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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

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We thank Reviewer 1 for constructive comments to improve the overall quality of this manuscript. All suggestions for clarifications and typos ('additional comments' section) will be addressed in the revised manuscript. Our responses to the overall criticisms are given below.

1. Nitrate was the focus of this study because it is the most mobile species of inorganic nitrogen and measured concentrations varied significantly over a tidal cycle at the study

sites. Ammonium was analyzed and reported at or below the detection level during all sampling events. Due to the low in situ ammonium concentrations, we excluded this species from our calculations. Nitrite was present during few sampling campaigns, and concentrations may reflect incomplete denitrification at a water treatment plant that went offline in 2009 (Seldomridge, 2009). Nitrite concentrations did not vary beyond analytical error over the tidal cycle and concentrations dropped as the study continued into 2011, therefore, we excluded this species from the calculations.

2. A primary goal of this study was to measure the nitrate retention in individual marshes of varying size and then apply these results to other marshes within the freshwater tidal ecosystem. To achieve this goal, nitrate retention was measured and predicted for a single tidal stage and time of year (i.e. autumn spring tides, which represent 'bankfull' tidal stages). As demonstrated in figure 7, the relationship between water volume and nitrate retention indicated little seasonal variation in the multi-year data set. Three data points were highlighted to indicate those that corresponded to the identified baseline condition referenced throughout the manuscript. To eliminate confusion, all autumn data points will be highlighted in the revised figure 7. The autumn conditions produce the following trend: NR= 0.0064V1.04 (n=6, R2=1), whereas the multi-seasonal, multi-year dataset produce: NR=0.0045V1.1 (n=13, R2=0.98).

The relationship between water volume and nitrate retention does not change significantly when data are combined into a seasonal, multi-year dataset. Although not shown in this manuscript, the small deviation does not account for the difference in uncertainty in figure 8. Error was propagated through all calculations; error calculations included remotely-sensed geomorphic measurement error (section 2.2), analytical error (section 2.6) and field measurement error of channel morphology, gauge height and velocity (section 2.4).

3. The results of this study indicated that nitrate retention processes, which were not identified in this study, were transport-limited and thus water volume is important for the prediction of tidal nitrate retention. We will revise the main conclusion to clarify the im-

portance of overbank flooding and soil-water contact in the nitrate retention processes rather than attributing nitrate retention to water volume alone.

This was a field-based approach; however, the tidal prism exercise was used to compare classic prediction methods (Jarrett et al., 1976; Byrne et al., 1980) with field data. The revised manuscript will clearly define the difference between tidal prism (Tp) and tidal water volume (Vw). This exercise demonstrated the weaknesses of the tidal prism method. As acknowledged by Reviewer 1, the classic method (Jarrett et al., 1976; Byrne et al., 1980) doesn't account for the change in depth with position within the marsh. Therefore, tidal prism estimations do not take into account overbank flooding, and is only applicable for bankfull tidal stages. In this study, we constrained calculations by examining the tidal fluxes through the tidal inlet, the gatekeeper for water fluxes. Moreover, non-systematic errors are produced during the tidal prism calculations likely because the small and large end-member channels display different inundation behavior as a result of channel geomorphology and differing vegetative flow resistance. We examine this effect in forthcoming papers. This comparison of tidal water volume to simple calculations of tidal prism demonstrates the necessity for field-base hydraulic measurements to determine marsh hydrodynamics.

References

Byrne, R. J., Gammisch, R. A., and Thomas, G. R.: Tidal prism-inlet area relations for small tidal inlets. Proceedings of the Seventeenth Coastal Engineering Conference (American Society of Civil Engineers, New York) 3, 2517-2533, 1980.

Jarrett, J. T.: Tidal prism-inlet area relationships, General Investigation of Tidal Inlets Report 3, U.S. Army Coastal Engineering Research Center and U.S. Army Engineer Waterways Experiment Station 55 p, 1976.

Seldomridge, E.: Importance of channel networks on nitrate retention in freshwater tidal wetlands, Patuxent River, MD. University of Maryland M.S. Thesis, College Park, MD, 2009.

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