Biogeosciences Discuss., 9, C647–C650, 2012
www.biogeosciences-discuss.net/9/C647/2012/

Biogeosciences Discussions

Interactive comment on "Use of geomorphic, hydrologic, and nitrogen mass balance data to model ecosystem nitrate retention in tidal freshwater wetlands" *by* E. D. Seldomridge and K. L. Prestegaard

Anonymous Referee #2

Received and published: 12 April 2012

General Comments

This paper is focused on using geomorphic analyses and nitrate mass balance measurements to determine geomorphic scaling variables to predict nitrate retention in tidal freshwater wetland ecosystems in the Patuxent River watershed (part of the larger Chesapeake Bay watershed). Marsh area, total channel length, and inlet width were related to tidal prism. Net nitrate retention was also related to water volume. These relationships were used to define nitrate retention equations for each of these geomorphic parameters and then applied to all marshes in a cumulative distribution for a spring

tide. Cumulative probability distributions of nitrate retention indicate that the largest marshes retain half of the total nitrate in the system. This last statement is a significant result. This paper addresses the significant topic of nitrogen cycling in tidal freshwater ecosystems. Anthropogenic activities have doubled the rate of nitrogen input into the terrestrial nitrogen cycle (Vitousek et al., 1997), which has accelerated transfer through watersheds to estuaries and coast. This has resulted in a loss of biodiversity and caused changes in ecosystem functioning of wetlands. Tidal freshwater wetlands provide essential ecosystem services which are currently being disrupted by human impacts (Craft et al., 2009). In addition, nitrate is a significant pollutant to the Chesapeake Bay (Phillips et al., 1999) and although a great deal of work has been done on stream geomorphology and nitrate reduction in various environments (hyporheic zone, slackwater regions, floodplain, etc.) much still needs to be done in tidal freshwater wetlands. This makes the research both timely and important. However, there are a few comments that should be addressed before the paper is published (see specific comments below).

Specific comments:

1.Abstract – Page 1408, Line 13. It is unclear whether you are referring to field data for mass balance measurements or for geomorphic parameters. Perhaps you should include a statement in the abstract about how you measured the geomorphic characteristics or specifically refer to the remotely sensed data as such.

2.Introduction – Page 1409, Line 13. "Geomorphic scaling parameters have been used to evaluate N loads and processing for both terrestrial watersheds (references should be provided here separate from tidal systems)..."

3.Methods, Geomorphic measurements and analysis – Page 1411, Line 22-24. How many field measurements did you compare with remote sensing data?

4.Methods, Field balance measurements of nitrate retention over spring tidal cycles – Page 1415, Line 5. You measured a portion of the flooding tide because it's constant

BGD

9, C647–C650, 2012

and all of the falling tide because it's variable for nitrate? Clarify. Additionally, nitrate was the only variable parameter, but ammonia is the only potentially insignificant parameter – how come you didn't include nitrite?

5.Results, Equations 4 through 6 (n values) and Relationships between geomorphic variables – Page 1416, Line 16. What about the error for the area and the length? Line 19. I am a little confused by "missing data" and why the n values change. Clarify.

6.Results, Relationship of spring tidal volume to geomorphic parameters – Page 1418, Lines 9-11. I suggest quantifying this in the text for the 3 study sites.

7.Results, Mass balance results of nitrate retention – Page 1418, Lines 15-17. Did you use 6 or 3 points to generate this relationship? The figure indicates 3 and the text 6. Was the spring data (open circles) plotted to match the trend? Why wouldn't you use all of the data if they all plot along the same line? I suggest running the regression through all the points to obtain an R2 or do an analysis of error between observed and predicted.

8.Results, Comparison of ecosystem calculations of nitrate retention. . . - Page 1419, Lines 13-15. Given the disparity between the remote sensing metrics with those measured in the field, do you think it is reasonable to develop equations using only the field sites and then applying this to the cumulative distribution?

9.Discussion, Geomorphic data and geomorphic relationships (I suggest changing to just Geomorphic data and relationships) – Page 1421, Lines 19-21 – Vegetative resistance seems out of place and not well-connected to the rest of the ideas presented in the manuscript. I suggest expounding a bit on the importance of this throughout the manuscript (with respect to flow, sediment, nitrate) and provide references (there is a rich body of work on this topic) or remove the mention of it here.

10.Discussion, Hydrologic controls on nitrate retention – Page 1422, Line 9. I see where vegetative resistance is important in a hydrologic sense, not necessarily geo-

BGD

9, C647–C650, 2012

morphic. The connection should be made explicitly and consistently throughout the work. Additionally, is this result because of contact with the marsh sediments because greater water would result in more surface contact? Lines 17-20. This might be a situation of correlation and not necessarily causality. This result implies somehow that these processes are more related to the fluid and not the sediment. Is this the idea that you are conveying? If not, maybe provide a mechanism for why the flow is important.

11.Figure 7 should have a legend indicating difference between open circles and black squares. (General figure comment – captions should be more detailed and specific, define any abbreviations used).

Technical comments:

No major technical comments noted. The manuscript is generally well-written.

Interactive comment on Biogeosciences Discuss., 9, 1407, 2012.