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Biogeosciences Discussions

Interactive comment on "On the impact of the Bimodal Oscillating System (BiOS) on the biogeochemistry and biology of the Adriatic and Ionian Seas (Eastern Mediterranean)" *by* G. Civitarese et al.

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Ref. #1 comments and Authors answer

An articulated answer to the points 1, 2, and 3 has been already posted on the BGD page (see AC C3473). Section 4.2 of the ms. has been modified/implemented, according to the discussion already done.

The new figure added in the section 4.2 was numbered as Fig. 4. Consequently, the old Fig. 4 becomes Fig. 5.. The corresponding figure captions have been changed,

accordingly (see below).

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Minor Ref. #1 comments and Authors answers

Ref. #1 - Pag. 6973 Line 20: A more accurate plan of the paper should improve the readability of the manuscript.

Authors – The sentence (lines 21-25, pag. 6973) has been changed with the following:

Here, we will focus our attention on the possible impact of the BiOS mechanism on the biogeochemistry (chapter 3) and biology (chapter 4) of the Adriatic–Ionian system, in terms of decadal variability of the nutrient pool in the Southern Adriatic (section 3.1), and of nutricline dynamics in the Ionian Sea (section 3.2). In section 3.3 we revised the theory of "Adriatic ingression" formulated for the first time by Buljan in 1953. The impacts of the BiOS mechanism on the Adriatic and Ionian ecosystems (chapter 4) are illustrated in sections 4.1 and 4.2, respectively, with more emphasis on the possible impact on the Adriatic biodiversity (4.2.1). The Summary and Conclusions (chapter 5), and the List of Acronyms used in the text conclude the paper.

Ref. #1 - Pag. 6974, Line 8: Define here nitracline, as in figure 3.

Authors – The sentence (lines 8-10, pag. 6974): Nitracline distributions derived from nitrate data collected during the oceanographic campaigns are presented in Fig. 3.

Has been changed as follows:

Nitracline depth (depth of [nitrate]=3 μM) distributions derived from nitrate data collected during the oceanographic campaigns are presented in Fig. 3.

Ref. #1 - Pag. 6975 Line 9: A good paper to cite on this subject is Stratford K, Haines

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K (2002) “Modelling nutrient cycling during the eastern Mediterranean transient event 1987-1995 and beyond”. Geophysical Research Letters, 29, 10102-10106.

Authors – We agree with Ref. #1 to insert al least one reference concerning the NIG reversal in 1997. Nevertheless, in our opinion the two added papers cited in the text and in the References section are more relevant in addressing this issue:

Larnicol, G., Ayoub, N., Le Traon, P. Y.: Major changes in Mediterranean Sea level variability from 7 years of TOPEX/Poseidon and ERS-1/2 data, J. Mar. Systems, 33-34, 63-89, 2002.

Manca, B. B., Ursella, L., and Scarazzato, P.: New development of Eastern Mediterranean circulation based on hydrological observations and current measurements, Mar. Ecol., 23, Suppl. 1, 237-257, 2002.

Ref. #1 - Pag. 6977, Line 24: This sentence is not too clear. Maybe rephrase.

Authors – We have rephrased the sentence as follows:

The spatial pattern of the horizontal distribution of the nutricline depth is similar for 1991 and 1995. Klein (1999) invoked the impact of the CSOW in uplifting the nutricline in 1995, but this mechanism cannot be responsible for the 1991 distribution since at that time the CSOW was not present in the area.

Ref. #1 - Pag. 6993 Figure 2: Could you indicate on the figure the years of observed deep convection in the South Adriatic area?

Authors – The winter convection occurs almost every year. What changes is the intensity of the process, in terms of the vertical mixing penetration, and of the numbers of mixing/restartification events. During the observation period, only in 1997 the convection was almost absent (Gačić et al., 2002). On the other hand, intense convection

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occurred in 1999, 2005, 2006, and 2007. A comment on these results was already posted on BGD page (see AC C3473) and, as suggested by Referee #1, we have implemented the section 4.2, accordingly. Since we do not have extensive information about the vertical mixing penetration and the number of mixing/restratification events during the whole time series, we are not able to indicate the characteristics of all convection processes. Anyhow, the relevant information are provided on section 4.2.

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Ref. #2 comments and Authors answer

We have modified/integrated the ms. as indicated in our answer posted on the BGD page (AC C3630), according to the Ref. #2 comments and suggestions.

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Other revisions

Fig. 5 (former Fig. 4): we added an asterisk, both on Fig. 5a and b, relative to the productivity decrease and increase, respectively. A note in the figure legend refers to the main text (section 4.2) for more detailed explanations (see Fig. 5 legend below).

We have re-numbered the two Tables as: former Table 1 becomes Table 2, and former Table 2 becomes Table 1.

Some references in Table 2 (former Table1), previously not included, have been added in the References list.

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Figure Legends

Figure 1. Study area. Red line and red ellipse indicate the area from which the data used in the averaged time series were collected.

Figure 2. Time series of salinity in the Southern Adriatic and nitrate in the Southern

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Adriatic and in the northeastern Ionian averaged over the depth of the 200-800 m layer. For clarity, data are fitted by polynomial curves.

Figure 3. Nutricline (depth of [nitrate] = 3 μM) horizontal distributions in the Ionian Sea in (a) 1987, (b) 1991, (c) 1995 and (d) 1999. Depth in meters.

Figure 4. SeaWiFS 8-day average Chlorophyll a concentration time series for the area (41.5°N-42.0°N, 17.5°E-18.0°E) in the SA (data produced by NASA at http://reason.gsfc.nasa.gov/OPS/Giovanni/ocean.swf8D.2.shtml#description). Red rectangles indicate periods with intense biomass blooms.

Figure 5. Summary of the main characteristics of the Adriatic–Ionian BiOS and its impact on the area. (a) cyclonic NIG; (b) anticyclonic NIG. * For more detailed explanations, see main text (section 4.2). For acronyms, see main text.

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Reference

Gačić, M., Civitarese, G., Miserocchi, S., Cardin, V., Crise, A., Mauri, E.: The open-ocean convection in the Southern Adriatic: a controlling mechanism of the spring phytoplankton bloom, Cont. Shelf. Res., 22, 1897-1908, 2002.

Interactive comment on Biogeosciences Discuss., 7, 6971, 2010.