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Biogeosciences Discussions

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

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GENERAL COMMENT

The main goal of this manuscript is to determine whether other physical processes, besides vertical mixing, can oxygenate bottom waters in an enclosed gulf. This appears to be a legitimate and interesting question to address. However, the main conclusion of the research is not new and in fact inconsistent with the premise of the research. The authors conclude that in an "enclosed gulf" subject to little vertical turbulent oxygenation, the lateral exchange with the open sea (!) can provide well oxygenated bottom water. Well, if the gulf is enclosed I don't see how this is possible. So obviously, the gulf into consideration is semi-enclosed but then the conclusion is not at all surprising or new. Consider for example the semi-enclosed Gulf of St. Lawrence that is also subject to hypoxia and where vertical mixing is too low to oxygenate the deep bottom water. It

is well documented that the main supply of deep water oxygen in that system comes from lateral advection from the open sea. This lateral advection is driven by an estuarine pressure gradient, i.e. a density difference between the gulf and the open sea. Many fjords also have well oxygenated bottom layer due to lateral intrusion with the open sea. There is unfortunately really not much content in this manuscript to deserve publication in a primary journal such as Biogeosciences. I recommend its rejection.

SPECIFIC COMMENTS

The Methods and especially the model testing is incomplete and not acceptable for publication. There is a lot of details missing in the description of the hydrodynamic model. For example, it is mentioned that the model is closed with a turbulent closure scheme. Which one? What parameters were used? Most variables are not defined in equation (1) to (6) and many details regarding how the forcing and boundary conditions were implemented are missing.

The model validation is too qualitative and inappropriate. The authors have field observations from September 2010 until July 2011. Yet, they chose to "validate" their model starting with an initial condition for January 2011 and comparing the results with the February 2011 data. A proper validation would use all available data and start the simulation in September 2010 and run it until July 2011 and statistically assess the performance of the model for all periods in between where observations are available. Qualitative phrases such as "... the model simulates quite well the boundaries of the halocline ...", " ... it is clear that the model can simulate the temperature conditions...", "... the range of observed temperatures is slightly different than the measured data...", "... the simulated surface elevation is almost the same as that measured ...", "... we can assume that the model is able to simulate the circulation and stratification patterns..." must be avoided in a scientific paper of this sort. All these claims must be quantified with appropriate statistics.

The observations presented are interesting but only of regional interests. These ob-

servations are presented more like a data report. There is not enough analysis made to draw more general conclusions about mechanisms contributing to hypoxia in this system.

The use of the model results is deceptive. There is no analysis made of the model results. The reader is left to wonder how the schematic diagram of Fig. 8 was put forward. A modeling study of this sort would need to show examples of the modeled circulation, examples of modeled inflow events, the modeled seasonal variations of the stratification, sensitivity analysis to poorly know parameters, etc. The only model result presented is Figure 7 but this figure does not tell much about the circulation, the seasonal variability or the mechanisms responsible for lateral oxygenation.

TECHNICAL CORRECTIONS

The manuscript is not yet at a stage to propose specific technical corrections.

Interactive comment on Biogeosciences Discuss., 9, 5049, 2012.