Interactive comment on:

"Modulation of the North Atlantic Deoxygenation by The Slowdown of the Nutrient Stream"

by F. Tagklis, T. Ito, A. Bracco

*Texts in black are the original comments by the reviewers, which is followed by our responses in blue coloured text.

Anonymous Referee #1:

This study presents an analysis of output of dissolved O2, PO4, temperature, advective velocities, and sinking POC flux from four ESMs in the CMIP5 ensemble to investigate the drivers of upper ocean deoxygenation, comparing the North Atlantic to the North Pacific. The compensating effects of the temperature-controlled decrease in O2 solubility, ocean circulation/ventilation effects, and changes in biological O2 utilization are examined and attributed to identified trends in basin O2 content in the ESM outputs comparing the 1970-2000 period with the predicted 2070-2100 period under RCP 8.5 forcing. A contrasting pattern between the North Atlantic and North Pacific is identified, with deoxygenation proceeding more rapidly in the Pacific despite a smaller temperature increase in that basin. Solubility driven deoxygenation in the North Atlantic is revealed to be compensated for by a mechanism rooted in the slowdown of the AMOC, which slows the important Gulf Stream nutrient stream, decreasing lateral injection of nutrients into the subtropical North Atlantic, decreasing export production and concomitant biological O2 utilization in the subsurface. Deoxygenation in the North Pacific is revealed to proceed via dual solubility and change in ventilation controls. This is a well-written, clear, and concise manuscript detailing the authors study. I only have some comments regarding the Methods.

We appreciate the positive comments on our manuscript. We have addressed the questions related to the Methods below.

Line 81-83: What method was used to interpolate the model output to the common WOA grid?

The method used was bilinear interpolation using Climate Data Operators.

Line 152-160: Why not perform a similar t-test as performed for O2 to test for statistical significance of the temperature increases identified?

The significance of ocean warming under rcp8.5 in the CMIP5 has been already presented in previous works. For consistency in terms of analysis we would direct you to our previous study (Tagklis et al., 2017) and figures 1, 14 and 16. We think that a t-test for temperature is not necessary as repetitive, while

the significance of O_2 provides new information. We added a comment in the manuscript though where T plots are presented.

Why were these 4 models chosen and not others from the CMIP5 ensemble? The given reason is that these 4 provided the variables of interest. Surely more than 4 CMIP5 models provide output of O2, PO4, temperature, advective velocities, and POC sinking flux for the historical and RCP8.5 cases?

We could not find the complete set of variables/experiments for the rest of the models (EPC100 is often the culprit).

Table 1: Why not include a column for the multi-model mean to be congruent with that which is provided in Figures 1-8?

Following the reviewer's suggestion, we included the column to the table to be congruent with the rest of the presentation in the manuscript.

Line 178: "The rate of solubility change ranges from -12.07 µM to -14.81 µM" A rate implies a change with respect to another quantity or dimension, in this case time. I recommend switching these numbers to -0.12 µM/yr or mention the rate in parenthesis, etc.

We want to thank the reviewer for pointing this out. Indeed, the rate refers to a centennial time scale, which should be clarified. Furthermore, switching these numbers to an annual rate would imply a linear trend, which is not justified in the current analysis. We re-wrote the sentence as:

"The centennial solubility changes are calculated as differences between two 30 years-periods 1975-2005 and 2070-2100."