

## ***Interactive comment on “Palaeostages of the Caspian Sea as a set of regional benchmark tests for the evaluation of climate model simulations” by A. Kislov et al.***

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This paper aims to use the variation of Caspian Sea level as a benchmark for PMIP simulations evaluation

This aim is not convincing for two major reasons:

1 – The target, as described by the authors (page 8 and 9 and associated figure and Tables) corresponds to the level of the Caspian Sea and is not enough accurately defined and reliable in chronology and amplitude to be used as a benchmark.

2 – The models ability to reach this benchmark is not really investigated, in fact there

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is only one model (MIROC) for LGM that is used for reasons that are not seriously explained. Moreover, the cause of the discrepancy: hydrologic P-E cycles, changes in routing of the Volga River are not clearly investigated.

Nevertheless, the interesting part of the paper is to give an overall description of the state of the art on the Caspian Sea level variations since the last 40 Ka. Because the target needs, for a MIP comparison, to be clearly defined in time (especially for Snapshot experiments as 6 ka and 21 ka in PMIP) and in amplitude, it is not obvious at all that this target is yet appropriate. Moreover the models ability to simulate this target is, in fact, really reduced to results of only one model for LGM (MIROC) and 2 for Mid Holocene and analysis of the discrepancy is not really described.

Therefore, despite the fact that the paper produces an interesting synthesis of Caspian level history, I do not consider that, with this aim and title, the paper can be published by Climate of the past.

In the following, I give some more detailed comments and suggestions that may help the authors to revise their manuscript.

## TITLE

As I said and, despite the real interest to connect more closely hydrologic studies with PMIP simulations, neither the target nor its capability to evaluate models results are clearly demonstrated in this paper, therefore I suggest as a new possible title.

“Possibility of understanding regional hydrologic changes in Caspian Sea catchment using PMIP modeling results for present day, Mid-Holocene and LGM”. This seems to me, more relevant of what is the paper doing.

## Abstract

This study suggests that water budget over EEP of CMIP/PMIP are able to simulate at least for present day the Caspian Sea level, therefore, it should be proved in the paper

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The paper in fact compares a very few models to data and therefore cannot conclude with only one or two model results.

## 1 - Introduction

Page 4 Line 5

A weakness of the paper is to claim to realize a PMIP comparison to Caspian Sea variations but the paper shows very few model results. Either the authors should claim to get from PMIP database, the appropriate variables (which are never seriously described) for including more models or they should modify this sentence.

## 2 - The Caspian Sea, changes in its level and the connections of such changes to river-runoff fluctuations

This section is interesting but it appears that with uncertainties that are described on chronology and amplitude of Caspian Sea level that it is difficult to use as a target and a benchmark to evaluate models. Moreover, the changes are related to Volga runoff which are may be difficult to simulate in these models even for present day.

## 3 - Current Caspian Sea level changes and the possibility of reproducing such changes using several CMIP5 models Page 7 Line 13

Which are the necessary parameters? It is very easy to ask for more variables (when available in the different groups). The authors should clarify this point which is indeed pivotal for them, because at the end, they only get comparison with one model at LGM, period very appropriate to be investigated due to the large sea level drop.

End of the section

With very few CMIP models results, the author show that (Fig2) the amplitude, and except for only one model (Cnrm), the phase are wrong. This result cannot be disgarded and the authors just decide : let's go to deep time and stronger oscillations. It is difficult to follow the authors: because :

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1- for Mid Holocene: there is no strong changes 2- For LGM where there are indeed large changes but it would be a bit doubtful to simulate this time period (with less data and chronology control) if present day variations are not understood.

Palaeostages of the Caspian Sea as a set of regional benchmark tests for the evaluation of climate model simulations

4 - Main stages of the Caspian Sea in the Late Pleistocene and the Holocene

This section shows the state of the Art of Late Pleistocene Caspian Sea variation. (Page 8 and 9) The authors draw a picture which clearly depicts large problems of chronology that remain during this period (lowstands but also highstands) which pin-points the question of target and bench-marking.

5 - Simulation of the Caspian Sea behaviour during the Last Glacial Maximum and Mid-Holocene

Once again it is very difficult to draw a benchmark of model response with one or two models. Models when coping with regional hydrologic balance use a zoomed resolution on the area of interest to better describe the topography and therefore the river runoff. For 6 Ka and 21 Ka no model changes the routing of the river which has been shown to be crucial [Alkama 2006 (1), 2008 (2)] Therefore mostly for 21 Ka the authors should discuss changes of elevation and drainage of the basin. For 6 Ka only MIROC results are discussed whereas the authors have 2 simulations available.

6 - On the origin of the Caspian Sea transgressive stages

This section is interesting as a state of the art of causes of Caspian Sea level variation. The link with, the aim and the title, as they are in this manuscript, is weak.

The extension of the European ice sheet is discussed but in PMIP3 they are different ice sheet configurations, the impact on Volga River runoff should be discussed.

Conclusion

From both points of view:

(1) Target and (2) benchmarking Models, this paper – as it is structured – seems much too preliminary. Especially the part on modeling is still very poor in terms of number of models used and analyzed of the results

Therefore I would suggest that the authors refocused their manuscript as I suggested, earlier and enlarge model section results to resubmit a new manuscript.

1. Alkama R, Kageyama M, Ramstein G. Freshwater discharges in a simulation of the Last Glacial Maximum climate using improved river routing, *Geophys. Res. Lett.* Nov 7 2006

2. Ramdane Alkama, M. Kageyama , G. Ramstein, O. Marti, P. Ribstein , D Swingedouw, 2008, Impact of a realistic river routing in coupled ocean–atmosphere simulations of the Last Glacial Maximum climate, *Climate Dynamics*.

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