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Interactive comment on “Benthic fluxes of dissolved organic nitrogen in the Lower St. Lawrence Estuary and implications for selective organic matter degradation” by M. Alkhatib et al.

Anonymous Referee #2

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General Comments

This paper looks at the magnitude and drivers of benthic DON and DOC fluxes in the Lower St Lawrence Estuary, and provides evidence that selective OM degradation/preservation can drive differences in the stoichiometry of DOC and DON fluxes. The paper is generally well written and would be of interest to many readers of Biogeosciences. I do however find that there are a number of issues with the paper that should be addressed. Firstly, and probably most importantly, the whole paper is really only based on 9 down core profiles, and draws upon a lot of data from previous work. While this in itself is not a fatal flaw, much more detail is needed on the previous data. Was it collected from the same cores at the same time? What are the errors etc asso-

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ciated with those methods etc. In addition there is no replication in the current data set, which is a fundamental weakness. What is the within site variability, and is it larger than the inter-site variability? Benthic fluxes can show significant variability on the sub meter scale. The authors use their 9 down core profiles to estimate diffusive fluxes of DOC and DON, then use these calculations to scale up to the global shelf flux of DON. This is weak, and this section needs to be removed or revised completely. There is no within site replication, there is no temporal replication, and therefore it would be impossible to calculate the annual flux from within the study area, so scaling these measurements to global estimates is beyond the limits of this dataset. Fluxes calculated from porewater profiles neglect the influence of advection and bioturbation. These drivers may not be significant in the study area, however if this is the case then the authors need to include some discussion of this.

Specific Comments

Abstract The abstract leads the reader to believe that this study presents data on denitrification, POM reactivity, OET etc. This data is actually from previous studies. This should be made clear to the reader. **Introduction:** The introduction is well written and sets things up nicely. No problems here.

Methods Why wasn't the blank and for that matter concentrations for Rhizon sampling of DOC measured/calculated? What are the total errors for DON calculation (including the propagated errors associated with TDN, NO_x and NH₄) What is the precision/accuracy and errors associated of DOC analysis? These can be quite high, and accurate analysis of instrumental blanks is required for robust results. Some discussion on the uncertainties associated with the "best guess" estimate of DOC MW are needed, in particular what are the implications of this changing along the transect. It is likely that as the reactivity of the DOM pool changes, so does the MW of DOC.

Discussion: Too much discussion on the potential artefacts associated with the methods. This should be restricted to a single paragraph. Much of the discussion is based

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on OM reactivity; data presented in the authors previous papers. While there is no issue in using this data, basing much of the discussion on previously published work gives the reader the feeling that the authors are try to “scrape together” one last paper. The authors do not mention the role of benthic bacterial respiration in DOC and DON dynamics; this can have a significant role. Water column respiration is given as the likely cause for no DOC increase along the transect, but this could also be driven by benthic respiration. The sediments are clearly heterotrophic (oxygen fluxes in table 1 indicate this) yet this is not adequately addressed. Is it possible that the flux of DOC might be overestimated due to bacterial respiration of DOC at the SWI? The entire “scaling up to global fluxes” section either need to be improved or removed altogether. The authors data could be integrated with previous studies to give an indication of the likely magnitude of global DON fluxes, but this requires consideration of a number factors that are likely to influence the fluxes including, but not limited to: sediment type, OM loading, depth, seasonality etc.

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