometry and environmental conditions
-doing a number of observations at non-optimal conditions or sensor geometry will not produce good results so I suggest you make it clear here, the number of measurements will not matter if the precision and accuracy is bad
-ship based measurements also require you do quality control especially for irradiance which is assumed to be valid for a plus minus 5 degree accuracy from zenith

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Line 5 -18 the instrument description can be brief. I suggest authors rewrite this paragraph.
-I suggest the abbreviations be consistent with prior publications in ocean color
-TriOS is a common instrument and providing the diameter and length is not necessary in my opinion
-the notations used should be consistent with Ocean Color notations see (Mobley, 1994, 1999; Mueller et al., 2003)
- did you centre the TriOS wavebands to match the MERIS wavebands and maybe add the MERIS wavebands
Line 11 t0 12 – you checked the sensors at the start of the cruise? Why was it to clean them? Or make sure they were working or ..?
Line 19-23 suggest rephrase
-Why did you put the sensor above the bridge? Why not near the other sensor
-you also mention 'usually the recordings…' did you have them at any other depth?
Line 24-26 what do you mean by 22 series? Did you make 22 measurements or you made 22 measurements but each measurements over time? Can you be specific here
Line 26 – why did you calculate this ratio at 560 nm? Why use the mean instead of the median? Since it was an non-optimal weather is it possible some of the min or max was going to be outlier data?

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Line 6-12 it was a median of how many measurements?
-how big is the difference between the mean and median? It would be interesting to know what you mean by insignificant
Line 13-18 can you quantify the CDOM? What is yellow-substance rich?
-what bio-optical properties can you be specific?
Line 19-25 I suggest using 'zenith' and 'nadir' instead of 'tilted'
-was the azimuthal angle exactly 135 degrees or about 135 degree because at sea getting exact sensor geometry is a challenge
-if it was exactly at these angles can you explain how because it will be a new approach important for the ocean color community
-Did you get above water data? Is it comparable to your in-water data?

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Equation 1 – is your K_L not commonly known as K_D? if different please provide a reference see e.g. (Lee et al., 2014; Morel, 1988)

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Line 22 – what is Br is it B*r or another term? What is the value of r if the diameter is 4.83 cm since you state no unit for B.

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Equation 6 – is this a true value or a best approximation?
Equation 6 – Is C_L not radiance transmittance (Tr)?

Equation 8- did you measure the temperature and salinity which you suggest are useful in getting a precise transmittance value? So what value did you use for transmittance here? 0.556 or 0.546 or 0.5458?

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assuming the L_R which is the surface reflected glint to be negligible means you collected you data at optimal conditions clear skies and little or no wind. From your methods this is not the case right? It therefore means even if you made an uncertainty budget you still do not account for the error in L_R
-Fresnel reflectance is applicable for a flat sea and this is also not the case based on Table 1 data so maybe avoid using 0.021 or maybe leave this information out of the manuscript
-In the work by (Ruddick et al., 2006) they present an approach to estimate the correction factor for glint which is a product of cloud cover and wind speed

Figure 1 – the high reflectance in the NIR is indicative of surface reflected glint or highly turbid waters, can you say something about this? The absorption feature at 760 nm is related to oxygen and glint so maybe your measured data had so much glint

Referenced example works

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