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# *Interactive comment on* "Impact of decadal reversals of the North Ionian circulation on phytoplankton phenology" *by* Héloise Lavigne et al.

**Anonymous Referee #1**

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General comments

Several phytoplankton phenology parameters, such as the chlorophyll maximum value in March, chlorophyll max increase, etc. are obtained from satellite imagery of the Ionian Sea and related to both the documented effects of BiOS cyclonic-anticyclonic circulation reversals in the basin and air-sea fluxes. This is done to demonstrate the high impact of this physical forcing on the Ionian Sea productivity. I find this paper extremely interesting and ground-breaking. A just biological "add-on" to the knowledge concerning BiOS phenomenology. The Authors have resorted to a varied and complex dataset to illustrate their results, indicating also good interdisciplinary teamwork. The



text is well-written (needs English improvement, though) and structured. It is clear and results seem to me more than solid, and very interesting. Especially, it is a sort of "eye-opener" indicating that biological/trophic monitoring CANNOT be confined to the coasts, as often happens: basin-wide variability is just as important to gain insight on e.g. changes occurring in the marine trophic chain. A similar study on secondary productivity (or fisheries) would be extremely interesting. Therefore, I recommend publication, after the minor corrections reported below. The list is long but they are mainly linguistic corrections.

Form

The English of the manuscript is reasonable but needs improvement. I tried to help with the list of corrections suggested below.

Particular comments and suggested text corrections

Abstract

Page 1

Line 12. Replace "regime with (hereafter "replace" = "->") "regimes". Lines 13-14. "the vertical dynamics and the nutrient distribution" -> "both vertical dynamics and nutrient distribution". Line 17. "time-series" -> "time series". No need for hyphen. Please change throughout the text. Line 19 and 20. "bloom initiation" -> "bloom onset". "Initiation" is more in a religious sense, in English. Line 20. "In the center of the gyre". Which gyre? Is it the North Ionian Gyre? If so cite it here, with acronym. Line 25. "model data" -> "model output".

1 Introduction

Page 2 Line 2. "satellite based" -> "satellite-based". Need a hyphen when an adjective is made of two or more words. Line 5. "nutrients availability" -> "nutrient availability". Adjective substantive always singular. Line 9. "whole" -> "overall". Line 15. "depress nutricline" -> "depress the nutricline". Line 16. "subtropical (subpolar) gyre"-> Replace

either with "a subtropical (subpolar) gyre" or with "subtropical (subpolar) gyres". Line 17. "which maintains the downwelling (upwelling)". To my knowledge, a stationary gyre, such as the great gyres of the oceans, doesn't cause up- or down-welling (vertical velocity should be zero in a common stationary case). It's a quasi-geostrophic, i.e. time-evolving situation that does. I do understand, though, that nutrients are kept more (less) distant from the surface at the center of an anticyclonic (cyclonic) feature, e.g. because of its depressed (uplifted) pycnocline. Please correct or comment (and provide reference). Lines 18-20. This is correct because upwelling (downwelling) is actually caused when a cyclonic (anticyclonic) gyre FORMS. Line 25. "time-life" -> "lifetime ". Change throughout text. Line 26. "spring" -> "the spring". Line 31. "(NIG, see Figure 1)". The NIG is absent from either Fig. 1 or its caption. Please highlight and describe it clearly. Line 34. "time-scale" -> "time scale". Non need for hyphen, change throughout text.

Page 3 Line 1. "feedback with the Adriatic Sea" -> add "(see below)". Line 3. "the vertical structure... have been" -> "the vertical structure... has been" Line 21. "during cyclonic" -> "during the cyclonic". Also, "downlift" -> "depression" or "lowering". There is no such thing as "lifting down". Change throughout text, please. Line 26. "initiation" -> "start"

2 Data and Methods

2.1 Satellite and modelling data

Page 4 Line 7. "8-day average maps time-series contains" -> "the 8-day average maps time series contains". Again, "map" is singular here, and no hyphen for "time series". Line 8. "80% of data" -> "80% of good data". Same for the 96% sentence. Also "linear" -> "a linear". Line 9. "Then, time-series". -> "Then, the time series". Line 21. "four air-sea fluxes components" -> "four air-sea flux components". Line 23. "as time-integral" -> "as the time-integral". Line 25. "Nucleous" -> "Nucleus". Line 31. "product performances" -> "product performance".



2.2 In-situ data

Page 5 Line 1. "from Coriolis" -> "from the Coriolis". Line 11. "nutrient depleted" -> "nutrient-depleted".

2.3 Phenological metrics

Line 14. "[Chl-a] time-series" -> "[Chl-a] remotely sensed time series" Line 16. "referred by" -> "referred to as". Line 19. "main growing period" -> "main growth period". Line 21. "trophic situation" -> "the trophic situation". Line 22. "March spatially" -> "March, spatially". Line 23-24. "Date of the" -> "The date of the". Line 24. "determine bloom initiation date although" -> " determine the bloom onset date, although". Needs an article and a comma. Line 25. "methodology... require then" -> "methodology... requires then" Lines 25-26. "8-day annual" -> "The 8-day annual"

3 Results and Discussion 3.1 Physical and chemical characterization of the NIG

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Line 3. "Time-series of ADT" -> "The time series of ADT" Line 4. "1992-1997." -> ""1992-1997. (Figure 2a)". Please cite figure right away, for the ease of the reader. Line 4 "Anticyclonic" -> "The anticyclonic". Line 6. "circulation was" -> "the circulation was" Line 7. "blooming period" -> "bloom" (suggested: "blooming period" in English sounds somewhat vernacular!) "ADT difference" -> "the ADT difference" Line 8. "Resulting values" -> "The esulting values"; "on Figure 2a" -> "in Figure 2a"; "referred in" -> "referred to in". Line 9. "Although, ICI" -> "Although the ICI". Add "the" and eliminate comma. Line 10. "by seasonal" -> "by the seasonal". Line 12. "small scale" -> "small-scale". Line 13. "2006, circulation" -> "2006, the circulation". Line 14. "On Figure 2b" -> "In Figure 2b". Line 17. "higher ADT value" - > "a higher ADT value". Line 18. "transition from an anticyclonic (Figure 2d)". I have difficulty in attributing an anticyclonic circulation to the ADT pattern of Fig. 2d. Could the Authors better illustrate this circulation? By eye, it doesn't seem conceptually (sign-wise) different from the cyclonic

pattens, though with less negative ADT values in the north. BTW I am OK with Fig. 2b's anticyclonic pattern, but Fig. 2d doesn't look like Fig. 2b. Line 20. "June 2012, NIG" -> "June 2012, the NIG". Line 21. "the period" -> "the periods". Line 22. "Resulting" -> "The resulting". Line 25. "to the cyclonic" -> "to describe the cyclonic". Line 29. "a steep gradient is observed" -> "a steep gradient, implying isopycnal southward deepening, is observed".

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Line 5. "when NIG" -> "when the NIG".

3.2 General patterns of phytoplankton phenology in the Ionian Sea

Line 12. "see Figure 4, D'Ortenzio" -> "Figure 4; D'Ortenzio". No need for "see"; "Highest" -> "The highest" Line 15. "lowest" -> "the lowest"; "from October" -> "starting in October"; "Date_GR_Max" -> "The Date_GR_Max". Lines 17-18. "between northern" -> "between the northern". çLine 18. "on the Hovmoeller" -> "in the Hovmoeller". Line 20. "centered on March" -> "centered in March"; "38°N-39°Nband" -> "38°N-39°N band": needs a space. Line 22. "of isopycnal" -> "of the isopycnal"; "during cyclonic" -> "during the cyclonic".

3.3 Impact of the NIG circulation on the [Chl-a] phenology

Line 26. "displays interannual average, over period July 1998 – June 2012" -> more simply: ""displays the July 1998 – June 2012 average". Also, eliminate commas. Line 27. "to interannual" -> "to such interannual". Line 29. "CHL_Year) with" -> better: "CHL_Year), indeed with". Line 31. "only March period is considered" -> "March only is considered"; "CHL_March" -> "the CHL_March"

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Line 1. "March which" -> "March, which". Line 4. "In South Ionian" -> "In the South Ionian". Line 5. "by BiOS" -> "by the BiOS". Line 7. "are anticipated by" -> maybe "are early by"? Not sure anticipated is OK. Pls check; "when circulation" -> " "when the



circulation". Line 15. "up to January" -> "to January"; "most of time-series" -> either "most time series" or "most of the time series" (no hyphen). Line 16. "generally few" -> "generally a few". Line 17. "of [Chl-a]" -> "of the [Chl-a]". Line 23. "as it can" -> "as can".

3.4 Role of the NIG circulation compared to the interannual variability in MLD (focus on the region S3)

Section title. I'm not sure about the title construction "Role of... compared to...", a little illogic. Maybe "NIG circulation patterns and MLD variability" or "Role of the NIG circulation in the variability of the MLD" or "The NIG circulation patterns compared to the ... MLD".

Line 27-28. "on the phytoplankton phenology" -> "on phytoplankton phenology". No "the" here. Line 28. "interannual variability also exists", maybe you should add "independently of the BiOS switch"? Do I understand well? Line 29. "to variability of ICI" -> "to the variability of the ICI". Line 31. "affect the bloom development" -> "affect bloom development". (or "the bloom's development") Line 32. "of late [Chl-a] peak" -> "of a late [Chl-a] peak".

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Line 1. "were anticipated to" -> "occurred as early as" or "were brought forward to". "to anticipate" means to expect something (check), not to occur early. Lines 2-3. "This...2012". Why don't Authors overplot buoyancy loss anomaly w/ respect to average in Fig. 6 and refer to Fig. 6 in sentences like this one? Once again, words are more cumbersome to digest without a figure. (Add another axis on the left with % difference buoyancy loss). Line 3. "compared to the average for the period 1999-2012" -> "compared to the reference 1999-2012 average". Line 4. "shallow winter MLD"-> "a shallow winter MLD"; "nutrients inputs" -> "nutrient inputs" Again, adjective-substantive always singular, even if nutrients are more than one type, in this case. Line 4. "to surface layer" -> "to the surface layer"; "consequently the spring bloom"->"consequently

hindered the spring bloom". Line 7. "spearman" -> "Spearman". Line 8. "to circulation regime" -> "to the circulation regime". Line 9. "of the [Chl-a]." -> "of [Chl-a]." No "the". Line 10. "is observed, only the year" -> "is observed: only the year". Line 11. "a ICI" -> "an ICI". Line 13. "circulation pattern" -> "the circulation pattern". Line 14-15. "when circulation is cyclonic and apparently affect" -> "when the circulation is cyclonic and apparently affects". Line 19. "uplift/downlift" -> "uplift/depression"; "cyclonic circulation" -> "the cyclonic circulation". Line 26. "overpasses" -> "overtakes in depth" or "lies deeper than". Line 31. "enlighten" -> "illuminated". Line 32. "in trades biome" -> "in the Trades' biome"

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Line 3. "wind driven" -> "wind-driven". Line 4. "that MLD" -> "that the MLD". Line 8. "nutrients supplies" -> "nutrient supplies". Line 9. "other not." -> "other not receiving such supply." Line 12. "Nitracline" -> "The nitracline"; "with difference density" -> "with the difference density"; "mg m-3" -> "kg m-3". Same corrections for the 0.03 case (add "the" and change to "kg m-3"). Line 15. "surface indicating" -> "surface, indicating". Line 17. "up to" -> "down to". Line 19. "a entrainment bloom (nutrient limited)" -> "an entrainment bloom (nutrient-limited)". What is an entrainment bloom? LIne 20. "light limited" -> "light-limited"; "initiation" -> "onset". Line 22. "shallowing" -> "shoaling". Line 23. "that phytoplankton bloom" -> "that a phytoplankton bloom" or " that phytoplankton blooms". Line 29. "MLD" -> "the MLD".

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Line 2. "light driven" -> "light-driven". Line 4. "make us conclude" -> "induce us to conclude". Line 5. " nutrient driven" -> "nutrient-driven". Line 6. " [Chl-a)" -> " [Chl-a]".

4 Summary and Conclusion -> 4 Summary and Conclusions

Line 10. "supply in the surface layer" -> "supply to the surface layer". Lines 10-11. "high all along the year" -> "high year-round". Line 13. "sustains phytoplankton bloom"



-> "sustains the phytoplankton bloom". Line 19. "and winter deepest MLD" -> "and the winter deepest MLD". Line 25. "large amount" -> "a large amount".

Figures and captions

Figure 2 caption. "(S1 – S2, see Figure 1c)" ->"(S1 – S2, see Figure 1b)". Fig. 3 caption. Maybe add "black dots indicate in situ stations used for the maps". Figure 4 caption. "satellite [Chl-a]" -> "8-day satellite [Chl-a]". Remind reader of temporal resolution. Figure 5. Even though you have units spec'd in the caption, I suggest you add the units on top of the palettes, i.e. mg m-3, month (this not strictly necessary) and %. Always for the ease of the reader. It can be done quickly, e.g. w/ Powerpoint. Fig 6. Characters are a bit small, in the Fig. Please enlarge (in view of drastic figure reduction by editorial process). Also, please add units on axes. Figure 7. Again, characters are small and isopycnal line almost invisible. Please enlarge chars, and thicken and change color to line.

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