

Interactive comment on “Summer-time episodic chlorophyll-a blooms near east coast of Korea” by Young-Tae Son et al.

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Reviewer #2 In major comments, 1) Upwelling is frequently observed in the east coastal area in the northern hemisphere under the summertime monsoonal (poleward) wind. This means that upwelling can be a major contributor for the chlorophyll a blooming event. Enhancement of vertical mixing associated with the strong wind is also an important process for the local nutrient budget. In the beginning of event E06, temperature decreased in the whole water column which is due to the passage of typhoon as described in the text. However, the authors did not mentioned it as a possible governing mechanism for the blooming event. Thank you very much for the constructive comments. We agree that the coastal upwelling off the east coast in the northern hemisphere under the summertime monsoonal wind and intermittently enhanced ver-

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tical mixing associated with strong wind are a major driver to trigger the bloom via nutrient supply to the euphotic zone in general. In the revised manuscript, we explicitly mentioned the up- and downwelling responses to the strong alongshore wind associated with the typhoon passages. However, as discussed in Section 4.2, local blooms triggered by nutrient loading may play a minor role here in shaping the CF variability/events at ESROB.

2) The documents by the National Institute of Fisheries Science of Korea show that July 2, July 11 and July 23-29, 2013 were the period of low temperature warning in the east coast of Korea including the study area. These periods are coincident with the blooming events. Thus, it must be carefully re-analyzed for the driving mechanism by using all available data, though no clear evidence for upwelling phenomena is shown in temperature data except E07 event in Figure 7. It would be better to show analytically whether the ESROB buoy site, i.e., the distance from the coast, is suitable to monitor the summertime coastal upwelling event. Good point. Thank you for the information. Yes, we agree that the low temperature warning in July 2013 is relevant to the coastal upwelling off the east coast of Korea. The ESROB is well located where both up- and downwelling responses to local wind can be frequently monitored as has been known for decades (most recent reference is Park and Nam [2018]). However, please note that most CF events observed in the three summers are not directly linked to the nutrient fluxes enhanced by upwelling, but the equatorward advection of CF-rich plume water in the northern coastal area.

In minor comments Line 76. Please provide the general width of the alongshore current, if possible. The general width was inserted in the revised manuscript as recommended.

Line 105. Please provide the source for precipitation data. The data source was inserted in the revised manuscript as recommended.

Line 144. ‘~ inducing strong equatorward (before E01)’. Both salinity and tempera-

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ture increased sharply, especially in the lower layers just before E01 in Figure 5. This is not consistent with the effect of the equatorward flow. Line 153. 'equatorward currents developed before E04'. Temperature increased in the whole water column before E04 under the equatorward current as well as before E01. We understand the original manuscript may cause unnecessary confusion with this interpretation. As commented by this and another reviewer, we included the up- and downwelling responses as schematically shown in Figure R1 below. The winds either increase or decrease the stratification near the coast owing to coastal up- and downwelling responses (with off-shore 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 with equatorward flow, Fig. R1 left) or homogenized (upwelling favorable wind, Fig. R1 right) depending on the alongshore wind.

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.

Line 176. 'a high surface CF zone in the northern area'. Is it a general feature in summer only? Why CF is high in the northern area? In general, the summer rainfall is much higher than that of the other seasons in the Korean peninsula and freshwater discharged from the rivers increases as previously reported (Bae et al., 2008; Kong et al., 2013). We believe that the nutrient loading associated with the river discharges in the northern coastal areas trigger blooms in summer, as often seen from relatively high GOCI CF in areas nearby river mouths (e.g., JJ, WS, SP, and HH).

Line 237. '4.2. Other mechanisms'. It would be better to add more discussion. More discussions were added in Section 4.2 of the revised manuscript as recommended by this and other reviewers.

Lines 275, 281, 286. Check 'Park et al., 2018'. Park and Nam, 2018 ? This has been revised as "Park and Nam (2018)".

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Line 297, '80%, 8 of 10'. It may not be conclusive. We counted the number of events where the (equatorward) alongshore advection plays a primary role in changing the CF at ESROB. 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 (both onshore and offshore advections). Thus, we concluded that all the summertime CF events at ESROB could be explained by the horizontal, not vertical advection, and local blooms were not triggered by biogeochemical mechanisms (nutrient loading or light availability).

Please also note the supplement to this comment:

<https://www.biogeosciences-discuss.net/bg-2018-183/bg-2018-183-AC2-supplement.pdf>

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