

Interactive comment on “Evidence for microbial mediated nitrate cycling within floodplain sediments during groundwater fluctuations” by Nicholas J. Bouskill et al.

Anonymous Referee #2

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Overall Quality:

The authors attempt to create a mechanistic model based on experimental isotope data from a floodplain in Rifle, Colorado. The model for this ecosystem is unique and definitely would be helpful for biogeochemists and practitioners attempting to identify denitrifying hotspots. The dataset used in the article is within a very small time period and the model appears to be only calibrated, but not validated. Further, nitrate concentration predictions appear to not be closely correlated, but statistical evaluations for goodness of fit were not presented in the article. The main conclusion, concurred with most research in floodplain ecosystems, that denitrification was the predominant

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removal mechanism for nitrate. Overall, the model in theory would be very helpful. However, the article in its present form lacks validation through microbial isotope experiments, which would truly provide “evidence” for microbial mediated nitrate cycling. Overall, the model presented in this paper has the potential to be an important step for predicting microbial processes in floodplain soils in Colorado and similar landscapes. However, validation and statistical assessments must be completed for the authors to be convincing that this model can predict all that is currently claimed.

Individual Scientific Questions/Issues:

The dataset is a small dataset and for only one season. The details of that season (e.g., rather it was a normal rainfall year) were not presented. Further, the article was unclear as to how many transects of monitoring wells or replicate samples were taken at each depth. Likely, a map of the monitoring locations would be helpful within the floodplain. Further information is needed regarding the soil and water chemistry (e.g. pH), which will impact microbial community population and productivity. The high concentrations of nitrate were surprising. Is this area in an agricultural landscape? Further information regarding the watershed land use would be helpful to understand the source of such high nitrate concentrations.

The nitrate isotope data was encouraging to see in the experimental design. However, the title “Evidence for microbial mediated nitrate cycling...” seems misleading, assuming no microbial isotopic data was collected in the soils. Additionally, do the authors have isotopic data for the confined aquifer to confirm that the mixing water is truly nitrate free?

The models need statistical results. Based on purely visual observations, the model predications do not appear to fit well with the observed data (Figure 4).

Technical Corrections:

The data presented in section 3.2 may benefit with having a table. All of the numbers

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are difficult to follow and compare in their present form. The second sentence in section 4.1 needs a reference. Additionally, several of the graphs are difficult to read (e.g. Fig 4, S3, S4).

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