Reviewer 3, David Nicholson
Below the review is reproduced in black font and our responses interspersed in blue.

Reviewer Comments:

General comments: This study seeks to apply dissolved oxygen measurements from profiling floats to estimate primary production and respiration from diel oxygen cycles. The study region in the shelf break region of the northern Gulf of Mexico is a challeng- ing environment for this approach because it is a region of low productivity, but high physical variability and thus is a good testbed to evaluate the limits of diel approaches. Further, near 30 N the Coriolis frequency is approximately 24-hours and near-inertial oscillations can confound biologically-driven diurnal cycles. In general, this study found that physical variability was too great to allow for robust estimates of biological rates in this challenging environment. This contribution is valuable as it is important to recog- nize the limitations of such methods.

Given the strong vertical O2 gradient and slow response time of the optode sensors, a significant portion of the manuscript is dedicated to optimizing methods for deconvolv- ing the oxygen time series and estimate sensor response time in situ. Indeed, this is such a major part of the manuscript, I would recommend changing the title of the paper to in some way reflect the time response part of the manuscript. Although dynamic cor- rections to optode oxygen sensors on floats has been explored in depth before (Bittig et al., 2014; Bittig and Körtzinger, 2017) the dataset here provides a valuable addition particularly because both ascent and descent profiles were logged, time-stepped and recorded in full resolution without binning.

Overall, I think this is a valuable contribution that will spur improved methodologies for correcting dissolved oxygen in biogeochemical Argo applications. The results should be further applicable to other platforms such as gliders and profiling moorings. I have several concerns about the analysis and some suggestions to extend interpretation that I think would be worthwhile for the authors to consider.

Response: Thank you, we appreciate the positive and constructive comments

Specific comments:

1. It seems a 7-pt moving mean smoothing is performed prior to deconvolution. With the stated 5 m resolution and 12 cm s-1 average vertical velocity that works out to averaging over about a 40 sec period. A moving average also is a filter (and one with a messy response in the frequency domain). I am concerned that this step would alter the calculated sensor response time that is determined by deconvolution after this averaging. Does the moving average operator slow down and/or complicating the sensor response before the deconvolution is even applied? An easy test is to report if the same median time responses are recovered without the moving mean step.

Response: Excellent suggestion. We would like to try this and include the result in the revised manuscript.

2. Bittig and Kortzinger (2017) outlined a detailed approach for scaling tau as a function of temperature and flow speed. What is the implication of using a constant tau here instead of the temperature and boundary-layer dependent tau. Is it possible to apply the Bittig approach as well

for comparison? There is a significant vertical temperature gradient in the study region and thus an expectation that response time would be slower in deeper water than near the surface.

Response: We agree, but our study focuses on the euphotic zone where temperature changes are small. See also response to comments by Henry Bittig (Reviewer 2). Refining the method for application throughout the whole water column and accounting for the temperature dependence is ongoing work and will be the subject of a future manuscript.

3. A recent publication by Barone et. al. (2019) quantifies GPP and R from diel cycles with uncertainty and fit statistics. Applying this approach would provide a more quantitative assessment of how good (or bad) daily diel fits are.

Response: Thank you for pointing this out. We will add this in the revision.

4. Are any corrections made for air-sea O2 flux? It sounds like there was significant atmospheric forcing. Barone et al. 2019 outlines how diel O2 inventories can be corrected for air-sea flux prior to fitting a diel cycle.

Response: The air-sea oxygen flux is quantified in Chris Gordon's MSc thesis and comparatively small. We will add this information and reference to the revised manuscript.

Technical suggestions:

L21: should specify that 12-24 hour incubations approximate NPP (cite Marra 2009). Other short-term incubation approaches also are fairly commonly used and measure something closer to GPP.

Response: Agree.

P2-L42: add (Barone et al., 2019) and (Johnson, 2010)

Response: Agree.

P3-L67: add salinity to list of corrections

Response: Agree.

P6: L67: There is temperature dependence both to molecular diffusivity and kinematic viscosity

Response: Agree. Will modify text appropriately.

P8 L84: since tau is a function of environment it is also a function of time but treated as a constant. How does that impact interpretation?

Response: Agree. Will modify text appropriately.

Fig 2: The label 'Scatter' in B seems odd. Maybe use 'difference' instead?

Response: Agree. We will remove "scatter."

P9 L29: change ’listen’ to ’listed’

Response: Done.

P13 L53: It seems possible that depending on sensor orientation there could be a big difference in up vs. down response time. Was this tested at all? Barone et al. (2019) found ∼35 sec tau for the same sensor on Seagliders (see supplemental info).

Response: Unfortunately, we don’t see a way to test this with the data we presently have.

Barone, B., Nicholson, D., Ferrón, S., Firing, E. and Karl, D.: The estimation of gross oxygen production and community respiration from autonomous time-series measure- ments in the oligotrophic ocean, Limnol. Oceanogr. Methods, 17(12), 650–664, doi:10.1002/lom3.10340, 2019.

Bittig, H. C. and Körtzinger, A.: Technical note: Update on response times, in-air mea- surements, and in situ drift for oxygen optodes on profiling platforms, Ocean Sci, 13(1), 1–11, doi:10.5194/os-13-1-2017, 2017.

Bittig, H. C., Fiedler, B., Scholz, R., Krahmann, G. and Körtzinger, A.: Time response of oxygen optodes on profiling platforms and its dependence on flow speed and tem- perature, Limnol. Oceanogr. Methods, 12(8), 617–636, doi:10.4319/lom.2014.12.617, 2014.

Johnson, K. S.: Simultaneous measurements of nitrate, oxygen, and carbon dioxide on oceanographic moorings: Observing the Redfield ratio in real time, Limnol. Oceanogr., 55(2), 615–627, doi:10.4319/lo.2010.55.2.0615, 2010.