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Biogeosciences Discussions



# *Interactive comment on* "The fate of riverine nutrients on Arctic shelves" *by* V. Le Fouest et al.

**Anonymous Referee #1**

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This paper presents estimates of river inputs (nitrate SRP, silicate, DOC, DON, POC, PON) to the Arctic Ocean and explores the potential of these inputs to support primary production. The importance of river inputs relative to inorganic nutrient and organic matter supply from ocean sources is quantified for the present, and potential changes in the future are discussed. The authors take advantage of several different data sources to derive their estimates of river inputs. One benefit of this synthesis effort is that it brings together information on a wider range of constituents than other recent papers addressing river inputs to the Arctic Ocean. One drawback is that different methods, sampling locations, timeframes, and errors associated with various data sources make it difficult to assess overall uncertainty with respect to the input estimates that the authors ultimately use for calculating how much primary production is supported. The method used by the authors to estimate annual river inputs also introduces bias in two distinct ways. First, monthly binning does not allow for coupled variations in concentra-



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tion and water discharge within months. For constituents that are positively correlated with discharge this leads to under-estimation. For constituents that are negatively correlated with discharge this leads to over-estimation. Second, calculating annual inputs without interpolating values for missing months results in under-estimation. Most of the missing months are during the winter, when water discharge is relatively low. However, where constituent concentrations are high during winter months the unaccounted for fluxes may still be very substantial. Uncertainty associated with different data sets and underestimation of fluxes associated with calculation methods are mentioned briefly in the manuscript, but more thorough treatment of these issues is needed. On the primary production side, it would be helpful to consider not only riverine influence at the large scale (shelf areas and entire Arctic Ocean basin) but also effects more closely associated with the river input locations. Although river inputs may not support a large proportion of primary production integrated over the arctic shelves or ocean basin as a whole, these inputs may support much of the primary production that occurs in large areas more proximate to the sources.

Additional details:

1) Introduction, third paragraph, third sentence: Insert “surface” between “terrestrial” and “run-off”.

2) Materials and methods, first paragraph. Clarify whether or not ammonium data were used. In one place it seems to say that ammonium data were not used then later in the paragraph an ammonium dataset is identified.

3) Results and discussion, section 3.1, first paragraph, second sentence. The Finlay et al. (2006) reference seems out of place here. This paper is about DOC, not nitrate and silicate.

4) Results and discussion, section 3.2. Consider using a range of input values rather than a single estimate for each river to calculate potential effects on primary production. Using a range of input values would convey some sense of the uncertainty associated



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with the calculations and help show that your general conclusions are robust despite that uncertainty. Also, given that the rivers used in the study only represent a proportion of the total inputs from rivers to the various shelf regions, the authors need to make it clear that their estimates of how much primary production is supported by river inputs represents a lower bound (and provide at least a semi-quantitative estimate of how much primary production might be supported if all river inputs were accounted for).

5) Concluding remarks, second sentence. Time series were not computed. Please clarify.

6) Table 1. In the footnotes, or in the main body of the text, more information is needed about where the data for the "climatology" values came from. Although a general description of the various data sets that were used is provided in the materials and methods section, readers need to know specifically what data sets contributed to the calculations for each constituent at each river. Same goes for the auxiliary tables.

7) Table 1. The caption for table 1 indicates that the number of months accounted for in various estimates is shown in brackets, but the numbers in the brackets seem to show number of months as well as some percentage values that don't make sense. Revise to show only number of months. The percentage of the annual flux that is not accounted for as a consequence of the missing months is unknown for the climatology estimates.

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Interactive comment on Biogeosciences Discuss., 9, 13397, 2012.