Biogeosciences Discussions

Interactive
Comment

Interactive comment on "Annual hypoxia dynamics in an enclosed gulf" *by* K. Kountoura and I. Zacharias

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Dear Referee,

I would like to thank you for your comments and for giving me the opportunity to correct the manuscript. I am not a native speaker and sometimes I don't realize some of my English errors. You are absolutely right, and I am willing to correct the manuscript title and some lines where I mentioned enclose gulf. As you have seen from all the analyses and the maps we presented, Amvrakikos gulf is a semi-enclose gulf and not enclosed. I believe that you should not base your judgment on such an error. Semi-enclose is what we mean. It is also clearly mentioned in line 7 when we describe the study area. In the following paragraphs you will see that I have answers to all your comments and I believe that when you will read them, you will reconsider your recommendation.

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GENERAL COMMENTS

First of all, I would like to remind you the description of the site. Amvrakikos gulf is a typical semi-enclosed gulf situated in north-western Greece. It is separated from the Ionian Sea by a beach barrier complex and its only connection with the open sea, is a narrow strait, 600m wide. In the Ionian Sea, the tidal range is about 1m. In contrast St. Lawrence estuary is a completely different environment. It is a semi-eclosed estuary with a very wide connection to the ocean. It has at least two connections to the ocean, the Strait of Belle Isle (17 km wide) and the Cabot Strait (104 km wide). It is connected to the Atlantic Ocean, where the tidal range is about 10m. From what I understand, the lateral advection from the connections to the sea is very different. So what I describe here is not what you used to know from the estuaries and fiords of the ocean, but a completely different system with very low energy. I agree with you that many fiords have well oxygenated bottom layer due to lateral intrusion, but with tidal range and connections, many times higher than what we have in the Mediterranean, the Baltic or in the Black sea. There is no information in the literature for such systems. Please inform me, if you know otherwise.

SPECIFIC COMMENTS

You wrote that the methods and the model testing are incomplete. I disagree. Please read some of my papers to realize that I am calibrating, validating and statistically explore my results, before I publish them: 1) Gianni, A., & Zacharias, I. (2012). Modeling the hydrodynamic interactions of deep anoxic lagoons with their source basins. Estuarine, Coastal and Shelf Science. http://dx.doi.org/10.1016/j.ecss.2012.04.030 and 2) Zacharias, I., & Gianni, A. (2008). Hydrodynamic and dispersion modeling as a tool for restoration of coastal ecosystems. Application to a re-flooded lagoon. Environmental Modelling and Software, 23(6), 751-767.

I have done the same in this paper. I just didn't think that it is worth to write the model details. The reason for this paper was the description of the hypoxia dynamics of such

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unique gulfs. It was not the description of MIKE 3. As you can see from my refs, I have been working with model validation for years. Here, I focused on the stratification, the circulation pattern and the oxygen distribution, not on the model description. So if you be more specific I can send you all the parameters used for the equations 1-6 and all the calibration details, but I don't think that it should be included in this paper. Reading the following comments I realize that you didn't notice carefully the model configuration. The model is three dimensional, its spatial discretization of the primitive equations is performed using a cell-centered finite volume method. In the horizontal plane, an unstructured mesh is used, while a structured mesh is used in the vertical domain. It is a model created by Danish Hydraulic Institute and it is well documented in the literature. In the present case I have used 22 layers and a detail grid of about 8.500 elements. I have also used a coarser grid to simulate the yearly circulation and a detailed grid to simulate the monthly effects. You are absolutely correct when you ask for a year of simulation, but not in such grid. The computational time for just one run, for one month real time, takes almost 20 hours of computational time. We have done more than 150 runs, to validate the model in the detailed grid. So you realize, the amount of computational time we need. It is impossible to run the model for a year. What is efficient to do, is to run a "small" model for a long time and the detail one for a certain problem, for short time. This is what we did. What we present in the manuscript is what we think appropriate. If you want any runs, of any particular time, please ask for it. According to our qualitative phrases, I agree with you and I can correct them as you suggested.

The next comment about the manuscript being a data report, I do not agree with it, at all. This manuscript includes a year of measurements, model simulations based on the measurements, model calibration and validation and a proposed circulation pattern for such hypoxic systems. Is that a data report? I do not think so. If you insist please give me suggestions.

About the analysis of the mechanisms contributing to hypoxia. This manuscript deals

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with the annual hypoxia dynamics, not with the mechanisms contributing to hypoxia. This is a different subject. You must realize that if we have put all the information you asked for, in the text, all about the methodology description, the model validation and the mechanisms contributing to hypoxia, the manuscript would have been very long. If you need a few additional paragraphs with the mechanisms, I would be more than happy to write it.

It is not nice to write comments such as "The use of the model results is deceptive". Please ask for detailed model results. I can send you all the information I have, to help you for your review. But I don't know how to deal with such comments. My objective is not to give deceptive results, but to present you an idea which I strongly believe in. You don't have to accept it, but you have to believe me. So please ask for proofs, don't write such comments.

Finally I would like to say that I respect this journal as much as you do. I can send all the information needed, in order, to review the paper correctly. If you are not satisfied with my answers, then reject the manuscript, but first listen to my replies.

Sincerely,

I.Zacharias

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