Response to minor editor's comment

Associate Editor Decision: Publish subject to technical corrections (25 May 2020) by Fortunat Joos
Comments to the Author:
Dear authors

thank you for providing an updated manuscript version. I am happy to accept your manuscript for publication in BG, potentially subject to technical corrections (see below).

Thank you for submitting your work to Biogeosciences. With kind regards,

Fortunat Joos

Fig 8l shows a clear scenario difference in 21st century O2 anomalies in the upper 1000 m, which larger negative anomalies for SSP1-8.5 than SSP1-2.6. In contrast, Fig 7c shows an almost identical end of 21st century global O2 anomaly (relative to PI) between SSP1-8.5 and SSP1-2.6. This is a bit puzzling and may be somewhat misleading for the reader. I suspect that this apparent difference is related to the choice of reference period. May be the changes in O2 should also be plotted relative to the modern instead PI reference period in Fig 7c to make the projected changes in global mean O2 between scenarios better visible? (Please also check the numerical values of these figures on benthic O2 changes.)

Thank you for this comment and the attention that you have given this manuscript. We have double-checked the analysis presented in Fig 7 and Fig 8. On doing so, we realised that there was an error in the x axes labels for Fig 8l. This has now been corrected.

The mentioned differences between Fig 7c and Fig 8l are not caused by different reference periods but due to differences between the SSP5-8.5 and SSP1-2.6 scenarios, as well as differing model ensembles for each scenario. It is correct that in benthic regions of the upper 1000m, indeed down to roughly 2400m there is greater deoxygenation in SSP5-8.5 than SSP1-2.6. However as shown below in the Fig. R1, benthic regions in the upper 1000m only account for roughly 7% of total benthic area and benthic regions in the upper 2400m only account for roughly 15% of total benthic area. Below approximately 2400m Fig8l previously showed slightly greater model-mean deoxygenation in SSP1-2.6 than SSP5-8.5. Although limited in magnitude, this represents roughly 85% of total benthic area and therefore somewhat offset the differences seen in the upper 2400m when plotting the global benthic anomalies in Fig 7c.

The difference between model-mean benthic deoxygenation below 2400m is a consequence of the different model ensembles for the two SSPs. In Fig. R2 below, we use the same model ensemble for SSP5-8.5 and SSP1-2.6 (reduced to 6 models for SSP5-8.5). This is shown to remove the greater deoxygenation in SSP1-2.6 than SSP5-8.5 below 2400m. The impact of using an identical model ensemble on the global benthic timeseries is shown in Fig R3 below. Multi-model mean global benthic deoxygenation is shown to increase with the radiative forcing of SSPs over the 21st century. However differences between SSPs are still not significant given the large inter-model uncertainty.

We accept that this is somewhat confusing to readers and therefore think that it is best that a consistent model ensemble is used for benthic oxygen projections in the manuscript. As such figures R2 and R3 below now appear as figures 7 and 8 in the revised manuscript. This has slightly changed the model-mean values given in the text but otherwise has no affect on the manuscript or its conclusions. If the editor would prefer it, we could instead use the full SSP5-8.5 ensemble for benthic oxygen projections but would be concerned that figures 7 and 8 would be misinterpreted.

Kind regards,

Lester Kwiatkowski

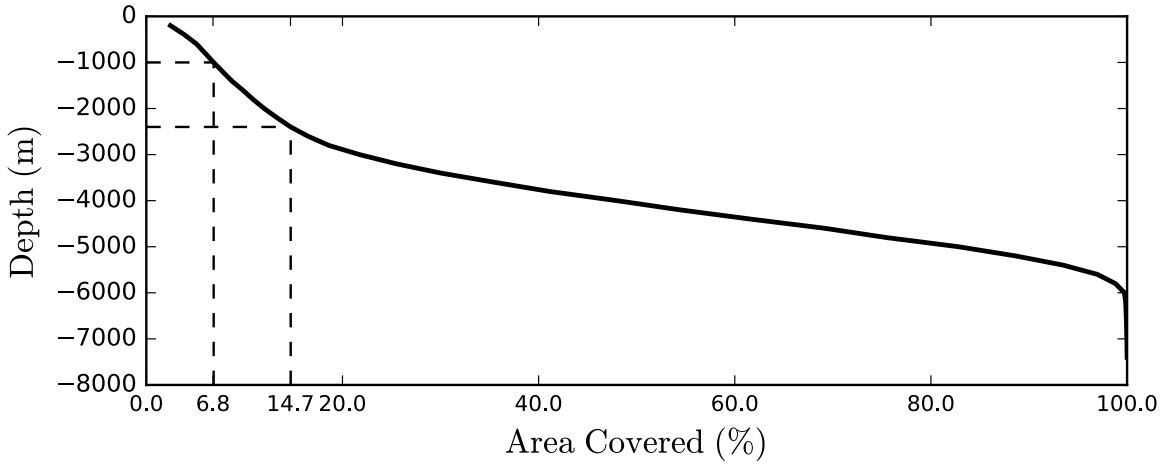

Fig R1. The cumulative benthic area coverage (% of global benthic area) with depth.

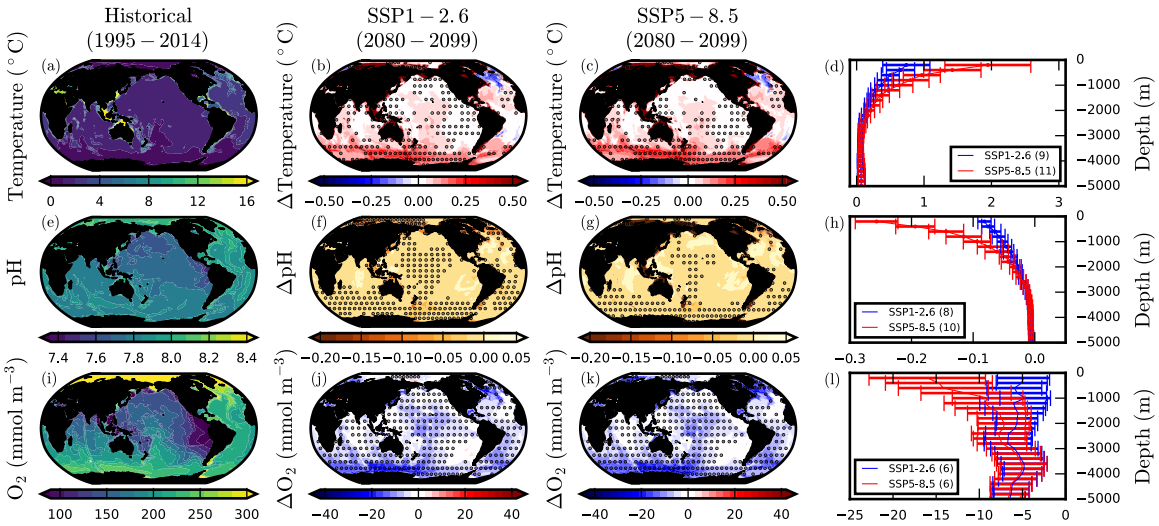

Fig R2. The same as figure 8 in the previous manuscript submission but using an identical model ensemble for O2 projections.

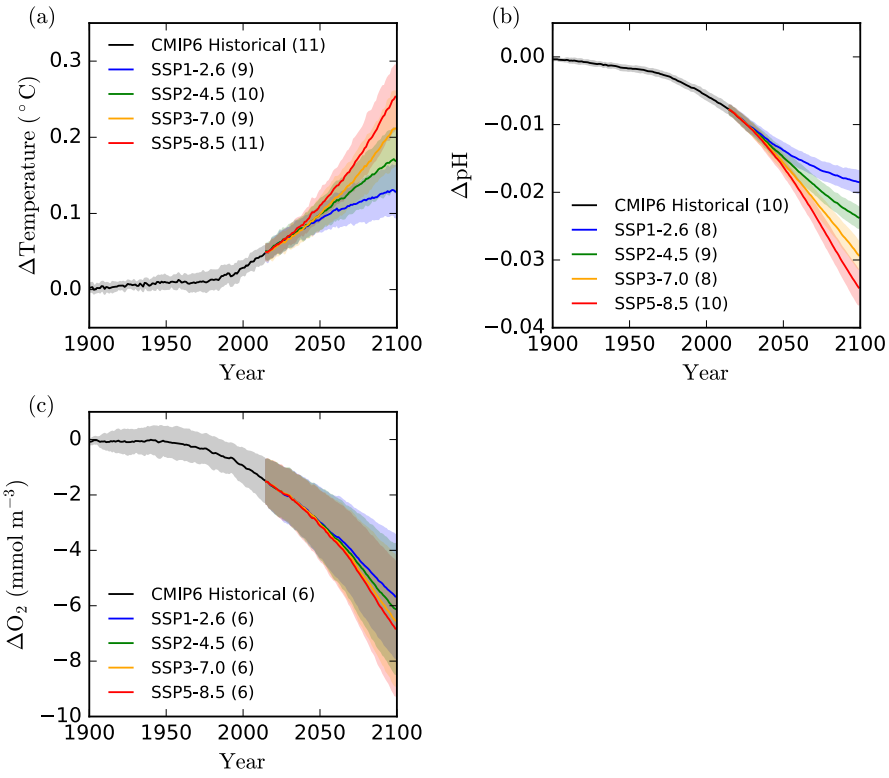

Fig R3. The same as figure 7 in the previous manuscript submission but using an identical model ensemble for O2 projections. (note that oxygen projections are now aligned at the start of the SSPs in 2015 and the greater multi-model mean dooxygenation in SPP5-8.5 is now apparent)