Response to Reviewer # 2

The authors present an optimization approach for the simultaneous determination of aerosol optical thickness (AOT) and normalized water leaving radiance (nLw) from MODIS. Retrieval of AOT from satellite over turbid oceans close to the coast has suffered from large uncertainties due to difficulties in separating radiances from the atmosphere and ocean surface, besides cloud contamination and an inadequate knowledge of aerosol optical properties (c.f. Li et al. 2009 for an overview). The problems were noted and demonstrated by Jeong and Li (2005, JGR) across the Northern Pacific and Atlantic off the Africa where they are most serious but have not been resolved. The retrieval algorithm presented here is novel and promising to tackle with the problems more effectively than any existing methods. Overall, the paper is well-written.

Dear Prof. Li, we appreciate your review very much, which helped improve our manuscript greatly. We have revised our paper based on your comments carefully. We also have reworded/rephrased some sentences and added some references that may improve the paper. Our responses are listed in below after each comment.

This paper seems to be a part of a systematic study tackling with the same set of problems which should be commended, but it is also necessary to clearly elaborate their distinct merits, e.g. with the following study: Shi, C., Nakajima, T., and Hashimoto, M.: Simultaneous retrieval of aerosol optical thickness and chlorophyll concentration from multi-wavelength measurement over East China Sea, J. Geophys. Res.: Atmospheres, 121, 14084-14101, 2016. How much of the improvement presented in this paper originated from that paper? Are they different just in terms of aerosol models used in different regions? The Section 2.3 of this paper is rather similar to the Section 3 of Shi et al. (2016). The description of this method is not clear enough. It'd be better to add a flow chart of the algorithm.

Response: Thanks for the comments. In this study, we generally follow the bio-optical module of oceanic substances developed in the study of Shi et al. (2016) (hereafter S2016) except for the modeling of seawater absorption due to the calibration between retrieval and observation of nL_w. The main distinct merit of this study is that we focus on the retrieval of spectral nL_w instead of direct determination of Chl shown in S2016, since the estimation of spectral nL_w is significantly important to many bio-optical inversion models and ocean color. In contrast, the performance of Chl retrieval could be simpler sometimes due to the parameterization adjustment of some factors. Therefore, we firstly develop a full-physical technique to calculate the spectral nL_w values from Eq. (2)~(4) and modify the oceanic module of radiative transfer model. Then the vicarious calibration is conducted before retrieval to get a high accuracy estimation of nL_w. The retrieved concentrations of Chl, sediment and CDOM are just three parameters to adjust the spectral nL_w values in this study and their concrete values are less important. To make the description of this method clearer, we add a flow chart of the algorithm followed by your comments.

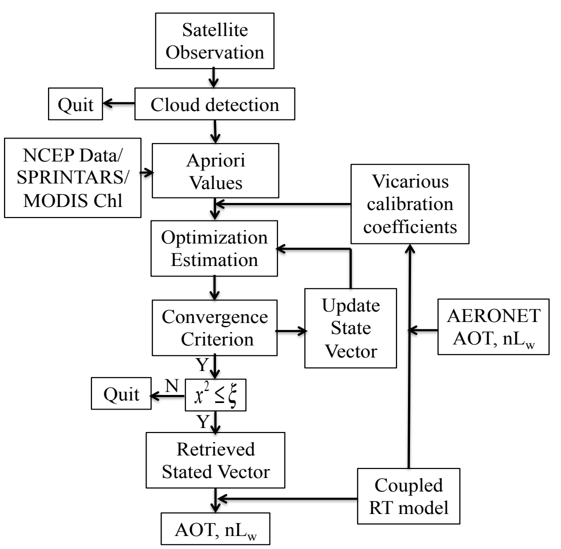

Figure1. Flow chart of retrieval algorithm

It'd be nice to present any spatial distribution maps of the retrieval results for the AOT and nLw.

Response: Thanks for the comments. We add a mapped result for the retrieval of AOT at 550 nm and nL_w at 412 and 554 nm in Fig.8. The following description is added at the end of section 4.2.

"The algorithm is then applied to the selected image obtained around the East China Sea on October 2011. Spatial distributions of the simultaneous retrieval of total AOT at 550 nm, nL_w at 412 nm and 554 nm are shown in Fig. 8(c), 8(e) and 8(g), the MODIS standard aerosol products (Fig. 8(a)) and OC products (Fig. 8(b), 8(d) and 8(f)) are also added as comparisons. In general, the retrieved AOT are mostly similar to that of MODIS aerosol products, as well as OC products, where the high aerosol loading around Bohai Sea can be observed in Fig. 8(a) and 8(c), however, the MODIS AC scheme can not produce useful AOT data in this heavy aerosol area (Fig. 8(b)). In regards to the estimated nL_w at 412nm and 554 nm, there are also good consistencies between MODIS OC products and those derived from the simultaneous retrieval approach, while the retrieved nL_w at 412 nm from MODIS OC products are reported to be negative values in the north of Yellow Sea (Fig. 8(d)), where such case can be avoided using current scheme shown in Fig. 8(e)."

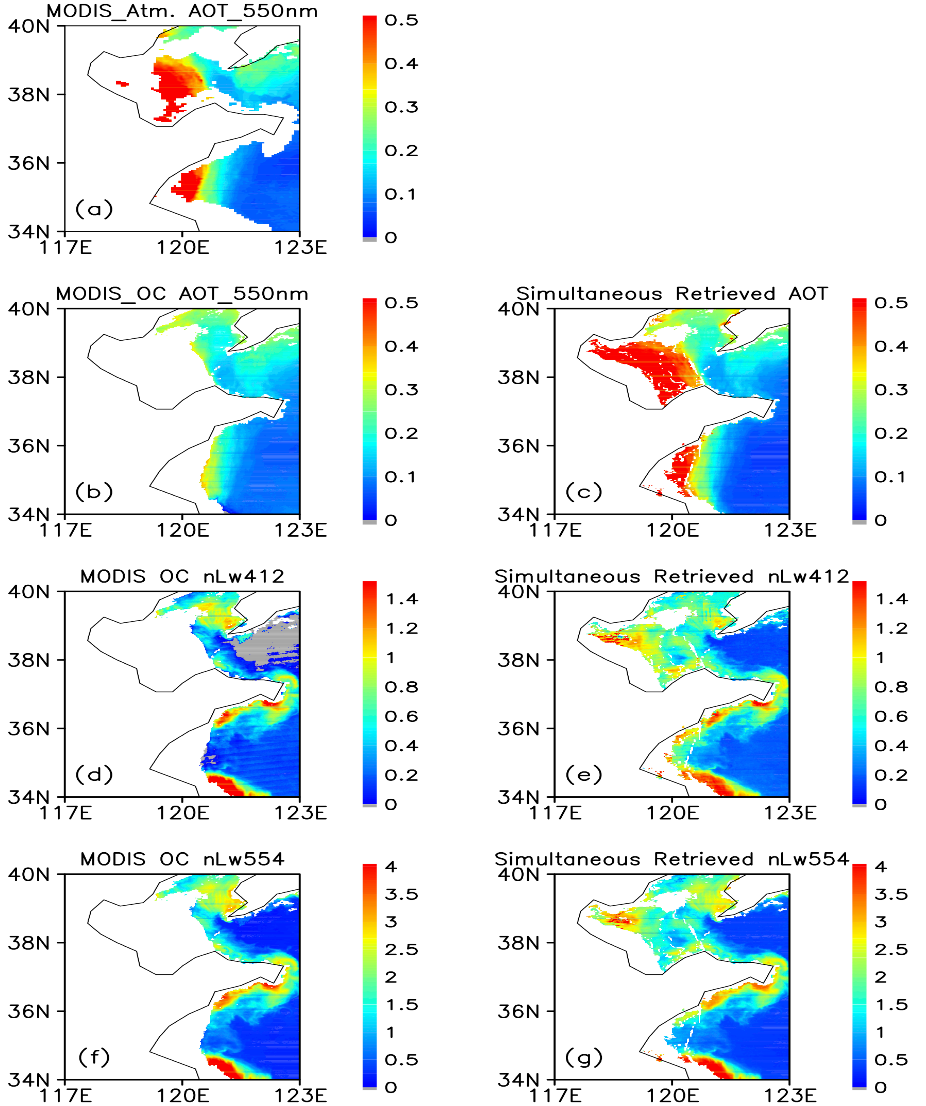

Figure8: Comparison of satellite simultaneously retrieved AOT at 550 nm and nL_w (mw sr^{-1} cm^{-2} μm^{-1}) at 412 nm and 554 nm with MODSI operational products over East China Sea on 18th Oct. 2011. (a) MODIS Aerosol AOT products; (b), (d), (f) MODIS Ocean Color AOT and nL_w products; (c), (e), (g): Simultaneously retrieved AOT and nL_w in this study

Page 7 line 27, what is the spatial resolution used in this research for MODIS data?

Response: we use the MODIS MYD021KM calibrated radiances products.

Page 26, Table 3, it is better to be "nLw (412 nm) nLw (442nm) nLw (488nm) nLw (554nm)".

Response: Thanks. Done.

Page 32, Figure 6f, the rational for the particular values (The upper and lower black lines of (f) are 1:2 and 2:1) of the estimated error is not explained. Why were these values chosen? Are they purely arbitrary numbers, or are they based on some error analyses?

Response: The upper and lower black lines of (f) with 1:2 and 2:1 are just arbitrary defined.

Page 34, Figure 8, the legend of the AERONET seems solid red line, please check it.

Response: Thanks. To make it clearer, we modify the red dashed line to solid.

Figure 8a and b should include other statistical measures, such as R2Âa˘and RMSE.

Response: Thanks. Done.

Page 32, Figure 6f, Page 35, Figure 9f, the meanings should be given of the dashed lines of different colors? Figure 6 and Figure 9 are described chiefly based on the 1:1 linear relationship which is insufficient for an objective understanding of the quality of the retrieval results.Âa˘It's suggested to add the regression line with some additional statistical measure such as r or r squared, RMSE and p-value, etc.

Response: Thanks. The description of dashed lines in Figure 6f and 9f are given in the related captions with the meaning of liner trend. Besides, we add some statistical parameters in Figure 6 and 9, such as regression line, correlated coefficient, RMSE and p-values as you mentioned.

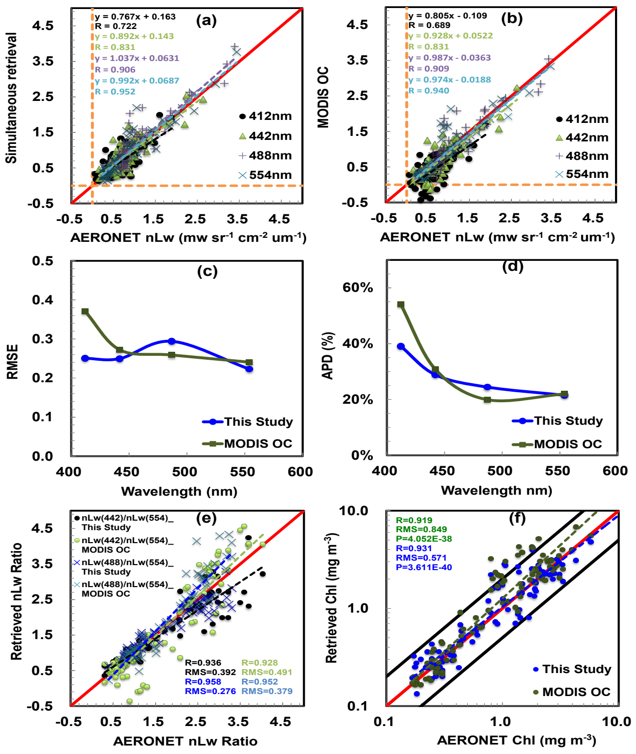

Figure 6 (changed to Figure 7 in revision)

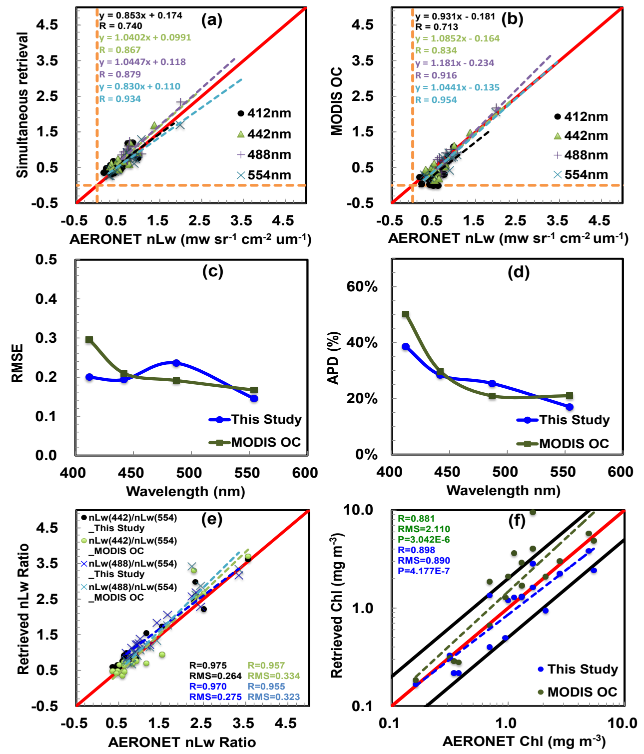

Figure 9 (changed to Figure 11 in revision)