Ocean Sci. Discuss., 6, C981–C983, 2010
www.ocean-sci-discuss.net/6/C981/2010/

Ocean Science
Discussions

Interactive comment on "The timescale and extent of thermal expansion of the oceans due to climate change" *by* S. Marčelja

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Received and published: 10 January 2010

Review Marcelja "The timescale. . . climate change"

By R.S.W. v.d. Wal.

The paper treats a first order model to describe the thermal expansion of the ocean. The model is used to calculate the expansion since 1880 and to calculate the commitment for near future based on the climate change we experienced so far. Validation is obtained by comparing the results with a recent comprehensive data set of thermal expansion by Domingues et al. 2008. In the model the ocean is treated by a single 1D Column with fixed upwelling velocity and constant vertical eddy diffusivity. After addressing the points below the paper is worth to be published.

Major comments

The paper is well organized and straightforward.

It reaches substantial results, but a simple sensitivity paragraph should be added. How sensitive are the results for the choice of Az, W, alfa and the choice for GISS.? Explore temporal variations of your parameters by closing the model and observed data set used for validation (see below)

The global context of the results is a bit meager, see below.

Minor comments

Line 6 Rephrase extended into to reconstructed from

Line 7 remove here

Line 8 Stress that it is a 1D column model with fixed upwelling and fixed eddy diffusivity.

Line 14. Remove even. . .... 1000 m (I do find it confusing).

Line 19 add within how much time this increase of 5 cm is reached and more specifically mention explicitly the e-folding time scale from figure 2.

Page 2977 Line 7 More recently. . .. Sea level change on line 15. Remove this entire section. I do see the analogue of this paper with the work by Rahmstorf but there are several complaints about his approach so I don't think you should use it as example to strengthen your approach. Your approach is valid on its own and need not to be further justified.

Page 2978 Do you have any idea why Munk did not calculate the consequences of his Az and W with a 1D model?

Page 2978 Line 15. A key result of your approach is that you can calculate the commitment for the expansion. You do however need to put this in the perspective of global sea level rise estimates which are say on the order of a meter for this century, in other

words the commitment is small. You also have to discuss the fact that the commitment of the temperature if we now stop emitting additional fossil fuels is on the order of 1-2 K, which also gives a commitment for thermal expansion. This effect is on purpose neglected by your approach, but you need to discuss these kind of things.

Page 2979. Would it be not simple to extend the calculation by taking the dependence of alfa on temperature and salinity into account.

Page 2981 Line 4. In fact you assume a steady state in 1880 as initial condition assuming a short time scale with respect to climate change before that time. If so mention it in this way.

Page 2981. Another point to be discussed is that fact that given the good match of your model with the data, you might wish to suggest that the ocean circulation did not change much over the period considered with respect to how the circulation affects the expansion. This argument holds because you get a good fit with constant values for W and Az. In fact you can treat your model in a closure approach to see what temporal variability of W and Az you need to optimize the match between your results and Domingues.

Page 2982. Line 15-17 Unclear what you mean to say. Does calculated refer to your own calculations?

Figure 5 and 6 can be combined in one figure

Interactive comment on Ocean Sci. Discuss., 6, 2975, 2009.