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Climate of the Past Discussions

Interactive comment on "Model study of the circulation of the Miocene Mediterranean Sea and Paratethys: closure of the Indian Gateway" *by* A. de la Vara et al.

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Dear authors,

Your paper 'Model study of the circulation of the Miocene Mediterranean Sea and Paratethys: closure of the Indian Gateway circulation of the Mediterranean ' submitted to Climate of the Past has received 2 reviews and one comment by Dr. Karami. You have replied to all of them.

Both reviewers saw the paper rather critical. Dr. Krapp considered major revisions to be necessary. Reviewer 2 criticizes both the use of closed boundary conditions in connection with a sponge layer as well as the use of idealized present day forcing

conditions instead of forcing derived from climate model simulations of the Miocene. Reviewer 2 recommended to reject your paper due to inadequate choice of boundary conditions.

Most studies with coarse resolution global climate models have shown a strong essentially barotropic throughflow from the Indian to the Atlantic (e.g. Krapp and Jungclaus 2011 or von der Heydt et al. 2006) of typically more than 10 Sv for deep sills and a few Sv for shallow sills. The recent study by Hamon et al. (2013) shows a more baroclinic circulation pattern, but it nevertheless shows barotropic transports with almost +/- 3 Sv. You argue (and here I agree with you) that these models (e.g. the model applied in the von der Heydt et al. 2006 study) are too coarse to adequately model the throughflow through the straits. Therefore you apply a regional model that is better suited to model the circulation in the Miocene Mediterranean. However, you chose a set up (model and boundary conditions), that does not allow you to study the effect of barotropic throughflow at all. Thus you have to ignore this effect and restrict yourselves to investigate the baroclinic circulation, as correctly stated in the paper. Judged from the results of the global models, however, you seem to have neglected a first order effect. A non-zero barotropic throughflow would have strongly influenced the time, for which the surface water masses in the Mediterranean are exposed to the net evaporation and thus the salinity difference between the Mediterranean and the inflowing water. The resulting changes in density distribution would then affect the baroclinic circulation.

The main point of your paper is the investigation of the sensitivity of the Mediteranean circulation to the depth of the Indian sill. However, the strength of the barotropic throughflow will depend on the sill depth as well, so these two problems cannot be easily separated.

After my guess, most of the conclusions drawn in your paper could be altered by a barotropic throughflow. You do not make a serious attempt to discuss how sensitive your results could be to a barotropic throughflow.

In your reply to the points raised by the reviewers you argue that also other boundary conditions would have involved arbitrary choices. After my opinion several other choices would at least have allowed you to investigate the sensitivity to a barotropic throughflow.

In your replies you do not show, that you are seriously concerned about this problem. You just argue that you cannot deal with this problem in this set up and therefore you are ignoring it. In the present form your paper cannot be published in Climate of the Past. After my opinion the main problem is the experimental set up. Here I agree with reviewer 2. I am sorry to say, but I believe, that in this case major revisions would not be sufficient to achieve a paper which could be considered to be suitable for publication in Climate of the Past.

Sincerely Yours

Uwe Mikolajewicz

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