

Interactive comment on “CO₂ exchange in a temperate marginal sea of the Mediterranean Sea: processes and carbon budget” by G. Cossarini et al.

Anonymous Referee #1

Received and published: 30 September 2012

Review of the manuscript: CO₂ exchange in a temperate marginal sea of the Mediterranean Sea: Process and carbon budget. G. Cossarini, S. Querin, C. Solidoro. Submitted to Biogeosciences

The submitted manuscript addresses the important problem of describing and quantifying the role of coastal shallow seas in modulating the Atmosphere-Ocean CO₂ exchange. It does so through the Adriatic Sea implementation of a coupled physical biogeochemical numerical model.

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Although the issue is an important one and the use of the numerical tool is needed in the assessment of biogeochemical processes I do not think I can recommend publication, as the assessment of the methodological tool in reproducing features of the Adriatic Sea functioning is not carried out at sufficient depth. Without an extensive quantitative assessment of the results all the paper conclusions remain very questionable.

I list below my main remarks at the base of the above decision.

1) The physical model is based on the MIT model implemented in the Adriatic Sea. I understand that there is another (but unknown to me) paper based on the results of the physical simulations, but the submitted manuscript I have at hand does not allow to assess the quality of the physical results of the model in terms of circulation patterns and seasonal variability.

2) The same should be said of the biogeochemical model. Such model is described elsewhere and it has been tested in a 0-D mode. NO assessment is provided here (and there) of the behaviour of the model in a coupled mode.

3) The paper does not give any indication of the numerical coupling technique used to put together the two (physical and biogeochemical) models. On-line or off-line? If off-line which frequency of the physical fields update has been adopted? Operator or source splitting? Numerical scheme to carry out the temporal integration? None of the above is made known to the reader. The coupling technique issue is a very important one and it is receiving increasingly attention (see for instance, but not only, Butenschoten et al., 2012)

4) The only attempt to provide a sort of model validation is made through the production of a table comparing simulated and observed averaged values claiming “consistency” between observations and simulations. Considering that the simulated (2007 and 2008) are covered by satellite observations (ocean colour and SST) a more quantitative objective comparison and validation (e.g. Stow et al., 2009) should have been mandatorily carried out.

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5) The model lack of a full sediment biogeochemical model (likely to be very important in studying the CO₂ dynamics in a shallow sea). This limitation in the model structure can seriously affect the final results. Unfortunately not much is said about the role of this lacking process in affecting the final budgets.

Other issues:

Section 2.3 page 6 lines 28-30, page 7 lines 1-2. Why using wind data from ALADIN and heat flux from MFS?. Please explain. I might be wrong but this may generate inconsistency in the forcing.

Section 3.1 page 7 lines 9 and 16. What do you mean with “normal climatology”? please explain your concept of “normality”.

Section 4.1 differences in winter PP and NCP should be shown (see page 11, line 11). The same applies to spatial variability (page 11, lines 17-20).

References mentioned in the review

Momme Butenschön, Marco Zavatarelli, Marcello Vichi (2012) Sensitivity of a marine coupled physical biogeochemical model to time resolution, integration scheme and time splitting method *Ocean Modelling*, Volumes 52–53, August 2012, Pages 36-53

Craig A. Stow, Jason Jolliff, Dennis J. McGillicuddy Jr., Scott C. Doney, J. Icarus Allen, Marjorie A.M. Friedrichs, Kenneth A. Rose, Philip Wallhead Skill assessment for coupled biological/physical models of marine systems *Journal of Marine Systems*, Volume 76, Issues 1–2, 20 February 2009, Pages 4-15

Interactive comment on *Biogeosciences Discuss.*, 9, 10331, 2012.