Second Reviewer :

1. Section 2.1.2 p. 8670 line 12

Why not use a Cox-Munk type of ocean surface model instead of a Lambertian surface?

A radiative transfer code for the ocean-atmosphere system that includes a rough air-water inter-surface and that uses the successive-orders-of-scattering method is under-development. This code is not avalable yet.

By considering a lambertian contribution for the ocean surface, we are neglecting two points: (1) the contribution of the under-water light scattered by water molecules and hydrosols is not lambertian and (2) we neglect the processes of refraction and reflection through/at the water-air interface that also modify the directional and polarized behavior of the up-welling radiances emerging from the ocean.

Would your results differ if you used a more realistic model of the ocean surface?

No, these assumptions introduce small errors, as demonstrated below. We have evaluated these errors and have included them in our error budget.

The effects of the water-leaving radiance on the signal modeled at TOA can be safely ignored at 865 nm and are rather small at 670 nm. So, we only focused our analysis on the 0.490 nm spectral band. We evaluated the assumption by using the OSOA code (Chami et al., 2001). This code allows to simulate the total and polarized radiances for an ocean-atmosphere system. The successive-orders-of-scattering method is used but the air–water interface is modeled as a planar mirror. The Figure 2 (given below) shows the differences between our modeling (i.e. SOS code from with a lambertian reflectance) and the calculations made with the OSOA code that uses a bio-optical model and accounts for realistic marine layer. The total radiance at 490 nm is computed at the top of the atmosphere (sun zenithal angle = 45° and calculations made for the principal plane). r_o is the lambertian reflectance used in the SOS code. We used a chlorophyll concentration of 1 mg/m^3, which is representative of the observations made for the transect analyzed for the 7 May 2010 in this paper. We constrained the lambertian contribution in the SOS code in order to minimize the differences between our calculations and the ones performed with the OSOA code. We found r_o=0.21. Note that we constrained the lambertian reflectance by using calculations made for different plans of observation (phi=0, 45, 90 and 135°). Finally, note that the contribution of the glitter was removed and not shown for sake of clarity. The maximal directional errors for the total radiances vary between 0 and 4% for view angles (θv) smaller than 40°, between 0 and 6 % for 40<θv<60 and between 0 and 7% for θv>70°, depending on the relative azimuth angle. These results stand for concentration values in Chlorophyll smaller than 1 mg/m^3, 30° < sun view angles < 60°. These calculations are valid for clear-sky conditions (no aerosol). These errors progressively decrease with increasing aerosol optical thickness and become negligible for AOT > 0.6 at 490 nm. These “directional” errors remain small but they are not negligible. We included these errors into the OEM algorithm, as an additional source of error.

The OSOA code does not yet include a rough interface. In case of a rough air–water interface (i.e. a Cox and Muck model), the light emerging from the ocean that is transmitted through the water-air interface will be angularly re-distributed and the « directional » errors will be necessarily smaller than in case of computations made for a planar water-air interface.

The figure also shows the total radiance computed with the SOS code for a lambertian reflectance r_o of 0.014. If r_o is underestimated, it causes an underestimation of the total radiance. This is in fact the main source of errors in our modeling. In our method, r_o is adjusted using MODIS ocean products. We assume a maximal error of 0.005 for this parameter and included this additional modeling error in our error budget. These errors are reflected in the retrievals uncertainties shown in Figure 4 (in the paper). The main effect is to increase the retrieved uncertainties, especially for the optical parameters retrieved at 490 nm but it does not much affect our results and conclusions.

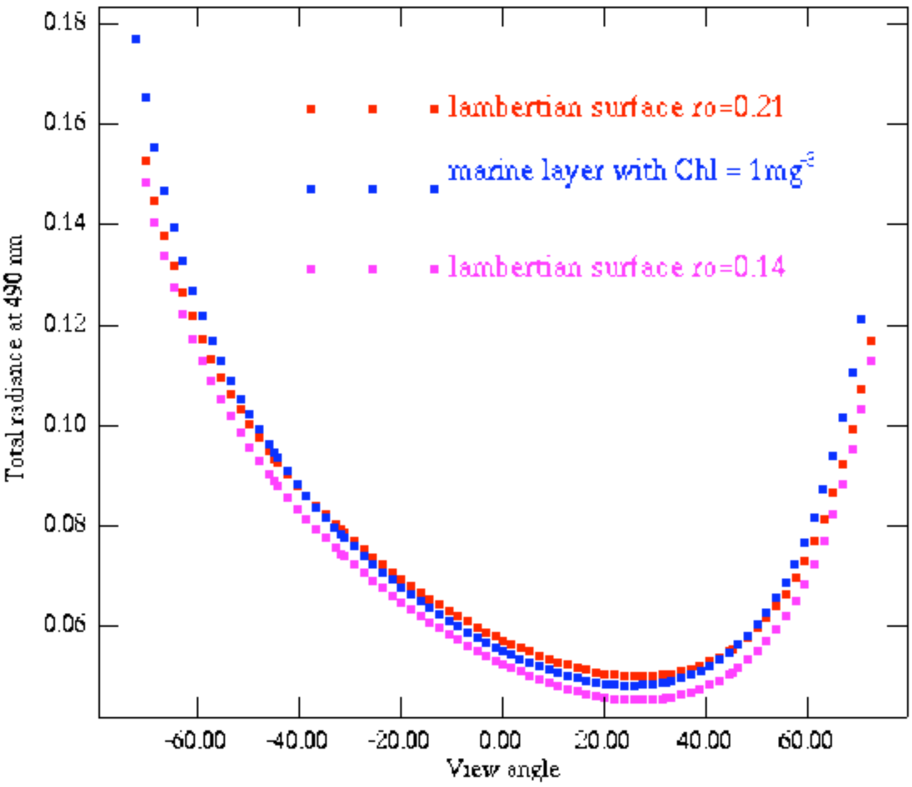

Figure 2

We added the following sentences in the paper:

"We assume a maximal error of 0.005 for the surface reflectance and included this potential additional source of error in our retrieval error budget."

"We assume a maximal error of 0.005 for the surface reflectance given by MODIS and accounted for this error in our retrieval uncertainties. We assume a Lambertian reflectance model for the ocean surface reflectance, since the errors introduced by this assumption are small. We evaluated the effects of this assumption by using a radiative transfer code that allows to simulate the total and polarized radiances emerging from a coupled ocean-atmosphere system (Chami et al., 2001). The effects of the water-leaving radiance on the signal modeled at TOA can be safely ignored at 865 nm and are small at 670 nm. So, we only focused our analysis on the 0.490 nm spectral band. The directional (relative) errors for the total radiances at 490 nm vary between 0 and 4% for view angles (θ_v) smaller than 40°, between 0 and 6 % for 40° < θ_v < 60° and between 0 and 7% for θ_v > 70°, depending on the relative azimuth angle. These calculations are valid for radiances computed at the top of the atmosphere, for sun zenithal angles ranging between 30 and 60°, for a chlorophyll concentration smaller than 1 mg/m^3 and for a pure molecular atmosphere."

We added Chami et al., (2001) in the list of reference.

2. Section 3.2.1 p. 8677 line 23 It would be helpful here to direct the reader to relevant literature on the signature of polarized radiance from cirrus clouds.

We added the following reference in the paper :

Anthony J. Baran and L. C-Labonnote, "A self-consistent scattering model for cirrus. I: The solar region", 2007, *Quant. J. Royal Meteorol. Soc.* , **133, 1899-1912**

Corrections:
1. Introduction p. 8665 line 7: clouds needs an apostrophe after it (clouds') to indicate possession. The sentence may also be reworded something like this: ": : : and indirect influence on the microphysical properties and lifetime of clouds." There are several examples throughout the manuscript (e.g. Introduction p 8665 line 21, Introduction p. 8666 line 13) of this error, and each one can be corrected with an apostrophe or by rewriting the sentence to make it clear.
2. Introduction p. 8666 line 16 Should be "high spectral resolution"
3. Introduction p. 8666 line 16 aerosol instead of aerosols
4. Introduction p 8667 line 11 looks at instead of gets onto
5. Section 3.1.1 p. 8673 line 9 detail instead of details
6. Section 3.1.2 p 8674 line 14 percent instead of percents
7. Section 3.1.2 p. 8675 line 15 delete the word exhibits
8. Section 3.1.2 p. 8675 line 17 delete the word present or the word show
9. Section 3.2.1 p. 8680 line 2 where instead of were
10. Section 3.2.2 p. 8679 line 25 masks instead of mask
11. Section 3.2.2 p. 8679 line 25
12. Section 4 Discussion p. 8682 line 13 detail instead of details
13. Section 4 discussion p. 8683 line 9 again state instead of remind

Thanks, we included these corrections in the paper.