

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: 21 January 2010

General impression

The author presents an elegant and simple way of calculating global mean steric sea level rise in the past and developing approximate future projections for this quantity. The method has a clear physical basis in the assumption that the vertical advection-diffusion balance can be used to describe the transfer of heat from the ocean surface towards the deep ocean. Hence, the only information required to calculate global mean ocean heat content changes and (approximate) steric sea level changes is the (evolution of) sea surface temperature (SST) and generic values for the vertical velocity and the diffusion coefficient.

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However, I presume that this simple approach only holds in a global mean sense. Locally, variations in the diffusion strength and horizontal advection will probably play a role. I would like to see this mentioned / discussed in the final section. Also, this should be made clear by referring to "global mean sea level rise" rather than just "sea level rise" etcetera throughout the text [preferably in the title as well].

Specific comments

The introduction can be organized in a better way to improve the clarity. Now, the text discusses OHC observations (Domingues et al 08), then Munk (1966) - the adv diff model, and then Rahsmtorf 08 - another simple model used for projections of global mean sea level rise - and then the new model. I suggest re-ordering: [1] OHC observations (Domingues et al 08), [2] simple models, Rahsmtorf 08 - but there are others as well that can be mentioned e.g. Grinsted, A. and Moore, J. C. and S. Jevrejeva, 2007, *Clim Dyn*; Mark Siddall, Thomas F. Stocker, Peter U. Clark, *Nature Geoscience* 2, 571-575 [3] model developed in this study, based on the Munk (1966) adv / diff balance and fitted parameters

The future scenarios deserve more attention than one sentence on p. 2982. After all, that was what the model was primarily developed for I would say. It also does not match the expectations raised on the abstract with the text on p.2976, line 7. It should be easy to get some estimates based on f.ex. a continuation of the (recent) trend in global mean SST, or even an acceleration, deduced from the timeseries in Fig 3. Or, one could look at climate model data for SRES scenario runs - SST data can be freely obtained from the CMIP3 database (Meehl et al 2007, BAMS). The results need to be put into perspective by comparing with IPCC scenarios.

Technical comments

p.2976 - l.11: "the well known profile" - unclear what is meant before having read the paper - use "generic profile" or canonical profile" in stead (add reference to Munk 1966 if allowed in abstract)

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p.2977 - l.1 "global SST's as a function of position" - the combination of global and position confuses me?

p. 2980 - l.21 "lines of evidence": specify, give references

p.2981 - l.10: the.... by Domingues et al (08) - l.24: heat content over 0-700 m

p.2982 - l.23: In the earlier

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

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