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Climate of the Past Discussions

Interactive comment on "Upper ocean climate of the Eastern Mediterranean Sea during the Holocene Insolation Maximum – a model study" *by* F. Adloff et al.

Anonymous Referee #2

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In contrast to reviewer #1, I'm a modeler and I don't work directly with proxies. So, my review will mainly dealing with the model and results section.

The authors study the differences between present-day climate of the Eastern Mediterranean Sea between present-day and 9 ka by using a regional Ocean model that uses boundary conditions from a global coupled climate model. They perform two simulations for 9 ka: One with only orbital induced insolation differences (9k1) and also with additional lower CO2 and changed topography (9k2). The early Holocene is of course an important period due to due to the formation of sapropel 1 and therefore this study is very interesting and worthwhile reading. I especially liked the separation of orbital

induced climate changes and the additional influence of 'glacial' boundary conditions clearly showing that insolation alone is not sufficient to explain the climate at 9 ka.. The manuscript is very well written and the mechanisms are clearly explained and thoroughly studied.

General comment:

My biggest concern is the detailed focus on SST while vertical (overturning) circulation and density are not shown. In the introduction the authors mention the role of density in sapropel formation but in the remainder of the article density is not discussed. Numerous articles emphasize that salinity (rather than temperature) induced density changes are at least equally, and probably even more, important for the stagnation of deepwater formation and consequently for the formation of sapropels. The authors' focus on temperature and mechanisms to explain the temperature pattern is more suited for an ocean (modeling) journal while I think that readers of Climate of the Past would be more interested in the influence of SST and SSS on sapropel formation. I'm aware that the authors might focus on stagnation and sapropels in future studies as mentioned in the last section. Nevertheless, I strongly suggest that the authors' add pictures and some discussion of density (at least at the surface) and of the overturning circulation (both north-south and east-west) in this paper. This gives the reader an idea of a (possible) influence of SST and SSS on deep water formation and the associated depletion of oxygen. To my opinion this would make this study more appropriate for Climate of the Past.

Specific comments:

P1459 Line 7: "Coinciding". The authors could add here a short discussion about the lag between minimum precession (i.e., strongest summer insolation) at 11 ka and the midpoint of sapropel 1 at about 8 ka. What could explain this lag and why did the authors choose 9 ka instead of 11 ka for their simulations? To my opinion, 11 ka is really the 'Holocene Insolation Maximum'.

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P1461 Line 2/3. Here a short summary of the physics in the model would be welcome. Only a reference to Marsland et al. is not sufficient.

P1462 Line 15: year 1950 is not pre-industrial. Shouldn't that be 1850? Or do the authors assume that insolation in 1950 is similar to 1850?

P1463 Lines 3-17: I don't fully understand the role of the NCEP reanalysis. Do you also use NCEP for the downscaling at 9 ka? If so, how can NCEP be suited for that? If not, how do you downscale for 9 ka? This should be more explained.

P1466 First the authors discuss winter (lines 7-12), after that the discuss summer (lines 12-18) and finally they return to winter (lines 18-24). It would be clearer if the third part would be added to the first part (so, first winter and then summer).

P1467 Lines 6-9. I don't understand why smoothing could explain the discrepancy. This needs more explanation.

P1469 Lines 9-10: Why do cyclones propagate more southerly during increased seasonal cycle?

P1469 Lines 10-11: I don't see why the intensified North African monsoon causes more precipitation over the Mediterranean Sea. I'm sure that the extent of the African monsoon at 9 ka is not that large that the Mediterranean is directly influenced by monsoonal precipitation. Is it an indirect effect or just an error?

P1470 Lines 5-6 The river Nile overcompensates the missing water from the Black Sea. I don't see that. If it overcompensates you should see changed in the freshwater budget, don't you mean 'compensate'? Furthermore, as you mention in the introduction, it is not clear whether there was some in input from the Black Sea at 9 ka. If the fresh water budget with the missing Black Sea does not show large changes in the fresh water budget, the role of the Black Sea could be crucial. In a ideal scenario, you should run a 9 ka simulation with input from the Black Sea. However, I realize this might take a lot of (computer)time. In any case, you could at least discuss this matter in the discussion

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sector (which is to my opinion section 4, but this section is not called discussion). If you would include the Black Sea at 9k, what could happen with the freshwater budget and SSS?

Section 4.3.2. As already said, although the explanation is very clear, this section is very detailed and maybe of less interest for the readers of Climate of the Past. I suggest that the authors shorten this section and also remove some figures (suggestion: remove figures 14, 15 and 17 and discussion about the difference 'wind stress' and 'wind speed' and strongly shorten the discussion about the role of the atmospheric heating).

Section 4.3.2, Figures 16i and 16m: There is still a insolation induced warming in the far north in JAS while for the 'open basin' the winter cooling dominates. Why is there no winter signal in the far north?

Typographical comments:

P1467 Line 25: Add "is" between 'models' and 'only'.

P1472 Line 9: I don't exactly know to what "This" refers to.

P1476 Line 5: Add "looking the effect" is not right.

Figures

Figures 1 and/or 2: For the readers convenience the authors could add some labels at the locations of the seas they mention (e.g., Marmaran, Levantice, Adriatic, Aegean and so on). This would be easier for readers that don't know the map of the Mediterranean Sea by heart.

Figure 5: There is a pronounced "warm anomaly" centered at 25N;30E in all diagrams. Why is that?

Figure 6: Differences in P-E between two runs are always hard to interpret. Maybe you could add 4 diagrams with annual mean anomalies of P and E.

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Interactive comment on Clim. Past Discuss., 7, 1457, 2011.