Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2019-349-RC1, 2019

Biogeosciences Discussions
Open Access
EGU

Interactive comment on "Anoxic monimolimnia: Nutrients devious feeders" *by* Areti Gianni and Ierotheos Zacharias

Anonymous Referee #1

Received and published: 4 November 2019

The authors present data from time series measurements in a small, semi-enclosed, stratified basin with anoxic conditions prevailing in the bottom waters for most of the time. In addition to the regular monitoring the authors present data from a sampling directly after a winter storm that apparently lead to a breakdown of the stratification in the estuary and transport of the anoxic bottom waters to the surface, which was associated with strong environmental impact and massive fish kills.

The basin comprises an interesting setting where the impact of anoxic conditions and their ventilation on estuarine habitats can be studied in detail. The authors present data from well-established parameters that are generally well suited to characterize the conditions in the basin before and after the storm event.

However, the manuscript is rather descriptive, and lacks a more detailed discussion of

Printer-friendly version

Discussion paper

the biogeochemical and particularly the physical mechanisms accompanying the water column turnover in the basin.

First of all, I am missing a detailed discussion on the water column circulation in the Aitoliko basin in general and particularly during the storm event. What is the general circulation pattern of the waters in the Aitoliko basin? What is the role of the fresh water discharge from the pumping station? To which extent can this water be seen in the T,S distribution? Does the water discharge from the pumping station lead to a general net outflow of water from the Aitoliko basin?

It would furthermore be good if the physical conditions before and after the storm event are discussed in more detail. E.g. it would be good to know temperature and salinity conditions before the storm event. Do the data presented here allow that the authors give a time line of the relaxation process after the storm event? In their conclusions, they state that the restoration of the geochemical conditions takes several weeks to months and that the recolonization takes even longer. However, these conclusions are neither supported by the data presented in the manuscript not referenced sufficiently.

On page 14, the authors state that waters from the Messolonghi Lagoon that are forced into the basin cause disturbances in the water column of the Aitoliko basin. It would be useful if the authors could give some information on the characteristics (e.g. temperature, salinity (i.e. density), oxygen and nutrient concentrations) of the inflowing waters from the Messolonghi lagoon. Can the Messolonghi waters be traced back in the T,S profiles of the basin after the storm event? Figure 6 indicates that the bottom waters of the basin are pushed upwards in the northern part of the basin. – is this a result of the Messolonghi water inflow?

I am also wondering if the stratification that can be seen in Figures 5-7 reflects the fact that the turnover of the water body in the basin is indeed not complete, and that the processes related to the storm event could partly be described by advective rather than by mixing processes.

Printer-friendly version

Discussion paper

If this is the case, the authors should revise the paper accordingly (the term "total mixing event“ might be misleading).

I would furthermore assume that an inflow of Messolonghi water leads to a concurrent outflow of (surface) water from the Aitoliko basin – how does this exchange of waters affect the nutrient budget of the basin?

To estimate the importance of storm events for the basin‘s turnover it would furthermore be useful to quantify the number of storm events over time and to relate the time series data to the sampling from the storm event. Specific comments:

Title: I found the title somewhat cryptic and would suggest to change it to something that is more descriptive to the study.

Page 1, Line 17: replace "water column total mixing“ with "complete mixing of the water column“

Page 1, Line 19: "the basin becomes anoxic“ I would be careful with the term "anoxic“ here. I agree the authors that the transport of anoxic bottom waters to the surface causes the environmental disturbances and the observed fish kills associated with "anoxic events“. However, this does not necessarily mean that the entire basin becomes anoxic. The data shown in Figure 6 indeed indicate that not the entire basin is anoxic after the storm event.

Page 1, Line 20: replace "interface“ with "intermediate“

Page 1, Line 20: replace "promoting“ with "promote“

Page 1, Line 21-22: "Bottom layer can [. . .] stratification“: this sentence is somewhat contradictory to the hypothesis stated in the previous sentences where it is stated that "storm events can result in water column total mixing“. If the water column is completely mixed, this means that the stratification is broken up. Please specify how the mixing through storm events affects stratification and nutrient supply to the surface waters.

Page 4, Lines 5-6: "The importance [. . .] has emerged.“ It is not clear to me what the authors are referring to.

Page 5, Lines 5-6: This sentence should be rephrased. "Large freshwater inflows arise from...“

Page 5, Line 6: replace "are implicated both for the“ with "implicate both the“

Page 5, Lines 11-13: How were the sensors calibrated?

Page6, Lines 9-10: were the daily mean wind speed data used in the analysis at all? In the discussion of the storm event,

Page 6, Line 23: replace "studying“ with "studied“

Page 14, Line 3: replace "these winds caused, the forcible enter...“ with "these winds forced water from the Messolonghi lagoon to enter the Aitoliko basin, disturbing“

Page 16. Line 18: replace "mean ammonium concentration determined at the 10 surface meters“ with "mean ammonium concentration in the upper 10m“.

Page 17, Line 1: "About 0.8 mg/l ...“ is this the H2S concentration at 10m or the mean concentration in the upper 10m?

Page 18, Line 1: replace "are referred in“ with "report“

Page 18, Line 2: " H2S sulfide release“: delete "“sulfide“

Page 18, Line 9: when did the deepening of the sill between Messolonghi lagoon and Aitoliko basin take place?

Page 19, Lines 1-19: the description of the historic conditions in the Aitoliko basin should go into the introduction section.

Page 20, Lines 19-21: is this statement correct? The profiles shown in Fig. 7 show a clear Chlorophyll b maximum in the bottom water.

Printer-friendly version

Discussion paper

Page 21, lines 21-27: "This increase could be [. . .] external loading scenario“. This paragraph should be rephrased. For me it was hard to perceive the conclusion of the authors that the D6 pumping station indeed does not explain the increased PO43- inventory at station A9.

Page 22, line 17: "The spring [. . .] and was enhanced in the anoxic layers of the Aitoliko basin.“ This sentence does not make sense to me.

Page 23, lines 2-3: "Hydrogen sulfide [. . .] algal blooms“: the data shown in the manuscript do not necessarily support this statement. The nutrient profiles (Fig.7) show a clearly stratified water column. Compared to the time series data shown in Figures 2 and 3 the surface water nutrient concentrations are relatively low. I agree that Chlorophyll a and c concentrations in the surface are enhanced, but for a full interpretation of the impact of the storm event it would be necessary to know the conditions before the storm.

Fig. 2C and D: is it correct that Fig. 2C shows the distribution of nitrate over time, while Fig. 2D shows the nitrite inventory in the surface layer at station A9 and not the corresponding nitrate inventory? If this is the case, I think it would make sense to add two more panels to the Figure that additionally show the nitrite distribution and the nitrate inventory.

Table 1: I found it confusing that Table 1 shows H2S concentrations and not PO43- concentrations together with the discharge rates of the D6 pumping station. In the discussion section, it is the PO43- concentration which is discussed in relation to the fresh water discharge, not the H2S.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2019-349, 2019.

Printer-friendly version

Discussion paper