

Interactive comment on “Fluxes of carbon and nutrients to the Iceland Sea surface layer and inferred primary productivity and stoichiometry” by E. Jeansson et al.

Anonymous Referee #1

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Title: Fluxes of carbon and nutrients to the Iceland Sea surface layer and inferred primary productivity and stoichiometry

Author(s): E. Jeansson et al. MS No.: bg-2014-485 MS Type: Research Article

General comments

The paper presents up to 13 years of nutrient and carbon data from the Iceland Sea to investigate primary productivity and related stoichiometry. It was an interesting paper and generally well written. Deficits to the surface layer were discussed in terms of productivity and fluxes and produced some interesting results in an otherwise under sampled region. I would recommend publication with some small corrections. My main

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concerns are related to advection, which was assumed to be zero in the region despite a lengthy discussion in the introduction of different flows to the area. Secondly this would be a good data set for investigating inter annual variability, however the year to year variations and the spread of data with respect to time was not obvious in the current write up.

Specific comments 1) P 15401 lines 15-23 there is a lengthy review of water flow to the region – the advection is later dismissed and set to zero. Why is this? I would suggest a ‘description of the region’ section with figure 1 (adding arrows to indicate flows to the figure). As it stands the introduction of water flow makes this seem like the main aim of the paper.

2) In the introduction there is a paragraph about different productivity estimates that a) needs references and b) may be better in the discussion (defining only the ones that you use).

3) You refer to 100m as surface, is this always the surface? (eg: in march when MLD is over 150m).

4) In the data section the source of temperature and salinity data (to calculate MLD) is not shown. Please add details on methods of measurement and confidence in the measurements.

5) Also the nutrient data – where did this come from? How were the measurements made? What is your confidence in them?

6) Re: DIC analysis: please include references on CARINA data quality at the very least. Surface sampling from 1983 is mentioned but was it included? Please state (as in the abstract) the range of years used.

7) The frequency of measurements for each month is covered in the table but the spread of the data is not shown. Survey dates with respect to time would be useful. The data sources should be acknowledged in the acknowledgement section too.

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8) Where there are fewer data points I understand that the median values were interpolated – please make his clear wherever it is mentioned. For example on p 15404 line 6 and p 15409 14 (In this case where you have written: due to few data this could be rewritten as 'as fewer data were available in winter the values have been interpolated'). Likewise the caption for Figure 2 should refer to '... MLD, for the months with few data points, was interpolated' Also add a comment re: interpolation for the caption to Figure 4?

9) Units and chemical symbols should not be mixed to avoid confusion. For example, "C" stands for the unit "coulomb". While the risk of such confusion may be small it can be easily avoided completely by placing the chemical symbol after the unit, i.e. '1 mol m⁻² a⁻¹ C' or, better, '1 mol m⁻² a⁻¹ as C equivalent'. In this document the units are not consistent: some productivity estimates do not have 'gC' units eg: p15408 line 18, p15416 l24. In contrast some do have 'gC' eg: (line 17 on the same page). Be consistent. 'gC' is not an SI unit (& 'gN' for nitrate may be misinterpreted as Newton).

10) The assumption of negligible horizontal nutrient supply (under biological production) should be explained, considering the lengthy description of different flows. Do the arctic and Atlantic water masses have the same nutrient concentrations?

11) What is the significance of the 47% (PO₄) and 60% (Si) regenerated production? Is this discussed at all?

Technical corrections

1) The partial pressure of CO₂ should be abbreviated as p(CO₂), with p in italics to identify it as a physical quantity.

2) There is an overuse of the word 'thus' throughout the document.

3) Overuse of '≈', should this be used at all? Please be specific rather than using the approximation symbol

4) P 15400 line 26: add 'a' (a very long time...)

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5) P 15400 line 27 add a reference to increasing CO₂

6) P 15401 l.28. remove 'only' (in: are only few estimates..).

7) P 15402 l.1. Production estimates should range from 75 to 179?

8) P 15402 l.10. I suggest O₂ (and later Ar) in full as oxygen (and Argon).

9) P 15402 l.20. 'debate during the last decades' (change to 'debate over the last few decades').

10) P 15402 l.26 'changes in nutrients'; l27 add a reference for model studies?

11) P 15403 l 1. There is some query over the tenses used, please check this. For example 'in this study we will use' (remove 'will') – in the same paragraph you say 'will estimate'. Likewise page 15405 (use of the word 'choose' instead of 'chose'?)

12) P 15404 l 2. Add reference for Hermite interpolation? Line 3: 'cause' should be 'course'. Line 6 use neighbouring (rather than neighbour) months.

13) P 15405 l 24. SD if this is standard deviation please use in full the first time this appears.

14) p 15407 l 3 repeat of 'the the'.

15) P 15407 l 9. Partial pressure of CO₂ in the atmosphere (not partial pressure of the atmosphere)?

16) P 15408 line 1. 'reduced rate of deficit increase' needs to be reworded for clarity. Line 3: deduced from 'a' change (add 'a'); line 5: in the following 'section' and 'are' summarised... (add these words for clarity).

17) P 15409 line 24: 'silicate gives a total production...'; l27. Recommend changing text to: 'but also shows a negative flux...'

18) P15410 l4. Carbon-to-nitrate ratio is written in full (this should be at the start only and henceforth C:N.

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- 19) There are a few long sentences that could be broken up eg: p15410 line 5 ('the seasonality between DIC and nitrate. During the first part...'). Line 24: replace 'but' with 'Another aim is to see how representative... ' to break this into 2 sentences.
- 20) p15410 line 5 'rather high agreement'? How high?
- 21) P15411 l 26: relative to nitrate (add 'to').
- 22) P 15412 l 4. Low-N (define N earlier on)?
- 23) P15412 line 12 to 29 (this paragraph needs to be altered in a few places to make it easier to read: eg: line 12: 'As previously mention the different season lengths with net N or C based production makes it difficult'...; eg: line 26: 'Furthermore C:N ratios have been observed...').
- 24) P15413 l3: 'this value represents the...'; l8: 'mechanistic explanations of uptake ratios'.
- 25) P 15414 l6: If equating... (rather than equalling).
- 26) P 15414 l24-26. 'This will aid understanding of variability drivers in biological production...'
- 29) P 15415 l4: 'With this mentioned' could be 'with this in mind we...'; l16: reword as follows:- 'when the concentrations are lowest by 20-30%'; l23: add 'an' (in an absolute sense).
- 28) P15416 line 2. 'With some bends?' What does this refer to? This needs to be clarified.
- 29) P15416 line 7: Slight changes here to: 'Since we mainly want to evaluate the fluxes of importance for production, and these seem to be confined...'; l22: omitted words & repeats as follows: 'due to the spread in mean pCO₂ values'.
- 30) P 15419 l 31 remove 'on internet', it is sufficient to put the 'ftp' address in place.

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- 31) Table 1: 'MLD', spell this out in full when used for the 1st time in the caption. What is the range of years used? Footnote a: 'surface layer to be negative'. Footnote b: are these all averages anyway? Do you mean interpolated rather than averaged?
- 32) Table 2 caption. Replace 'thus' with 'were'.
- 33) Figure 1: add arrows for water mass movement and flows?
- 34) Figure 2: Why are there more data points in Feb? It would be interesting to see the variability with respect to year? What about the higher than usual MLD in one year for March (and lower than usual value in June) – these are not discussed. Which years are they? Is this the reason for deviations in the profiles in figure 3?
- 35) Figure 3: 'An increase in MLD' – relative to what? Which years are presented? Where is the y-axis label?
- 36) Figure 5: If you use molC m⁻² in the text this could be used in the y-axis labels? Remove legend within the figure if explained in the caption.

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