Reviewer #1

General comments
This paper deals with summertime coastal phytoplankton blooms off eastern Korea, as measured at the ESROB fixed buoy site. The Authors show how advection of chl-rich, low salinity (due to typhoon-related heavy rainfall), water to the site triggers chl blooms, during which chl a reaches 4 ug/l and beyond. I find this paper very interesting, both in a phenomenological sense and because of the completeness of the parameters measured at ESROB, accompanied by satellite imagery. The text is well written even though it needs a little English improvement. However, I have some reserves before recommending publication, which are explained in detail below in the particular comments.
Thank you very much for the valuable comments below. We deeply appreciate the detailed suggestions and have revised the manuscript based on these comments.

To sum them up, I am mainly concerned with:
1) the fact that Total Suspended Matter (TSS) and chl a don't co-vary for chl a > 3 ug/l, so high chl may actually be due to non-chl particulate optical signature
The GOCI Chl a can be overestimated when the TSS is high as has also been shown in previous research. In the revised manuscript, we clarified this point, citing a new reference as below.

"Despite the fact that absolute value of Chl a can be overestimated at high TSS (Kim et al., 2016), this indicates …"

However, the relative value of GOCI Chl a in this area is still useful for understanding spatial Chl a distributions and their temporal variations.

Kim, W., Moon, J. -E., Park, Y. -J., and Ishizaka, J., Evaluation of chlorophyll retrievals from Geostationary Ocean Color Imager (GOCI) for the North-East Asian region, Rem. Sens. Environ., 184, 428–495, 2016.

2) the interpretation of the dynamic situation, i.e. I have a problem with the wind re-stratifying a water column. Also, upwelling is visible in the ESROB T and S record during poleward wind events, but it is not mentioned: even though it is not relevant for blooms, it should be, to make the physical interpretation complete
We agree that the description in the original manuscript was not sufficient and could cause unnecessary confusion on the interpretation of mixing and re-stratifying dynamics. In general, i.e., with no coastal boundary, winds enhance mixing and only break stratification. However, the winds either increase or decrease the stratification near the coast owing to coastal up- and downwelling responses (with offshore and onshore Ekman transport in the upper layer) to alongshore wind, depending on its direction. The water column in the coastal area can be either re-stratified (downwelling favorable wind, Fig. R1 left) or homogenized (upwelling favorable wind, Fig. R1 right) depending on the alongshore wind. Here, we believe the mixing process is minor compared to the upwelling/downwelling response with Ekman transport.

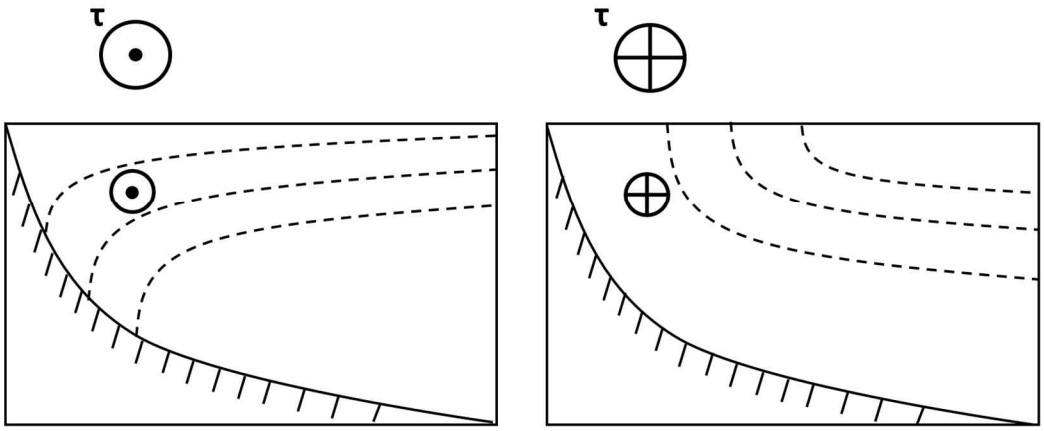

Figure R1. Schematics of isopycnals or isotherms (dashed line) and alongshore currents at the upper layer in response to downwelling (left) and upwelling (right) favorable wind stress.

To clarify this point, we revised the sentences in Section 3.2 as below.

"… and implying the downwelling (before E01) and upwelling (after E03) in the vicinity of ESROB."

"Since typhoon KHANUN drove poleward wind stress, the strong equatorward currents (showing downwelling induced by equatorward wind stress) developed before and during the most of E04 were weakened, and SSS increased to …"

"Two typhoons (BOLAVEN and TENBIIN) successively passed the area and poleward (equatorward) wind stress imposed by BOLAVEN (TENBIIN) induced an upwelling (downwelling) response with poleward (equatorward) and offshore (onshore)

transports at the upper layer, decreasing (increasing) water temperature, and increasing (decreasing) salinity in the whole column during E06."

3) the lack of the description of the method for which the Authors find out that advection "... is primarily responsible for most (80 %) of the CF events"
We simply counted the number of events where the alongshore advection plays a primary role in changing the CF. More specifically, equatorward currents and salinity decreases were accompanied during the 8 events (E01–E06, E08–E09). The high CFs during the remaining two events (E07 and E10) were discussed in association with cross-advections. In the revised manuscript, we inserted supplementary information as *"... primarily responsible for most (80%, 8 of 10) of the CF events."*

4) the fact that salinity at ESROB never goes below 30 g/kg, except for E03, while SSS data indicate 27-29 g/kg for the plume in 2013. So does the plume really reach ESROB? Or maybe a mix of plume and offshore water?
Great point. We believe that what was observed at the ESROB is not pure plume water, but water mixed with offshore water. The plume water salinity increases as mixed with the saline offshore water and the modified plume water is advected equatorward to the ESROB. In the revised manuscript, we clarified the point by inserting the new sentence below in Section 4.1.

"The distribution and temporal evolution of SSS observed in July 30, 2013 implies the low salinity plume water (SSS < 29 found in the northern coastal area, Fig. 8e) is mixed with saline offshore water while advected equatorward, yielding slightly higher (> 31) SSS at ESROB."

5) the lack the suggestion for the mechanism for which the northern plume or southern chl-rich waters trigger blooms; also, why are there no other strong blooms north of ESROB? Has the nutrient load of such surface, fresh waters anything to do with bloom triggering?
As mentioned in 1), the GOCI CF can be overestimated and may not be comparable to the in-situ CF observed at the ESROB directly. We believe the CF is higher in the northern plume water than the modified water found at the ESROB; the CF maintained or decreased while advected equatorward. The opposite case (CF increased while advected) was tested by examining the possibility of local blooms triggered by either nutrients or light availability, but not supported as discussed in Section 4.2.

Replace "summer-time" with "summertime" (hereafter "replace" will be represented as "->"). Please correct this also in the rest of the text.
This has been revised throughout the manuscript.

"near east coast" -> "near the east coast"
This has been corrected.

Line 23. Replace "accompanied" -> "were accompanied by".
This has been corrected.

Line 37. "among others" -> "among other phenomena" Line 40. "plume-delivering" -> "plume- delivered". Line 42. "and significant" -> "and a significant". Line 43. "plume" -> "plumes". Line 44. "demonstrating localized"-> "demonstrating that localized".
These have been revised.

Line 45. What do you mean by "diversion"?
We meant the change of dominant plankton species within the plume water by the "diversion." In the revised manuscript, we changed the sentence to *"a few days after the plume water discharge"* to avoid the confusion.

Line 47. "differences with respect to the plume" -> Do you mean "differences between the plume and surrounding waters"? Please clarify
No, it means differences among the local plumes. To clarify this, the sentence was revised to *"... revealing large Chl a differences among the local plumes."*

Line 57. "limited short-duration" -> " short-duration ". "limited" is redundant.
This has been corrected.

Line 68. "The data collected includes" -> "The collected data include" Line 70-71. "vertical profile of current" -> "current vertical profiles" Line 71. "upper most" -> "uppermost".
This has been revised as recommended.

Line 76. "alongshore current" -> "alongshore northward current", right?
This has been revised to *"poleward alongshore current"* to make it consistent with other expressions.

Line 79. "is needed to calibrate" -> "always needs calibration".
This has been revised as recommended.

Line 79. "owing to long-term sensor drift" -> "owing both to long-term sensor drift and to the fact that different chl a concentrations may yield the same fluorescence energy, i.e. the same number from the
fluorimeter, because of temporal differences in phytoplankton species assemblage and of the adaptation of species to different light conditions". I should add this because, as the Authors know, this point is very important if one wants to obtain realistic chl a quantities from a fluorimeter. See for example Longhurst et al., Prog. Oceanog. VoL 22, pp. 47 - 123, 1989, but also more recent references, with which I'm sure the Authors are familiar.
Thank you for the reference. We agreed that the issues of temporal differences in species assemblage and species adaptation to different light conditions are important to obtain realistic Chl a. In the revised manuscript, we included the point as commented by citing Longhurst et al. (1989).

Line 92. "geostationary ocean color satellite" -> is this the "NASA Geostationary Ocean Color Imager (GOCI)"? If not, which satellite? By the way, if you write the acronym of the satellite you can use it in the text instead of repeating "the ocean color satellite" every time.
The GOCI is the first geostationary orbit satellite image sensor to observe an ocean color around the Korean peninsula, loaded on the Communication, Ocean, and Meteorological Satellite (COMS, launched in 2010) of South Korea. The data may also be distributed via NASA. We revised the text to use GOCI throughout the manuscript.

Line 94. "... at a grid 50 times further...". What do you mean? Please rephrase. I know that polar orbiting OC products have resolution of from 1 km onwards, so why 50 times? The 500 m grid would be 2 to 5 times finer, maybe. If "further" means "finer", that is.
The geostationary satellite was positioned 50 times higher than low altitude polar orbit ones. We corrected the sentence to avoid the confusion.

Line 95. "by the total" -> "by total".
This has been corrected.

Line 98. "software modules applying a correction algorithm for the TSS and CDOM". Please cite software name and authors, as well as the reference or SW manual. These modules should be well described for anyone who might want to use them, because these corrections are very important.
The software and references providing detailed descriptions were inserted into the sentence.

Line 101-102. "This indicated that Chl a can be measured regardless of the TSS both in the coastal and outer sea" -> I disagree: from Fig. 2b it seems that your Chl a measurements co-vary with TSS significantly only up to chl a = 3 ug l-1 and TSS = 2 mg m-3. This means that, up to these values, TSS
is reasonably made only of phytoplankton. But when TSS is high, other particulate besides phytoplankton is present, so your satellite chl a algorithm may fail because it may mistake the light signal coming from other particulate for phytoplankton. Please comment or correct phrase. Is this issue crucial for what follows? That is, how much of the CF peaks in Fig. 4 is actually due to non-phytoplankton fluorescence? I say this because the peak values are beyond the range of chla-TSS tight covariance. So are they really phytoplankton blooms?
Suggestion: why not over-plot the in situ chl a data in Fig. 4, e.g. as asterisks or crosses? This would make sure that the peaks are real chl a.
As described in 1), the GOCI Chl a can be overestimated when the TSS is high as has also been shown in previous works. However, the overestimation issue is only for GOCI CF (Fig. 2b and 2c) and not for the ESROB WQM (Fig. 2a). Note that Fig. 4 does not show the GOCI CF but the ESROB WQM. We agree that the GOCI Chl a can be somehow affected by non-phytoplankton fluorescence when the TSS is high. This is why we limit our interpretation on the GOCI CF to relative (not absolute) values, which is still useful for understanding its spatial distributions and temporal changes although it is not directly comparable to the ESROB WQM data shown in Fig. 4. We tried to over-plot the in situ CF in Fig. 4 but decided not to replace the original as in-situ water samples were taken in very limited times having relatively wide CF ranges, which were not very useful for addressing the point above. Instead, we clarified the GOCI CF and ESROB WQM CF against the in-situ water samples in the revised manuscript.

Line 106-107. "Precipitation in unit of mm/day recorded" -> "Precipitation (mm/day) was recorded".
This was revised as recommended.

Line 109. "were proxied as freshwater..." -> I think there is a piece of sentence missing.
We inserted the missing part on the sentence.

Line 21. "trophic situation" -> "the trophic situation". Line 120. "upper most" -> "uppermost".
We could not find "trophic situation." The word "upper most" was revised to "uppermost."

Line 121. "summer-time" -> "summertime".
This was revised as recommended.

Line 134. "over considerable period (Fig. 4, Table 1)" -> "over a considerable period, i.e. days to weeks (Fig. 4, Table 1)".
This was revised as recommended.

Line 136. "when CF > 1.0 _g/l" -> I don't understand this third condition, given the first two.
In the revised manuscript, we clarified the conditions to define the CF events as the original sentence was confusing. The event was basically defined as a period when CF > 1.0 µg/l. To avoid selecting too many temporal fluctuations as events, we use a constraint to select the 10 events using additional criterion where the duration of CF > 2.0 µg/l was longer than 1 d.

Line 137. "three each year" -> "three in each year" Line 141. "rainfalls" -> "rainfall". For this word, usually plural not used. Pls correct also rest of manuscript.
This was revised throughout the manuscript.

Line 152. "wind stress, strong" -> "wind stress, the strong".
This has been revised.

Line 153. "developed before E04" -> should this not be "developed before and during most of E04"? Refer to Fig. 5.
This is correct, the sentence has been revised.

Line 157. Eliminate "both" if you use parentheses for opposing effects.
This has been revised.

Line 156-159. "poleward (equatorward) wind stress re-stratified (well-mixed)" -> In my opinion, it is impossible for wind stress to re-stratify a water column, no matter its direction. So, I think that poleward (and, by the way, strong) wind stress cannot re-stratify, but mix only. Indeed, if one looks at the T and S time series of Fig. 6c and d, in correspondence of the B poleward event, the isotherms drop and the isohalines rise, but remain separated, except for the 1 and 5 m isolines. This indicates upwelling, which is consistent with the wind and coast configuration. Next, during the T (equatorward) event the isotherms rise and the isohalines drop, indicating downwelling, and after the events the isolines settle to their normal values. So mixing is not so visible, to my opinion. However, Authors are right about mixing for the M1, T and S events, all equatorward, when the 1, 5 and 20 m isolines join. In sum, it looks like during equatorward events the mixing takes place and stays there so it can be measured (Ekman transport is onshore). On the other hand, during poleward events, mixing probably takes place, but is either less intense or is not visible at ESROB, because mixed water is displaced offshore by Ekman transport, and only the "frictionless" effect of upwelling is measurable. What are the Authors' comments?
We mostly agree with you, and as mentioned in 2), believe that the water column at the ESROB is re-stratified and homogenized in response to downwelling and upwelling favorable winds (Fig. R1 left vs. right), assuming the mixing process plays only a minor role compared to the upwelling/downwelling response with Ekman transport.

Line 164 "did not accompany preceding heavy" -> "did not follow heavy".
This was revised as recommended.

Line 176. "(Fig. 9a, b, c and d)" -> "(Fig. 8a-d)" Should this be Fig. 8, not 9?
Correct. This has been revised to Fig. 8.

Line 177. "e.g. off the SP, HH, and WS," -> "e.g. off the SP, HH, and WS sites," Lines 178 - 179. "and extended" -> "while a more coastal branch extended" Line
This has been revised as recommended.

179. "(Fig. 9a, b, c and d)" -> "(Fig. 8a-d)" Again should it be Fig. 8?
Correct. This has been revised to Fig. 8.

Lines 179-180. "coast during the period (Fig. 9a, b, c and d) after the heavy rainfalls in July 19–24 (Fig. 7a)." -> "coast (Fig. 8a-d) after the heavy rainfalls of July 19–24 (Fig. 7a)."
This has been revised as recommended.

Line 184. "(Fig. 9e and 9f)" -> "(Fig. 8e, f)". Again Fig. 8.
This has been revised.

Line 188. "A pattern of" -> "The patterns of" Line 190. "within cyclonic" -> "within the cyclonic" Lines 194-195. "coastal zone" -> "coastal zone, near DH and ESROB, as well as equatorward currents just to the north". Line 196. "(as cases of many other events, see Fig. 1 or Fig. 8)" -> "(see Fig. 7, but also other similar events, as in Fig. 1 or Fig. 8)"
This has been revised as recommended.

Line 203. "and is primarily responsible for most (80 %) of the CF events." Please tell how the Authors checked this, practically. Did they see if the plume could reach ESROB for each event, given the duration of the event and the equatorward current? Did they use the current at ESROB or available imagery, as in the example of Fig. 8?

As mentioned in 3), we simply counted the number of events where the equatorward currents and salinity decreases were accompanied with the CF events. The exceptions are only two events (E07 and E10) where the equatorward currents and salinity decreases are not clear just before and during the event periods (Fig. 7).

Line 205. "measured to 100 km (= dy)" -> "measured to be dy = 100 km"
This has been revised as recommended.

Line 206. "with Chl a change of about 2.5 _g/l". Is this the difference between chlorophyll at the plume source and the initially oligotrophic water at ESROB? If not, between which points is this difference computed? Please specify.
Yes, it is the difference between CF at the plume source and initially oligotrophic water at ESROB as specified in the revised manuscript.

Line 207. "(Fig. 9a, b, c and d)." -> "(Fig. 8a-d)." Again Fig. 8.
Correct. This has been revised to Fig. 8.

Lines 201-214. I understand the calculation and it is good that the computed advective rate of change matches local change at ESROB. However, I do notice that the maximum chl in the plume doesn't exceed 2.5 _g/l (Fig. 8), and that this is the source value at the plume's origin, which never moves south. Indeed, the water that eventually reaches ESROB has much lower chl, according to Fig. 8, i.e. max 1-1.5 _g/l. So how can E09 reach a peak of 3.5 _g/l (Fig. 7) if it is only fueled by the plume? Maybe the plume is more important as a nutrient carrier than a chl carrier, so arriving at ESROB it triggers a bloom? However, if so, why are there no other strong blooms north of ESROB in the images of Fig. 8, but only the southward-decreasing chl a plume signal? If the plume is the responsible for the blooms, then there should be even more intense blooms north of ESROB. Am I missing something? Please comment/revise in text. Also, concerning the plume investing ESROB: from ESROB and SSS cruise data in Figs. 7 and 8 one sees that S = 31.5 g/kg at ESROB at the peak of the E09 event, but the plume salinity seems much lower from Fig. 8e, i.e. S < 29. So which water reaches ESROB? It doesn't look like pure plume water; maybe it is a plume-offshore mix? I think the Authors should clarify this issue.
Great point. We tested the possibility of a local bloom triggered by nutrients advected equatorward and discussed in addition to that triggered by vertical nutrient supply in Section 4.2. However, the nutrient loading mechanisms were found to play only a minor role. Here, we have two issues using the GOCI CF data. One is that the GOCI CF cannot only overestimate but can also underestimate the Chl a when the TSS is high in the coastal area (Fig. 2b). We would limit our interpretation on the GOCI CF to relative (not absolute) values, not directly comparable to the ESROB WQM data shown in Fig. 4. Next is that the GOCI CF, unfortunately, is not available very near the coastal zone (see the blanks shown in white in Fig. 8a–8d). We believe the plume water having high (> 2.5 μg/l in GOCI CF scale) CF and low (< 29 g/kg) salinity advected equatorward very near the coast as in the wedge patterns of SSS and SST observed in July 30 (Fig. 8e and 8f) to reach the ESROB although slightly mixed by saline and low CF offshore water. The CF and SSS at ESROB would be ~2.0 μg/l in absolute ESROB WQM scale and ~32 g/kg, respectively. More quantitatively, we showed that the rate of CF change observed at the ESROB is comparable with that owing to equatorward advection (v times dChl/dy) in Section 4.1.

Line 224. "estimated to 0.86" -> "estimated to be 0.86"
Correct. This has been revised to Fig. 8.

Lines 225-226. "demonstrating a high CF region offshore of ESROB (Fig. 9a, d)" -> "demonstrating the influence of the high CF region offshore on the ESROB site (Fig. 9a, d)". Do I understand well?
Correct. This has been revised as recommended.

Line 227. "nutrient rich" -> "nutrient-rich"
This has been revised as recommended.

Line 227. "accounting for half the CF change" -> "accounts for half the CF change".
This has been revised as recommended.

Line 227. Question same as above: since E07's peak reaches ~ (3.5 - 1.6 = 1.7 ug/l) come from?
Note that the 1.6 μg/l/d is not CF itself in a unit of μg/l but the time rate of its change at the ESROB site in a unit of μg/l/d, i.e., CF change in a day. We clarified that the time rate of CF change (up to 1.6 μg/l/d averaged over the E07 for the period when $\partial \mathrm{Chl}\ a/\partial t > 0$) and the contribution of cross-shore advection (0.86 μg/l/d) are comparable.

Line 230. "significant as that of E10" -> "significant, as happens for the E10 bloom". Do I understand well?
Correct. This has been revised as recommended.

Line 244. "different each other" -> "different from each other" Line 251. "euphotic zone" -> "euphotic zone depth".
This has been revised as recommended.

Line 251. "was compared with others" - > "were compared with others". What do you mean by "others"?
We specified the word as *"the other time-series data recorded at ESROB"* in the revised manuscript.

Line 252. "events from two PAR" -> "events, using two PAR" Line 252-3. "Basically, Zeu of 18 m averaged over E04–E10 was deeper" -> ""Basically, the average for the E04 to E10 bloom periods, Zeu = 18 m, was deeper".
This has been revised to *"events, using the data collected with two PAR sensors ..."* The latter was revised as recommended.

Line 255. "Zeu of 20 m averaged" -> "A Zeu of 20 m obtained by averaging". Line 265. "typhoons passed through" -> "typhoons that passed through" Line 277. "summer-time" -> "summertime".
Line 296. "high surface CF enhancements" -> "high surface CF events" or "enhanced surface CF"
This was revised as recommended.

Lines 297-299. "Alongshore advection... in summer". I think that this is my main concern about the paper. That is, the Authors have demonstrated that the blooms at ESROB are not driven by local vertical nutrient supply (text relative to Fig. 10). In addition, the Authors show that chl-rich plume waters or southern waters reach ESROB. So they argue that such advection is responsible for most events. But, I ask, how? What is the biogeochemical mechanism that triggers the blooms at ESROB, after the chl-rich water hits the site? This is not clearly stated. Especially since the advected waters that arrive at ESROB have only about half of the peak chl that is measured during blooms. Why is ESROB so special about blooms, with respect to the rest of the? Or maybe other blooms are visible in other sites?
We think there was a misunderstanding possibly owing to the poor presentation of the original manuscript. Our conclusion is that there was no local bloom at ESROB, but the water having high CF was transported past the ESROB in the alongshore (equatorward) or cross-shore directions. The summertime equatorward current near the coast was the primary process accounting for the CF variability at ESROB.

I suggest that Authors should
(1) propose a mechanism for bloom generation (also tentative, that's OK);
There might be potential biogeochemical mechanisms that trigger local blooms at or nearby the ESROB. However, as discussed in Section 4.2, both nutrient loading and changing light availability at ESROB hardly accounted for the observed CF variability. Based on our results, we believe that the blooms triggered in remote places (particularly in the northern coastal area) by some mechanisms, such as advective and diffusive nutrient supplies from rivers/rainfall or changing euphotic depth, and the CF-rich water are frequently transported (particularly equatorward) into the ESROB site in summer.

(2) discuss the occurrence or lack thereof of such other blooms at other sites along the coast, by showing or commenting evidence from satellite imagery (or other available data).
The GOCI CF, although the absolute values are not very useful, often shows higher CF in the northern coastal areas in summer along the east coast of North Korea where the in-situ data are not available. A typical GOCI CF image such as Fig. 1 supports such blooms occurring more frequently in the northern than southern coastal areas in summer. However, there is another source of CF-rich water originating from the southern coastal area, which may be related to frequent summertime coastal upwelling off the southeastern coast of Korea. The ESROB is located in the area affected by both sources of high CFs although the equatorward advection prevailed at and inshore of the site in the three summers.

By the way: (3) is there an image showing any of the blooms at ESROB itself, to have an idea of the bloom's extension around the site?
We hoped to find high CF at ESROB from the GOCI images for all the event and non-event periods in the three summers. However, we could not find this, as the GOCI CF data are not available very near the coast (blank area near the coast shown with white color in Fig. 8d) including the ESROB site owing to cloud cover.

Line 303. "the equatorward and cross-shore advections" -> "the equatorward and cross-shore advection". No need for plural. Line 303. "SSS plays" -> "SSS play"
This was revised as recommended.

Table 1 caption. "duration in day" ->"duration in days". Line 405. Figure 1 caption. "water depth in meter" -> "water depth in meters" Line 422. Figure 4 caption. "at the ESROB" -> "at ESROB" Line 430. Figure 5 caption. "at surface" -> "at the surface" Line 431. Figure 5 caption. "at the ESROB" -> "at ESROB" Line 437. Figure 6 caption. "except for 2012 bloom events" -> "but for the 2012 bloom
events" Line 442. Figure 7 caption. "except for 2013 bloom events" -> "but for the 2013 bloom events"
This was revised as recommended.

Lines 446-7, Fig. 8 caption. "Surface distributions of e) salinity and f) temperature observed using a small research vessel (ship tracks and CTD stations are remarked with dashed lines and dots)" -> "In situ surface distributions of e) salinity and f) temperature (dashed lines: ship tracks; dots: CTD stations)"
This was revised to *"Surface distributions of in-situ e) salinity and f) temperature (dashed lines: ship tracks; dots: CTD stations) ..."*

Line 459. Figure 10 caption. "in summers" -> "in the summers" Line 460. Figure 10 caption. "A standard deviation of" -> "Standard deviations for".

This was revised as recommended.