

Interactive comment on “Natural and human-induced hypoxia and consequences for coastal areas: synthesis and future development” by J. Zhang et al.

Anonymous Referee #1

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This biogeochemically-oriented review on hypoxia includes a comprehensive, well integrated synthesis of the state of the science of coastal hypoxia, including considerations of spatio-temporal variability, natural and human causes, impacts of hypoxia on coastal biogeochemistry and ecology, resilience and recovery of ecosystems affected by hypoxia, and identification of gaps in our understanding of hypoxia, and recommendations for future research. The emphasis in this review was on characterizing natural as well as human induced hypoxia in coastal environments occurring on temporal scales ranging from episodic (irregular occurrence) to persistent (hypoxic events taking place over a time scale long enough to cause damage to the biota) and with spatial dimensions from tens to tens to hundreds of thousands of square kilometers. In addition, paleo-

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and historical information on hypoxia from sediment cores was included in this synthesis. Lastly, the authors have made an effort to identify the requirements for observing and modeling hypoxia and its impacts in coastal systems; and they have documented synthetic publications that integrate results from the efforts listed above.

While it is mentioned in the introduction and sprinkled throughout the text, the article needs to specifically address the short- and long-term impacts of climate change (warming, altered rainfall and freshwater discharge) on hypoxia. It is anticipated that these elements of global change will have a strong influence on the frequency, magnitude, temporal and spatial extent of hypoxia. Furthermore, climate change interacts with human disturbance (and changes therein) in many watersheds. These interactions need to be identified and clarified if improvements in management in coastal watersheds are to be realized. There is some limited discussion on this topic on P. 28, but this is at best superficial and neither informative nor well-integrated.

Specific Comments:

On P. 4, top of second paragraph, it is stated that “The earliest systematic records of coastal hypoxia appear in literature from Europe and North America in 1910-1920.” Can the authors provide documentation of this?

P. 5, 2nd paragraph, line 5. omit “by bacteria” from this sentence. Algae and higher plants can function heterotrophically as well.

P. 8, line 2. Do the authors mean to say “models” instead of “modules”?

P. 11, line 16. Omit “Note that”. Line 6 from bottom, omit “Coastal” at the beginning of the sentence.

P. 12, 2nd paragraph, line 1. Change “Coastal eutrophication develops in the area adjacent to the river discharge” to “Coastal eutrophication often occurs in waters receiving river discharge”. Line 5. Change “vegetations” to “vegetation”. Line 6. Change “fresh-water” to “freshwater”. Line 9. Change “deep” to “deeper”. Bottom line. Change

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“modulates” to “modulate”.

P. 13, top of page. Expand the discussion of effects of climate variability on coastal hypoxia.

P. 17, line 10. Change “environment” to “environments”.

P. 18, 2nd paragraph, line 8. Change “is” to “are”.

Figure 3, is at best inferential. There are many products of human activities; pollutants, sediment loads, increased freshwater discharge due to channelization, that have increased over the time span indicated. They all correlate in one fashion or another. I did not find this figure very helpful.

Interactive comment on Biogeosciences Discuss., 6, 11035, 2009.