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Ocean Science Discussions

Interactive comment on "Long-Term Evolution of the Caspian Sea Thermohaline Properties Reconstructed in an Eddy-Resolving OGCM" *by* Gleb S. Dyakonov and Rashit A. Ibrayev

Özsoy (Referee)

ozsoy@ims.metu.edu.tr

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This paper studies the crucial issue of predicting climate-driven sea level changes in the Caspian Sea based on an appropriately designed numerical circulation model and interactive atmosphere-ocean fluxes. The specific question that is asked is if the seasonal - decadal sea-level and its large drift observed in response to climatic shift from late 1970's to the about 1990 can be investigated with a special hydrodynamic model subject to realistic forcing. The paper relies on earlier investigations of model sensitivity to certain physical processes that are of key importance in obtaining better predictions of climate-driven changes in sea-level.

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Discussion paper

The improvements on air-sea fluxes, bottom friction in shallow areas, initialization and spin-up and interaction of shallow waters with the deep sea are some of the issues that the authors have given care. It is shown that detailed eddy-resolving modeling with adequate fine-resolution representation of specific key processes and fluxes is able to produce and closely simulate the observed response of the Caspian Sea to both seasonal and climatic events. Yet information with sufficient detail is not given on how adjustments were made to tune the model with respect to identified key processes. For example, it would be desirable to know, from the reader's standpoint, what numerical values were selected and which parameterizations were used for bottom and internal friction, advection and diffusion schemes, and surface fluxes.

Some of the investigated long-standing questions are well resolved by this work, such as the relative roles of buoyancy and wind-driven circulations, inter-basin transports, shallow-deep sea interactions, winter-time convective mixing, as far as we know for the first time at such high resolution but not sufficiently emphasized by displaying these characteristics in some detail or in the conclusions. The paper is focused on climate response, but all the fine detail that finally achieves performance would be better appreciated if they could be better exposed and emphasized. For instance, surviving myth on total overturn of deep waters by severe winter convection seems finally to be settled by demonstration of limited penetration in the present period of investigation. However, remembering even greater excursions in past climates and consequent greater shifts in sea-level, it may be desirable to discuss in the last section of the paper if and how such more extreme changes could be expected or simulated by extension of the present results.

Similarly the roles of down-slope convection processes not represented in the model could be further discussed, from the points of view on short-term and climatic response, to elucidate issues in model development and prediction in the future. Other fine-scale processes such as fronts and upwelling could also be important in the climate sense although they are often considered to be short-term, as also shown earlier by

the authors, and they could be emphasized in their presentation and the discussion.

A minor note: The 6 year low-passed time-series plotted in red in Fig.2a-h is shifted by 6 years - which is the window length. If the low-pass should be centered there would be only a loss of 3 year at the beginning and end of the filtered series (and even this could be partially recovered by adjusting length near the ends). The accordingly corrected low-passed series should be presented in this Figure.

In order to help the authors with style and written language, editing changes are proposed on the pdf, which the authors could choose to adopt.

In short, the paper addresses an important problem of the Caspian Sea which is an important element of regional climate, and thus should be published with minor revisions placing emphasis on discussion of the results.

Please also note the supplement to this comment:
https://www.ocean-sci-discuss.net/os-2018-128/os-2018-128-RC3-supplement.zip

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