Clim. Past Discuss., 10, C1453–C1454, 2014
www.clim-past-discuss.net/10/C1453/2014/

Climate of the Past
Discussions
Open Access

Interactive comment on "Changes in Mediterranean circulation and water characteristics due to restriction of the Atlantic connection: a high-resolution parallel ocean model" *by* R. P. M. Topper and P. Th. Meijer

M. Rogerson

m.rogerson@hull.ac.uk

Received and published: 6 September 2014

This is a really interesting set of experiments, in which the authors investigate the impact of changing water depth at Gibraltar to the internal circulation of the Mediterranean. As several processes on different timescales could cause this to happen, solution to this problem has wide ranging implications for the Quaternary and Neogene.

The paper is well written, well presented and well illustrated. I enjoyed it, and commend the authors on their efforts in putting it together. Scientifically it is sound, but I do

have one strong worry about the results; the heat budget at Gibraltar is wrong. The Mediterranean today is a heat sink for the Atlantic, and because of the high altitude of its northern margin it probably was in the past also. In the model presented, it is a heat source for the Atlantic. This has some important consequences

1) The Western Mediterranean Deep Water does not seem to form properly (today this is fresher and colder than eastern sourced waters, and the missing heat sink is essential to its formation).

2) Levantine Intermediate Water seems to be to weak, probably also because it is being formed too warm. As about 2/3 of the water leaving Gibraltar is LIW, this matters.

3) As the sill level drops, the Mediterranean warms. It should cool - at least on average.

4) As the sign of the heat budget is wrong, the simulations may be wholly specific missing thermal convection processes in shallow sill scenarios driven by strong cooling in parts of the western Mediterranean. I fear that the lack of this thermal convection means "real life" sill-depth scenarios will certainly be different to those presented, which limits their usefulness.

These are really important issues for the capability of the model to provide useful constraint on the past behaviour of the system. Before publication we need to clearly see the authors justification for why their simulations are not fatally undermined by the simple fact that their heat budget has the wrong direction.

Interactive comment on Clim. Past Discuss., 10, 2979, 2014.