

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2021-170

Anonymous Referee #2

Referee comment on "Simultaneous assessment of oxygen- and nitrate-based net community production in a temperate shelf sea from a single ocean glider" by Tom Hull et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-170-RC2>, 2021

I have read the manuscript "Simultaneous assessment of oxygen and nitrate-based net community production in a temperate shelf sea from a single ocean glider" by Tom Hull and coauthors and found it interesting to read.

BG review criteria:

The paper describes analyses of data from a glider deployed North of Dogger Bank in the North during spring bloom season which is an appropriate subject for BG.

The glider was equipped with a (still) novel lab-on-a-chip sensor for NO_x measurements.

Using these new data together with the more common pressure, temperature, salinity, and oxygen data allows for the observation and analysis of properties such as e.g. the O₂:N ratio during the bloom. As these properties might change under a changing climate these observations can be seen as a pilot study for possible monitoring systems.

The findings support the feasibility of such a system and are clearly described.

The results support the interpretations and conclusions.

The description of the experiments is sufficient and the calculations can

in most cases be followed. In a few cases (see below) some alternative units could make it even easier. And some additional explanations/definitions would be helpful for the less well versed reader.

The authors give credit where due and adequately mark their own contributions.

The title is adequate.

The abstract gives a complete yet concise description.

The overall presentation is fine.

The language is very good.

Formulae are mostly correctly defined and used. Some additional definitions/explanations will be helpful. See below.

No significant parts of the paper require reorganization.

The references are appropriate.

General comments:

As a physicist I have difficulties with the 'net community production in equivalents'. See e.g. Table 1.

Could you please explain how they are calculated. In appendix A1 I can find a definition for

J. Is that J(O₂)? But nowhere I can find a J(NO_x) definition.

As this is a calculation at the heart of the paper, it should be described better.

I would like to see the title include the LoC sensor.

I found it at times difficult to compare the numbers within the paper. That is between the integrated properties and the concentration properties. Lines 231 to 235 are a good example.

In the same sentence you use the change in concentration and the inventory. While I am able to divide by 40, I would very much prefer to have a consistent scaling. Maybe you can for each inventory number also give an average concentration in parenthesis. And in line

234 shouldn't $40 * -4.5 = -180$ be the same as the 214 ± 7 drawn down to 0, or am I getting something wrong?

Similarly I have difficulties following the jumping between unit prefixes. Sometimes you use

mol sometimes mmol. I would prefer a continuous use of mmol, even if the numbers are 1000* larger.

Detailed comments:

- title You use 'nitrate-based' here, but measure NO_x later. A common problem when describing these sensors for which I also do not have a good solution.

- line 153 How do you 'extrapolate' the salinity from the descent to the ascent? Using temperature as reference or pressure?

- line 163 'down to a 40 m depth' drop the 'a' ?

- line 205 You write the 'tidal advection was 5 km over 25 hours'. Do you mean the full length moved around the tidal ellipse? Then the ellipse in Figure 1 cannot be to scale. I would estimate the circumference of the red ellipse to be more like 20-25 km. Either state 'not to scale' in the caption or draw it smaller or correct the number in line 205. Or correct me ;-)

- line 231 'based on average depth'. Is there a 'the' missing?

- line 233 I would always write 'between ... and' or 'from ... to' not 'between ... to'

- line 233 I get slightly different numbers from Figure 3.
 $(0.4-0.04)*1000/40/12 = 0.75 \text{ mmol/m}^2/\text{d}$
 $(0.54-0.16)*1000/82/12 = 0.39 \text{ mmol/m}^2/\text{d}$
 Or am I calculating something wrong?

- line 234 the same
 $-4.5 \text{ mmol/m}^3 * 40\text{m} = -180 \text{ mmol/m}^2 = -0.18 \text{ mol/m}^2$ over 12 days
 in Figure 3 this looks different. More like -0.36 mol/m^2 over 12 days

- line 244 Are you sure about the 1% ? I get more than 2% for a 1 deg change.

- line 245 Something is wrong with this sentence. You say 'Productivity J(O₂) is increasing'.
 But don't you actually mean 'Produced biomatter is increasing' ?
 To me 'productivity' is a derivative of an amount (or if per unit volume of a concentration).
 And in the same sentence you say there is a 'marked drop in productivity' when NO_x is used up
 which I would think is correct.

- line 263 'partitioning of the oxygen and NO_x—across the thermocline'
 looks like the 'the' is too much

- line 327 'was cooler then 2007' than

- line 536 Something is missing in 'by calculating the change oxygen inventory'.
 Maybe 'in the'?

- Figure 1 Axis labels are missing and the numbers could be bigger.

- Figure 5 Numbers are missing from the axes. I think, if you give numbers for the slopes, you should give numbers for the axes too. I understand that this is a conceptual diagram, but it still looks 'odd' without them.