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Discussions

Interactive comment on "Uncertainty and sensitivity in optode-based shelf-sea net community production estimates" *by* T. Hull et al.

Anonymous Referee #2

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This paper presents oxygen optode measurements from a moored deployment in the Thames estuary, which the authors use to calculate net community production over an annual cycle. Many researchers are struggling to use optode measurements in this way, so this paper will be of high interest to the community. For the most part, the discussion of errors is very thorough and interesting. Uncertainty in NCP estimates is often given short shrift, so it's nice to see a more full treatment. I think the paper would be even more valuable by doing a more careful job of discussing the potential uncertainties in the optode calibration and horizontal advection. I have a number of other minor comments.

The paper's conclusion that this area is net heterotrophic depends heavily on an accurate optode calibration, given the long periods of very slightly undersaturated condi-

tions. Given this, more details of the calibration are needed. Which of the calibration techniques were applied? Just a simple gain or gain and offset or redetermination of coefficients as in Uchida et al. (2008) or . . .? A figure showing the calibration would be helpful. Also, more information on the Winkler titrations would be useful. What standard was used? How was the blank determined? What is their total estimate of the Winkler oxygen accuracy (separate from precision)? The total error given of 0.52 mmol/m3 is very impressive, and some support of this would be useful to the reader. There appears to be some correlation between high wind speeds and larger undersaturations in Figure 2, which suggests that high winds are driving the system away from equilibrium. This is counterintuitive and could be explained by a poor optode calibration, which would impact the total NCP estimate strongly. The impact of error in the overall optode calibration could be more clearly discussed. Would inaccuracy in the optode mainly affect C0 or DeltaC or . . .?

Horizontal advection could be an enormous source of bias or uncertainty in this study. As such, it would be helpful to discuss it earlier in the paper, such as in the model implementation section rather than nearly at the end of the paper. I would also like to see greater clarity on the potential impact of an average horizontal gradient in oxygen vs. patchiness with no overall gradient. Intuitively, one would expect that a major estuary would be likely to have both a net flow and a gradient along that flow. It appears that the authors don't have access to reasonable estimates of that net gradient, but they could discuss how large it would need to be to change their estimates significantly. If the water entering into their box is undersaturated and leaving closer to equilibrium or supersaturated, then the region of the measurements could be net autotrophic.

Minor

I think the paper would benefit from a tighter, shorter introduction.

Section 2.4 would be clearer if the neglected terms (entrainment / dh/dt) were discussed and dismissed at the start of the section, so that the terms did not need to be

added in and then removed again. Then, equation 2 could be deleted and Equations 6-8 could be easily made into one equation. Also, since only one gas is considered here, it would be clearer to use O2 rather than C in the equations. The w subscript to the gas transfer velocity could suggest that a weighting is being used; a simple k might be clearer here.

Give timescale of wind speed averaging (Line 11, page 15619). Clarify length of time step (Line 16, page 15620).

It would help the non-expert reader to additionally discuss the statistical measures in plainer terms. There is already some effort to do this, but concepts like the “degree of monotonicity” will still be opaque to the average reader.

Suggest adding either O2 or C to all rates in mmol m-2 like mmol O2 m-2 to make clearer which are in O2 and which in C units.

Page 15630: In the discussion of the impact of different uncertainties on the spring period NCP, it would be useful to restate the best estimate, which I think is 0.5 from earlier in the paper. In that case, 2.3 is about 4 times it but I wouldn’t say that -0.5 was “double the corrected value”. Can you include a measure of the uncertainty in optode drift in Figure 7?

In section 4.5, it would be useful to specifically state the potential impact of each of these uncertainties on NCP estimates.

Figure A1: The line on this figure is not a 1:1 line. Were the ECMWF estimates corrected based on this best fit line? If not, show the 1:1 line instead and the use the error from the 1:1 line rather than the regression.

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