

Interactive comment on “Sediment-water column fluxes of carbon, oxygen and nutrients in Bedford Basin, Nova Scotia, inferred from ^{224}Ra measurements” by W. J. Burt et al.

Anonymous Referee #1

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General comments:

This study explores the possibilities to estimate sediment-water fluxes of oxygen, nutrients and DIC from vertical water column profiles of ^{224}Ra . In areas with a lack of information on sediment properties, this can indeed be an interesting alternative approach to direct (in situ) flux measurements, given the assumptions of the 1-D diffusion model are met. The paper is written very clearly, the model explanation is easy to follow, results including figures and tables are generally very explanatory. The discussion accurately addresses the questions scientific questions raised, although I think some remain to be answered. To my opinion, the paper can be published in BG after minor

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revision of the following specific comments.

Specific comments:

Abstract

P9202 L2: add “Direct”: Direct quantification of such benthic fluxes ...

Introduction

P9203 L13-16: redundant, omit

M&M

P9206 L9: add (a reference to) the assumptions of the 1D diffusion model?

P9209 L10: appropriate depths: add depths, this can now only be deduced from Fig 5.

Please clarify that the sampling period encompassed only 5-6 weeks (end of Oct to beginning of Dec), so the Ra profiles were taken more or less every week.

P9210 L9-10: analysis method of oxygen nitrate, phosphate, chl-a and POC?

Results

To my opinion, this section is already too much integrated with result interpretations that belong to the discussion. E.g. P9210 L17-21 , P9211 L11-20, P9212 L1-14 ...

Discussion

The oxygen consumption here reported is quite high for such low temperatures. Is there any literature information available on direct flux measurements in the area or similar, nearby areas? The study from Hargrave and Taguchi (1978) is also indirect.

When it comes to the interpretation of the pathways of OM mineralization, some basic information from literature on sediment composition would be at its place: what is the (approx.) sediment granulometry (cohesive mud, permeable sand? My guess is mud ...), organic content, oxygen penetration depth, etc. Also, faunal composition of the

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sediment could help: are bioturbation and bio-irrigation taking place that could explain enhanced reoxidation of reduced substances? But in case abundant irrigating fauna is present, then the assumptions of the 1-D diffusion model are violated.

In case all this abiotic and biotic information on sediment composition is not available for the study area, I would put more emphasis in the introduction on the fact that this paper is the first one to explore sediment – water fluxes in the area.

Why does oxygen consumption increase from end of Oct to beginning of December? Given the constant temperature during the sampling period, this is strange. Is there a delayed POC decomposition (e.g. Rudnick et al. 1986)? Is it increased fauna activity because of the POC arrival?

Technical corrections:

Fig. 5b caption: dotted line: you mean “within dashed box”?

Fig. 6e caption: the DIC decrease . . . add s - decreases?

References

Burdige 2012 (in text) should be Burdige 2011 (in reference list)

Men et al. 2011 not in text

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