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Interactive comment on "Eddy- and wind-sustained moderate primary productivity in the temperate East Sea (Sea of Japan)" *by* G.-H. Hong et al.

Anonymous Referee #1

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In this study time series of fluorescence and hydrographic properties from a buoy in the Sea of Japan are analyzed together with remote sensing data. Although it is an interesting data set its interpretation is very confusing, conclusions are note well supported with observations and there are many inconsistencies along the text. Thereby, on my opinion, this work is not acceptable for publication in Biogeoscience.

(1) The main point of the work which is the increase of chlorophyll due to eddy wind-interaction at the eddy periphery side where the wind and current are in the same direction is misinterpreted and very poorly supported with observations. Two mechanisms have been proposed regarding the increase of chlorophyll at the eddy periphery, the non-lineal Ekman pumping mechanism-NLEP-(see Mahadevan et al., 2008, Science)

related to the non-lineal eddy-wind interaction and the differential advection of chlorophyll by eddies in a background gradient of chlorophyll-CH11 (Chelton et al,. 2011, Science). The Lee and Niller (1998) mechanism introduced by the authors applies for a jet a not for the eddies periphery although is very similar to NLEP. In the case of NLEP mechanism an upwelling-downwelling cell is generated in both sides of the eddy not only at the side where the wind and current flows in the same direction. This added to the advection will generate an increase of chlorophyll all along the periphery (a roughly estimate of the rotating period for a 100 km eddy is c.a 6-10 days) and not only on the side where wind and current are in the same direction as pointed out in the manuscript. The asymmetry on chlorophyll distribution along the eddy periphery observed from satellites has been recently attributed to the eddy differential advection in a background chlorophyll gradient and not to eddy-wind interaction (CH11).

(2)Is not consistent to correlate the velocity time series as obtained from altimeter data and wind times series for investigating eddy wind interaction at the periphery (Figure 10) as is a close to submesoscale range process. Altimeter data have not enough time and spatial resolution for inferring the signal of the periphery passage (submesoscale ïA¿ 10 km). Whereas the signal of the eddies passage is clear in the temperature time series the corresponding geostrophic velocity times series do not show any clear clockwise pattern suggestive of the passage of cyclones. This indicates that the resolution is not enough to resolve the velocity field near to the submesoscale range as required to distinguish the circulation between the center and the periphery. This lack of resolution produce that eddies appears to be bigger in the geostrophic velocity field derived from altimeter when compared with its signal in the SLA field (see e g Figure 3 of Sangrà et al., 2009, DSR).

(3)Interpretation of the observations is very confusing and sometimes contradicting. As an example in section 3.3 the 11 May chlorophyll peak it is said to precede the passage of an eddy which center cross the buoy by 29 of April and it is showed in the SLA by 15 April. However later on in Figure 10 the passage of this eddy is correlated with the broad spring maximum which is more likely related with the spring bloom as the authors also pointing out thus adding confusion and entering in a contradiction. Moreover first is commented that the increases of chlorophyll occurs preceding the eddies passage (section 3.3) and then in section 4.3 (Figure 10) it is showed that chlorophyll increase follows the eddy passage.

(4))There are many inconsistencies all along the text for example: Title. All the eddies analyzed along the text are outside the summer period. Page 4. Line 13-15.The horizontal current (Ekman) is four order of magnitude larger than the ageostrophic secondary circulation (vertical). Section 3.2. As showed in Figures 1 and 2 low salinity is related with high temperature and not the contrary as pointed out in the text Pag 20-Line 20-23 Authors refers to the "eddy pumping" process to the uplifting of the nutricline/isopycnals by cyclonic eddies. Eddy pumping mechanism may be more complex as a decaying cyclone/strengthening anticyclone may induce downvelling and a strengthening cyclone/decaying anticyclone may induce upwelling (see Klein and Lapeyre (2009) and reference therein) Pag 10-Line 6-7. The seasonal thermocline disappears in fall-winter being replaced by the winter convection mixed layer that develops above the main thermocline. Pag 12-Line 8-9.Gesotrphic balanced cyclonic eddies introduce a negative temperature anomaly thus the decrease in temperature must not be related with upwelled water.

My recommendation is to eneterily rewrite the manuscript introducing the next suggested changes:

Introduction: CH11 mechanism and different mechanism for vertical velocity inside eddies must be introduced see for example Klein and Lapeyre (ARMS-2009) and references therein

Show the eddies signal in the density field: derive density from temperature and salinity and substitute figure 1 and 2 by the density time series. Then locate the possible eddy signal passage. Temperature signal show the possible passage of five eddies (29

Apr,29 May, 28 Jun, 27 Aug). Check SLA and Â£MODIS? for those eddies

Chlorophyll time series: remove the seasonal trend and high frequency peaks and then correlate the resulting peaks with the eddies passage

Eddy-wind interaction: periphery enhancement of chlorophyll will depend on wind intensity and not on it direction. Correlate wind intensity with chlorophyll peaks and the eddy passage

Discussion: Discuss eddy passage with chlorophyll enhancement Â£for which eddies?Â£in the case of positive correlation is there a peak on the wind intensity?Â£is the enhancement symmetric or asymmetric?Â£enhancement by eddy-wind interaction or differential advection?

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