

## ***Interactive comment on “Downscaling the climate change for oceans around Australia” by M. A. Chamberlain et al.***

### **Anonymous Referee #1**

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The paper by Chamberlain et al. introduces results from a downscaling experiment, in which fluxes obtained with a coupled ocean-atmosphere simulation of the 'A1B' climate change scenario are used to drive an ocean-only model with higher resolution in the Australian region.

I found the paper interesting and certainly worth of publication. The paper is well written, clear and thorough. The technique and results presented are innovative and useful for a variety of applications.

My only comment is that there seems to be little analysis on the differences between the coupled and downscaled experiments in terms of 'marine impacts of climate change on regional and local scales' (line 5, page 443). Providing maps of SST, SSS and stratification does seem a bit preliminary. Ideally, one would like to see the biogeo-

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chemical response in the high-resolution area around Australia, and whether resolving the mesoscale has a clear impact on 'marine life in Australian waters' (line 4, page 427).

You say that 'the magnitude of differences in SST change is  $\sim 0.5$  C and SSS change  $\sim 0.1$  psu between the downscaled and the coupled model projections' (line 11, page 442). Are these differences worth the downscaling exercise? Do these differences lie outside the spread of multi-model simulation in the Australian area? You actually use two very different versions of the same ocean model (MOM2.2 in the CSIRO Mk3.5 climate model and MOM4.0 in OFAM); could this potentially affect your upper ocean response?

Minor comments:

What are the changes in upwelling (vertical velocity)?

(page 430, line 13) 'coarser resolution outside this region'. How coarse is the model outside the Australian region?

(page 438, line 7) 'despite the different amplitudes ...'. I understand the point here, but the amplitude is crucial too in order to assess whether high-res is important or not in climate change simulations of marine life in Australian waters. The effects of climate change on the marine environment must be a function of both spatial patterns and magnitude of warming. The feedback parameterization proposed does change both SST and SSS response in a non-trivial way. In the abstract you say that 'While the magnitude of the climate change differences may vary with the feedback parameterization used, the patterns of the climate change differences are consistent ...' (line 14, page 426). But I think one of the main points of the downscaling and the paper is the feedback parameterization, so its importance, and control over the ocean response, should be highlighted.

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