**Ocean Science
Discussions**

Interactive comment on "Development of Black Sea nowcasting and forecasting system" by G. K. Korotaev et al.

G. K. Korotaev et al.

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First of all we appreciate referee comments and would like to take all of them into consideration. We believe that the manuscript will be better after the revision.

First referee general comments:

'several geographic locations are cited, but the paper lack of a geographical map reporting their positions and possibly other information like bathymetry and main circulation features already known' some oceanographic features produced by the model are defined as correct, but in the paper there is no indication about general circulation and oceanographic characteristics of the Black Sea neither correspondent sea-truth data.'

We are very grateful for this comment. We will extend the description of the Black Sea

geography and the most important features of the Black Sea dynamics and ecosystem.

'E.g., Sec. 2.2 ends with: "The Rim current frontal zone can be clearly seen in the left part of the section. The deepening of the thermocline as well as the Rim current jet is attached to the bottom slope. Thus the simulated fields are in a good qualitative agreement with observations. General features of the basin dynamics and stratification are well presented by model results.". But in the text the cited observations are not shown, and nothing is said about what is known "of the basin dynamics and stratification".'

We will pay particular attention to the description of processes which are considered as an important for the qualitative calibration of the model.

'Moreover, the quantitative model calibration section is quite poor in terms of quantitative analysis: mainly standard deviation is used, but wider use of other indexes (like Root Mean Square Error, Mean Bias, cross-correlation, etc.) would provide deeper indications. I know that ECOOP and/or MyOceans projects include a Workpackage dedicated to define and to distribute common methods and tools for model evaluation; it seems that no outcome has been used in this work nevertheless the described Black Sea system is part of such projects.'

We are also going to extend the quantitative model calibration including the comparison of simulations with IR SST and profiling floats which were available in the Black Sea during ECOOP. A full set of the statistical indexes will be evaluated according to the reviewer recommendation.

'Also Sec. 4.1 (.1 is missing in the test) Calibration of Ecosystem model is very poor in terms of data comparison (a seasonal cycle as the one in fig. 14, but deduced by data, would be needed).'

Unfortunately the Black Sea region is very poor with biological and chemical in situ observations which are suitable to calibrate the model. Particularly very few data are available during the last decade. That is why we calibrated the ecological model based

on space sea color data and a general knowledge of typical seasonal cycle of major compartments. We will try to extend calibration involving more observations about the vertical structure of simulated fields.

'Considering what written up to know, at present state of the paper the following part of the Conclusion does not appear justified: "Together with the circulation model it allows describing evolution of the Black Sea ecosystem. The models have been subject to the qualitative and quantitative tests, which are the essential part of the system. Archive climatic, hydrographical surveys data and measurements from the drifter and profiling floats were used for the models calibrations. Calibration tests showed reasonable accuracy of the system products.". The paper would also benefit of a Discussion section in which current weakness and possible future improvements of the system are treated.'

We are going to replace short Conclusion section by a more extended Discussion section to treat current weakness and possible future improvements of the system.

Specific comments:

'page 4, second par: how are POM results used "for improving the upper layer thermodynamics in the MHI model"?'

We have in mind the use of Mellor-Yamada turbulent model in MHI model which appears to improve description of the processes in the upper layer. We will make the description more clear.

'nothing is said about models initialization, apart a general statement in the Introduction which is not clear if it would be applicable to the Black Sea system;'

The model is initialized once by climatic data. Then we reinitialize it by means of optimal interpolation when new data are available. We will include some description of models initialization.

'the final phrase of Sec. 2.2 would need more considerations. If without assimilation of

climatic profiles there is a "slow sliding of the model to its own climate", a better model calibration would be needed. It would be interesting to know the order of such "sliding" and how it compares to possible deep waters natural trends;'

The Black Sea nowcasting/forecasting model assimilates in the real-time space altimetry and space SST. SST influences only upper layer thermodynamics. Space altimetry is used only to correct topography of isothermal and isohaline surfaces. The model stratification is initialized once (see previous comment) by the climatic data. Therefore the basic stratification of the basin is simulated by the model. The model is not perfect and after long enough integration it slides to its own climate. Typical trend is about 0.05 degrees per year and 0.1 ppt per year in the permanent pycnocline. Thus the model trend is not important for a short term forecast but it should be corrected when model run is long enough. In our case we initialized the model stratification in January 1992 and then it is simulated by model more than 15 years until the end of ECOOP and further in the framework of My Ocean project. We have to assimilate climatic profile to reduce errors in temperature and salinity profiles. We will extend description of the climatic profile assimilation to make it more clear for readers.

'in Section 3 is not specified which of the two models is examined'

Section 3 is devoted to calibration of the MHI model which is a core of the describing in the paper nowcasting and forecasting system. We will include proper clear comments.

'why fig. 5 reports anomalies? Salinities should be preferred as for temperature, and in any case it should be specified how anomalies were computed'

Anomalies on the fig.3 are deviations of salinity on the 105m from basin average value on the same depth. We chose anomalies to focus on the areas with low salinity which correspond to anticyclonic eddies on the periphery of the Rim current.

Technical corrections:

We also agree with comments about technical corrections and will take them into con-

sideration preparing revised manuscript.

The second referee comments contain three general points and specific points.

'1. This part of the manuscript is used to briefly describe two numerical models: MHI z-coordinate model and sigma-coordinate POM. I would give some comments what kind of model formulation has advantage/disadvantage to describe general and local structures of the Black Sea circulation as well as their coastal and mesoscale circulations, eddies, etc.'

We are planning to add specific comments about POM and MHI models advantage/disadvantage as applied to the Black Sea region.

'2. I suggest to cite some additional publications concerning sea/ocean modeling, physics, numerics, data assimilation techniques, etc. It would be nice to briefly clarify what is new in the MHI model, what is done by the Black Sea community (see p.919, lines 12-17) and some others teams.'

We will provide more discussion of the Black Sea modeling issues by different groups and add more references.

'3. I would structured section 7 Conclusions to have a more clear understanding what has been done during development of the Black Sea nowcasting/forecasting system from the physical, biochemical, data assimilation, etc. points of view.'

This comment is similar to the last general comment of the first referee. We agree with it and will include in the paper as a Discussion section.

We will take into account specific points about technical corrections recommended by the second reviewer.

Interactive comment on Ocean Sci. Discuss., 8, 917, 2011.