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Biogeosciences Discussions

Interactive comment on "Consistent calculation of aquatic gross production from oxygen triple isotope measurements" *by* J. Kaiser

Anonymous Referee #2

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The author provides a detailed description of the methods used to calculate gross production from measurements of oxygen triple isotopes. The manuscript provides a comparison of the different equations that have been used for estimating 17O excess and a thorough analysis of the uncertainty associated with parameters used in these calculations. The author clearly identifies discrepancies in calculations using the triple isotope system and a need for consistency within the field. He also derives an equation for gross oxygen production that is based on 17δ, 18δ, and O2 supersaturation and avoids the need for a steady state assumption or the poorly constrained respiratory isotope effect.

This manuscript presents important insights into oxygen triple isotope calculations and should be published. However, the manuscript needs significant revision to clarify the

message and strengthen the conclusions. In addition, I believe that there are important lessons presented in this paper that are relevant to the broader tracer community. However, as written, the manuscript is inaccessible to those outside of the oxygen isotope community. Therefore, I strongly suggest that the author consider clarifying and reorganizing the manuscript to make it more accessible.

Concerns: My primary concern is that the author attempts to present too many peripheral conclusions making the argument non-linear and difficult to follow. It is easy for the reader to get lost in the tangential arguments which are not relevant to the primary conclusions of the paper. I suggest that the author determine the 2 or 3 main points that he wishes to convey and lay out the manuscript so as to strongly and linearly convey these conclusions. For example, I would suggest that the author edit sections 3 and 4 to present a linear derivation of the most relevant equations.

On page 4021, the author introduces four equations for 17Δ. One of the main points of the manuscript is that these equations are functionally different and that calculations must therefore be done in a consistent manner to avoid significant error. However, the author never directly compares all four of these equations. Furthermore, in the conclusions, the author writes: "It is not important which 17Δ definition is chosen – any single one will do, provided all calculations are performed consistently" While the last half of this statement is strongly supported in the manuscript, the author never demonstrates that the choice of 17Δ definition is not important. On the contrary, in several cases he shows one equation or another to be inadequate.

The author presents a large range of f and g values in section 6 but focuses only on the oceanic range. The conclusions made in this section are only valid for the more limited oceanic range and providing the larger range is therefore confusing. If the author believes that a range of f = -0.1 to +0.4 and g = 0.01 to 0.1 is the pertinent range, then this is what should be presented and the extended range can be given as a supplemental figure. If the entire range is of interest than the conclusions need to be modified.

BGD

8, C1686–C1689, 2011

Detailed comments: - I suggest adding a table with all of the variables and assumptions used throughout the paper that the reader could use as a guide.

- Page 4018 line 13 “measurements to determine in production” should be “measurements in determining production”

- On page 4018 lines 19 - 29: Here the author refers to the “different equations of 17Δ” and “certain parameters”. While these are discussed in detail later in the paper, it would be helpful to provide the reader more information in the Introduction.

- Page 4020 lines 12 - 24: I suggest shortening this section to one sentence containing the relevant information.

- Page 4021 lines 17 – 22: If both κ and λ are the “expected mass-dependent isotope fractionation” then for simplicity and clarity in this paper I would suggest using the same symbol (ie standardize equations 4 -7 to use the same nomenclature).

- Section 2.3: The issue of “per meg” terminology is a non sequitur and tangential to the primary argument. I suggest removing it here and on page 4049 lines 8 – 11.

- Figure 1: I suggest adding the other 17Δ equations to this figure.

- Page 4032 lines 8-9: state which equations are being referred to.

- Equation 42 + 43: these equations appear to be missing a ‘c’ on the right hand side of the equation.

- Page 4035 lines 6-8: It appears that the author is stating here that 17Δ# definition is not appropriate, this is in contradiction to pg 4049 line 2.

- Page 4035 lines 16-17: Since the iterative approach has frequently been used to estimate gross oxygen production, it might be nice to demonstrate with a figure that the iterative approach and equation 48 give the same answer.

- Page 4038 lines 10-12: I suggest that the author contact Helman et al to determine

BGD

8, C1686–C1689, 2011

which definition of 17O they used.

- Page 4039 lines 6-10: I suggest that the author contact Luz and Barkan for the 17δ and 18δ values presented in their paper.

Interactive comment on Biogeosciences Discuss., 8, 4015, 2011.