Dear Reviewer,

We deeply appreciate your comments and effort towards improving our manuscript. We have taken your constructive comments carefully in the revision of our manuscript. For the revision, please kindly refer to the point-to-point responses as followings and the revised manuscript. The changes we made have been noted in the blue color for highlighting.

Response to Reviewer #2

The authors used *in situ* datasets and reconstructed R_{rs} data from MODIS to estimate the PSC in the East China Sea and investigated the seasonal variability of the PSC in the ECS using ~14 years MODIS- R_{rs} derived PSC data. The authors tuned the PCA approach proposed in an earlier study by Wang et al. 2014 to derive PSC from absorption measurements. The tuned approach was also applied to MODIS data via reconstructing MODIS R_{rs} in the blue bands and the QAA inversion method for MODIS derived phytoplankton absorption. Improvements in methods led to better retrievals in this region, which is encouraging. Seasonality of PSC was also investigated by discussing the relating factors such as water vertical structure, temperature, upwelling, etc., providing a better understanding on the PSC in this region with regard to environmental changes. The manuscript was overall well written despite a few inconsistencies in the tense and wording. The authors have also improved the manuscript according to what I suggested in the first review, including selecting a few typical subregions and analyzing the climatological variation besides the seasonality.

Response: Thank you for your positive comment.

My further suggestions are as below and details were highlighted in the manuscript.

1 As phytoplankton absorption and Chla are quite important in PSC estimation, probably the authors can also display the seasonal distributions of QAA derived a_{ph} (for example $a_{ph}(440)$ as $a_{ph}(675)$ is not successfully estimated) and QAA derived aph from reconstructed MODIS R_{rs} in the ECS? As QAA only retrieves IOPs but not Chla, this can at least give a hint on how the Chla distributes and changes over seasons by showing a_{ph} distributions. I then noticed that MODIS Chla products were also used.

How is the MODIS Chla compared with the in situ ones at matchups? and how was the MODIS derived a_{ph} versus in situ Chla? compared to the MODIS Chla, does QAA $a_{ph}(440)$ had a better correlation with *in situ* Chla?

Response: Thank you for your suggestions. First, we have discussed the relationships between $a_{ph}(443)$ and Chla for *in situ* measured and satellite datasets (Fig. R1). Here, the satellite $a_{ph}(443)$ were derived from the reconstructed satellite R_{rs} data. From Fig. R1, the significant positive correlations (R^2 >0.9 and p <0.001) between the Chla and $a_{ph}(443)$ for both satellite and *in situ* measured dataset. Meanwhile, we have analyzed the seasonal distributions of Chla and satellite-derived $a_{ph}(443)$ from the reconstructed satellite R_{rs} data in the ECS for four season, as shown in Fig. R2. The seasonal distribution patterns of Chla in the ECS were generally similar to those of the satellite-derived $a_{ph}(443)$. Meanwhile, distribution of phytoplankton biomass may help us to explain the spatial variability of PSCs; therefore, we have added the seasonal pattern distributions of Chla in the revised manuscript (see Fig. 8 in the revised manuscript, i.e., Fig. R3 in this response).

Additionally, based on 22 satellite matchups, we have also assessed the accuracy of MODIS Chla data using *in situ* measured Chla data (Fig. R4). The satellite Chla data in the matchup dataset were obtained from the daily Level 2 Chla products from MODIS Aqua sensor. This match-up dataset only consisted of satellite Chla with an overpass time window within 5h before and after field data. To avoid the effects of outliers, the median Chla values for a 3×3 pixels window centered on the locations of the sampling stations were defined as satellite Chla. As shown in Fig. R4, satellite Chl-a data generally agreed well with *in situ* measured Chl-a, with the R^2, RMSE and MAPE values of 0.85, 0.16 $mg \cdot m^{-3}$ and 31.38%, respectively. These results suggested that the MODIS Chl-a had high accuracy, which was considered generally acceptable in remote sensing research (Gregg and Casey, 2004; Siswanto et al., 2011).

Overall, in the revised manuscript, we have used the MODIS Chla products to help us to explain the spatial variability of PSC in the ECS (see Fig. 8 in the revised manuscript, i.e., Fig. R3 in this response). Meanwhile, in the revised manuscript, we have added the explanations regarding this issue in Section 3.5.

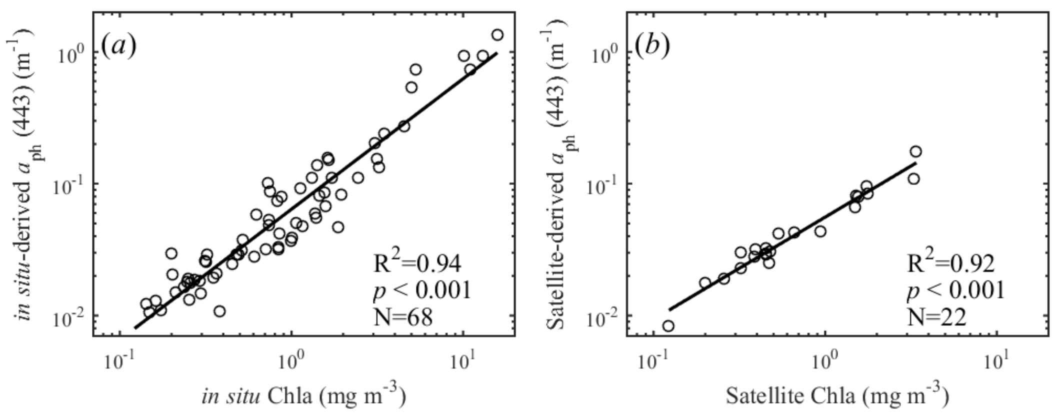

Fig. R1 Correlations between *in situ* measured Chla and the derived $a_{ph}(443)$ from *in situ* measured R_{rs} (a); satellite Chla and satellite-derived $a_{ph}(443)$ from the reconstructed satellite R_{rs} (b). Black lines correspond to the fit lines.

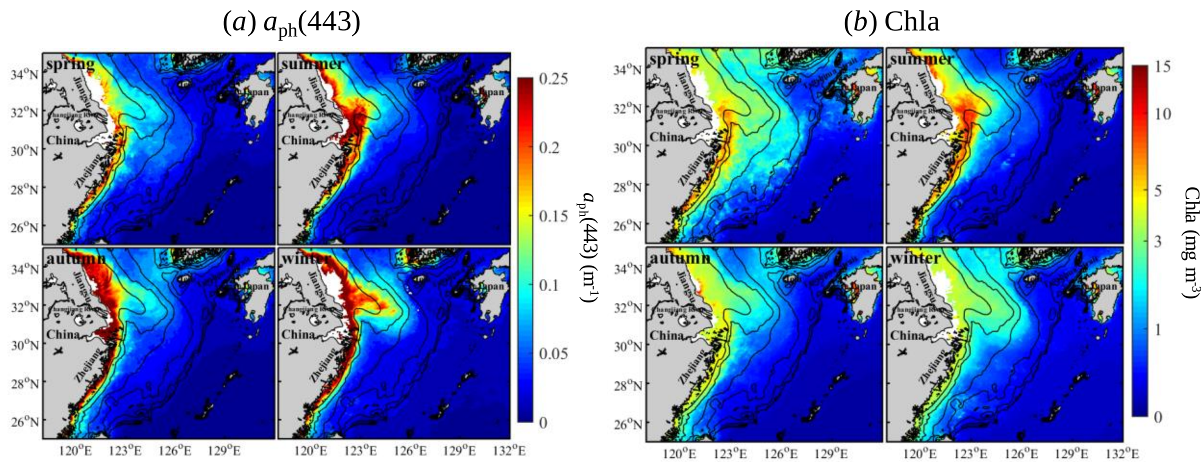

Fig. R2 Seasonal distributions of the satellite-derived $a_{ph}(443)$ from reconstructed R_{rs} (*a*) and chlorophyll-a concentration (b) in the ECS during 2003-2016.

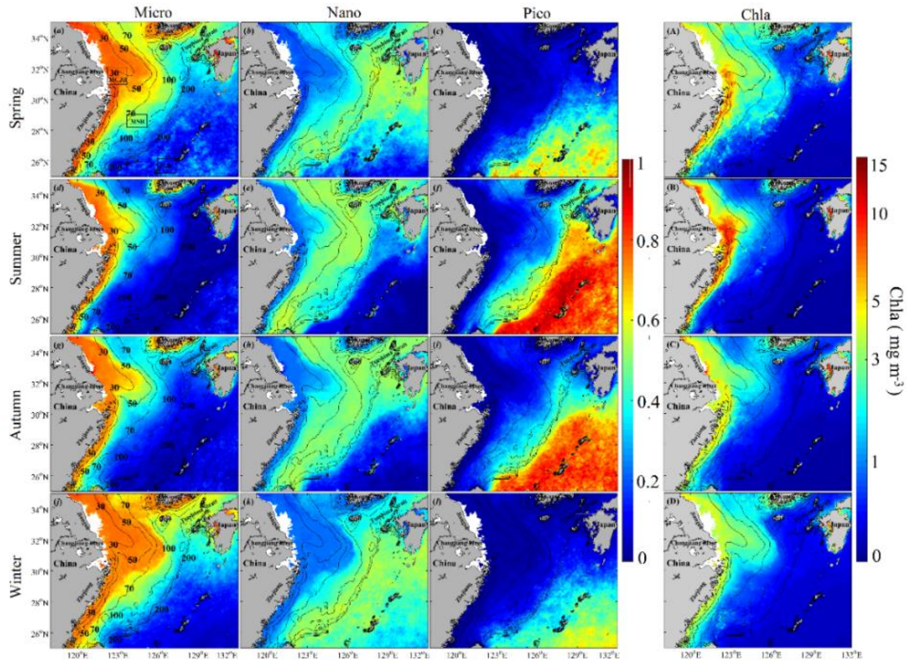

Fig. R3. Seasonal distributions of the PSC (*a-l*) and Chla (A-D, right panel) in the ECS during 2003-2016.

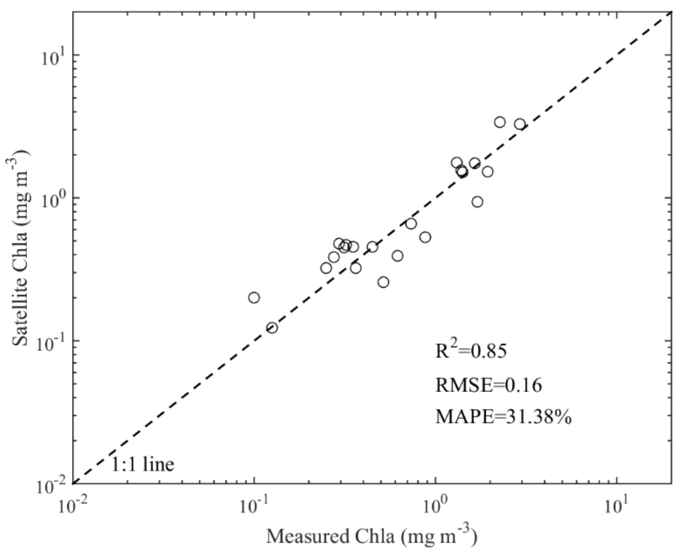

Fig. R4. Comparison of satellite-derived Chl-a with *in situ* measured values. Dashed line is the 1:1 line.

2 The authors stated that the findings presented here complement and enhance recent studies that have demonstrated that satellite ocean color data can be used to retrieve the PSC in the ECS. What other studies in this region or in China's seas? How are your results compared to these studies? are they

basically in consistence with the others?

Response: Thank you. To our knowledge, there is no study to examine PSC distribution in the ECS at synoptic scales from satellite observations. Previous investigations on the PSC in the ECS have been conducted based on field observations (e.g., Chen, 2000; Furuya et al., 2003; Wang et al., 2015). However, there are some studies that have estimated the PSC distribution in other China seas (e.g., Bohai sea , Yellow sea, and South China Sea) using the satellite ocean colour data. For instance, Sun et al. (2017) developed a local model to estimate PSC distributions in the Bohai Sea and Yellow Sea. Meanwhile, we have compared and discussed satellite-derived PSC with previous field investigations in the ECS, and found that the distributions of PSC in our study were generally consistent with those reported by other researchers from field observations (Chen, 2000; Furuya et al., 2003; Wang et al., 2015). In addition, Fig. R5 further showed the comparison between the spatial distributions of PSC during summer and autumn derived from both MODIS and our field measurements. Overall, their general distributions patterns agreed with each other. For micro-phytoplankton, high values were generally found in near-shore regions with lower values in offshore waters during summer and autumn. For nano-phytoplankton, both MODIS and field measurements showed high values in the middle shelf region of the ECS. For pico-phytoplankton, both MODIS and field measurements showed low values in the coastal region during summer and autumn and high values in the coastal waters of western Japan during summer. Overall, these results suggested that the refined PSC model in our study was able to derive reasonable PSC patterns in our study region.

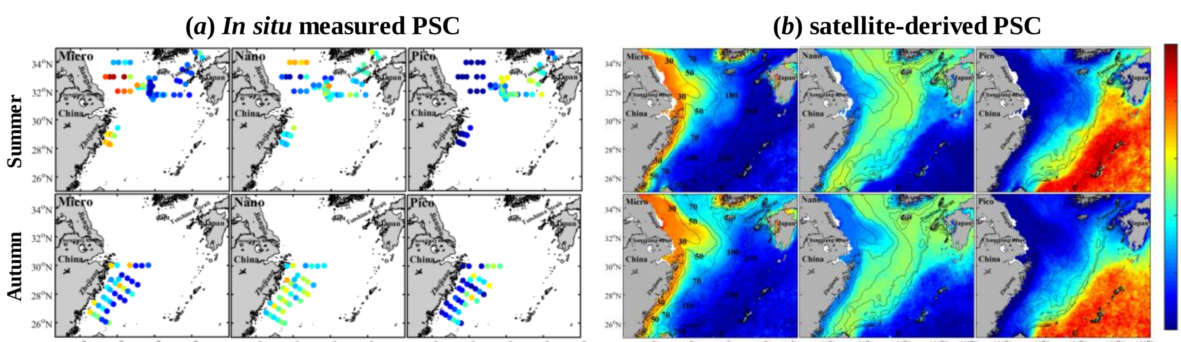

Fig. R5. Comparison of spatial distributions of PSC in the ECS between satellite retrievals and field measurements during summer and autumn.

3 Description on statistics sometimes is not very precise. Such as the authors used ‘acceptable errors’ or ‘significant correlation’ but did not explain how you defined acceptable or significant, maybe P values help a bit or change the way of interpretation.

Response: Thank you for your suggestion. To precisely describe the statistics, we have revised the manuscript carefully based on your comments. For instance, we have rephrased the “acceptable errors” (see the last paragraph in Section 3.4). In addition, we have added *p* values of the correlation in Fig. 10 in the revised manuscript (Fig. R6 in this response).

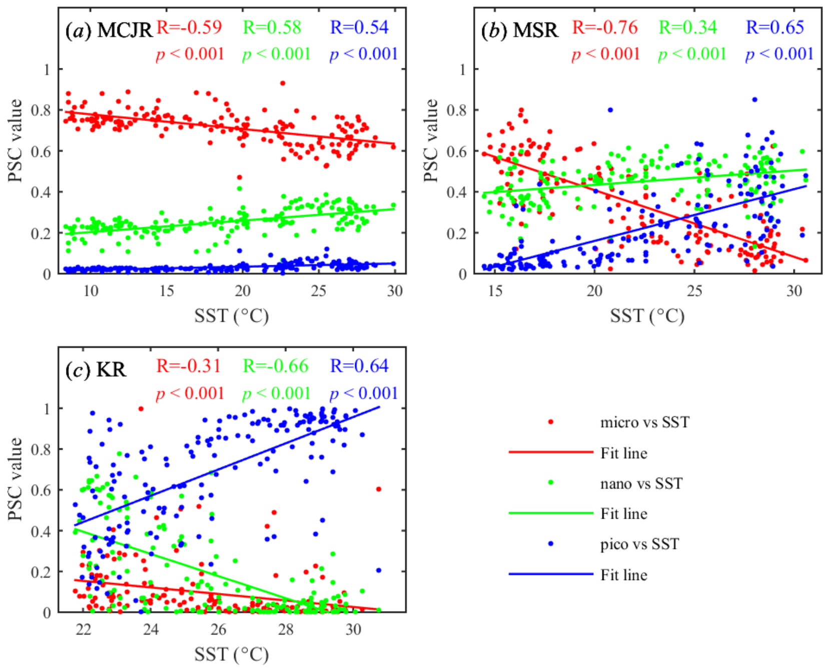

Fig. R6. The scatterplots showing the relationships between the monthly phytoplankton size fractions and SST from 2003 to 2016 for the MCJR (a), MSR (b), and KR (c).

4 The description of the sub-regions is inadequate, please specify their sizes, and use boxes to specify the exact size and location in the map.

Response: Thank you for your suggestion. In the revised manuscript, we have displayed the locations for the three subareas selected in our study in Fig. 1a (Fig. R7 in this response). Additionally, we have added the description of these subareas (e.g., box size) in the Materials and Methods (see Section 2.1 in the revised manuscript).

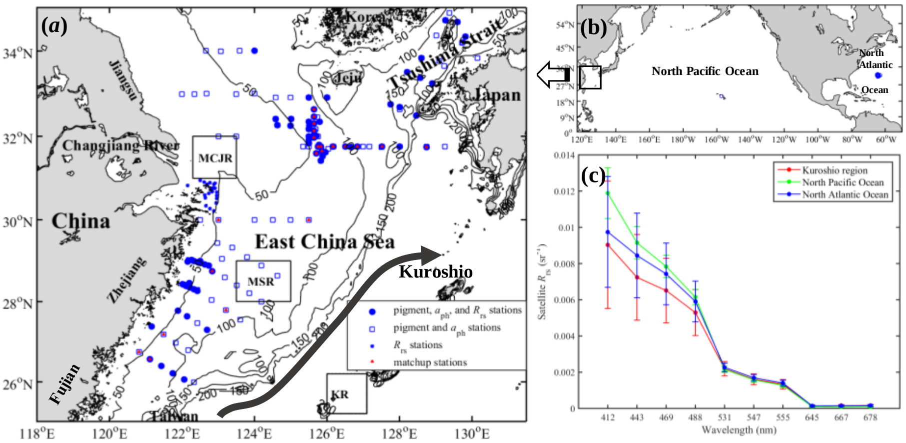

Fig. R7. Distribution of *in situ* and matchup dataset and locations of the selected subareas (black boxes) (*a*), namely MCJR (mouth area of Changjiang river), MSR (middle shelf region), and KR (Kuroshio region); locations of sampling stations collected in the North Pacific and North Atlantic oceans from the NASA SeaBASS archive (b); the average satellite $R_{rs}(\lambda)$ spectral from 2003 to 2016 for the Kuroshio region, North Pacific ocean, and North Atlantic ocean (blue circles in b) (c). Error bars represent standard deviations of the means.

5 When discussing the PSC response to the SST, it might be also helpful to also show the SST variations.

Response: In the revised manuscript, we have added the correlations between phytoplankton size fractions and SST for different subareas (see Fig. 10 in the revised manuscript, i.e., Fig. R6 in this response). In addition, Table 5 in the manuscript has been removed accordingly. Thank you very much.

More detailed comments and technical corrections were listed in the attached file. Please also note the supplement to this comment:

https://www.biogeosciences-discuss.net/bg-2017-508/bg-2017-508-RC2- supplement.pdf

Response: Thank you for your valuable comments and suggestions. We have carefully revised all of these issues according to your detailed comments in the PDF file.

References used in this response:

Chen, Y. L. L.: Comparisons of primary productivity and phytoplankton size structure in the marginal regions of southern East China Sea, Continental Shelf Research, 20, 437-458, 2000.

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