Biogeosciences Discuss., 6, C3349–C3353, 2009
www.biogeosciences-discuss.net/6/C3349/2009/

Biogeosciences Discussions

Interactive comment on "Dynamics and distribution of natural and human-caused coastal hypoxia" *by* N. N. Rabalais et al.

L. Farias (Referee)

lfarias@profc.udec.cl

Received and published: 2 December 2009

General observation

The manuscript entitled: "Dynamics and distribution of natural and human-caused coastal hypoxia" by Nancy Rabalais and co-authors contains an exhaustive revision of hypoxic systems. It covers both oceanic and coastal areas as well as suboxic and even anoxic systems such as the Black Sea and the Cariaco Basin. The ms also discusses the ecological implications of hypoxia and analyzes future scenarios of changes (including local and global scales). Thus, the title does not reflect the content of the ms, nor does the abstract reflect the analysis, interpretation, or comparisons therein. Rather, the latter is a description of two kinds of hypoxic systems (i.e., natural and human-induced hypoxia).

The authors have not quite succeeded in merging the considerable amount of case studies on natural and human-induced oxygen-deficient waters into a clear structure. It is so long and is not at all easy to treat such a huge and complex data set.

First of all, I have concerns regarding the use of the term "hypoxia" in this review. The authors defined hypoxia from a physiological point of view, that is, in terms of the effect that oxygen-deficient waters and sediments have on the physiology of organisms (in this case, multicellular eukaryotic organisms). Moreover, the term "normoxic" or "hypoxic" is used to refer to organisms, not the environment. Also, when mentioning a metabolism in relation to oxygen levels, the terms anaerobic (facultative or obligate organisms), aerobic, or micro-aerophilic must be used. However, when describing the environment, the terms oxic, hypoxic, suboxic, and anoxic should be used. It is important that this special volume use a standard definition for the levels of hypoxia in an environment regardless of whether said condition affects an organism, population, community, or ecosystem. This is particularly important for the SCOR working group 128. Personally, I think that since we are dealing with the marine environment, there should be a discussion about this with the SCOR group and the editor. Furthermore, the units of oxygen concentration should be consistent; at present, different units are used throughout the text (e.g., mg L-1, uM). I am not familiar with reporting oxygen concentrations in mg L-1. Consistency is important, and when reporting data from other studies, it is sometimes necessary to transform the units. Aditionaly, salinity should be given without units. The abbreviation psu means practical salinity scale and is not a unit.

In the second place, the authors describe many systems in one ms. Therefore, they address not only coastal systems but also open ocean systems. The paper lacks a narrative thread; it is very difficult to address simultaneously the processes related to the maintenance and dynamics of hypoxia. In the same sense, long-term impacts and consequences are not comparable due to different spatial and temporal scales. No doubt, human-impacted systems are better described than natural systems. Most of

the graphs (except Figure 7) present information on human-induced systems. The use of tables could help summarize the information and facilitate comparisons between all the described systems. Remove section 8.8 “other coastal and oceanic areas”. It does not contribute

Regarding the analysis of global climate change (GCC) and future expectations (p. 9403), although mean global ocean temperatures should go up with GCC, in some coastal areas they may drop due to changes in wind patterns (see Bakun). For example, in eastern boundary current systems, the predicted higher temperature gradients between the land and ocean would increase upwelling-favorable winds, promoting an intensification of the coastal upwelling process and, hence, the cooling the coastal ocean. In this scenario, there should be less precipitation and, therefore, less river runoff (dryer conditions on land). However, oxygen levels would still decline due to the increased upwelling of low-oxygen subsurface waters. Thus, the authors should mention that changes in mean global conditions could have different and even opposite local responses depending on the geographic area (see figure 25, wind?, increase or decrease?).

I suggest separating the ms into two: one that describes natural systems and another that deals with human-induced systems. Besides, I propose describing and grouping case studies by similarities. For example, ecosystems could be classified according to their geomorphology. For example:

Introduction

Terminology (include a Table with different hypoxia criteria)

1.-Natural hypoxic systems

1.1 Origin and maintenance (Not use the term dynamic)

1.2 Water processes (ecological or biogeochemical?)

1.3 Sedimentary processes

2.-Cases of study

-Eastern boundaries (e.g., coastal upwellings is most of the time associated with EBC and always have OMZs). To group section 4, 5 and 6 under a same point of analysis

-Closed and semi-closed basin (e.g.,Cariaco and Santa Barbara basin)

-Inland sea (e.g., Black Sea)

3.-Global change and future expectation

Ocean circulation, stratification, etc. etc

2. Human induced hypoxia

origin and maintenance

Water processes (ecological or biogeochemical?)

Sedimentary processes, Cases of studies (follow, for example, a geo-morphological criteria)

-drainage basin (river basin as Mississippi river, Chesapeake bay, Tampa Bay)

-Inland sea (Baltic sea)

-Marginal sea (East China Sea, Adriatic Sea, North Sea, etc)

Reversal, or not, human caused hypoxia

Approaches and implication of nutrient reduction

Global chance and future implication

Increases in eutrofication driven hypoxia, increase/decrease in the runoff, etc,

Conclusions

Minor observations

No comments will be given on grammar, as I am not a native speaker. (I do not feel qualified to make them.)

Please, include integrated and comparative tables. One table should present the criteria for hypoxia levels (e.g., environmental, biogeochemical, geofacies, etc.) and the corresponding references. Another table should describe all the case studies presented in the text: location, type of system, biogeochemical and physiological impacts, how they were recorded or observed, if they are undergoing remedial actions, etc., etc.

Best Regards

Laura Farias

Interactive comment on Biogeosciences Discuss., 6, 9359, 2009.