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Biogeosciences
Discussions

Interactive comment on "Mimicking floodplain reconnection and disconnection using ^{15}N mesocosm incubations" *by* N. Welti et al.

Anonymous Referee #1

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Title: Mimicking floodplain reconnection and disconnection using 15N mesocosm incubations Author(s): N. Welti et al. MS No.: bg-2012-111

The authors studied the regulation of nitrate metabolism in the water/sediment mesocosm in two types of floodplain water bodies of the Danube River, Austria: a disconnected pond and restored, reconnected channel. It was tested if NO3 concentrations and DOC quality were major drivers of the fate of nitrate in floodplain aquatic ecosystems. Two experiments were conducted one where levels of NO3 were varied and a second experiment where DOC quality was changed by exchanging the overlying water in the mesocosms with either river water (rich in microbial DOC) and floodplain pond water (rich in degraded terrestrial DOC). Rates of denitrification, dissimilatory nitrate reduction to ammonium (DNRA) and anammox were measured using 15N tracer

additions. Both labeling in N2 and N2O were determined to see if treatments had an effect on the completeness of denitrification. Assimilation of 15N in sediment was also measured alongside benthic and pelagic bacterial production. Assimilation was the main removal process followed by denitrification, other processes (DNRA and anammox were not important. Denitrification was higher in the restored site but was not affected by either nitrate concentrations or DOC composition. N2O/N2 ratios were also not affected in the NO3 treatment, but DOM quality significantly changed the N2O/N2 ratios in both sites. The main conclusions are that (1) increasing floodplains hydrological connection to the main river channel increases nitrogen retention (higher denitrification in the restored site) and (2) decreases nitrous oxide emissions (lower N2O/N2 ratios due to more riverine DOC).

As such, it is a comprehensive study on the effect of river connectivity of the retention of nitrate in floodplains. Experiments were carried out well and studied in great detail. The paper is generally well written although wording is occasionally fuzzy. There are however a number of major issues with the manuscript that need to be addressed. The main problem is with the basic design of the experiments in that there is a lack of replication as the authors choose to study only one reconnected and one disconnected site. The two sites are also of different types (pond, channel) and have different sediment characteristics and vegetation. It is therefore not clear to me if the higher rates in the restored, reconnected site have anything to do with river connectivity (conclusion 1) or are just due to different sediment characteristics. The results fit the general ideas about river connectivity (higher inputs of NO3 and organic matter at the restored sites leading to higher denitrification rates), but, as the authors already write, very high spatial variability is to expected in denitrification rates in both restored and disconnected sites. If possible, the authors should try to show clearly that the selected sites were representative or extend the study.

The second issue is that I do not understand how 15N-N2O production was measured. A quadropole MS was used for all dissolved gas labeling measurements and N2O

labeling was based on the Mz 44, 45 and 46 (Page 4142). However, CO2 has the same masses and therefore interferes strongly. Some kind of mathematical correction was made to correct for the CO2 contribution, but the description of this procedure if very limited and unclear to me. Apparently, the N2O/CO2 ratio data from a previous experiment were used to correct the labeling data in some way. I can only see this to work if N2O/CO2 are constant between sites and treatments, which seems highly unlikely. The typical procedures to remove the interference are either to trap the CO2 by making samples for headspace analysis alkaline or based on GC methods. Details of their procedure should be included and information on the effectiveness of the method should be provided either from references to other literature or from their own data.

DOC quality is used throughout the paper whereas DOC composition is measured. This distinction should be made more explicit.

Other comments: Page 4135 Line 19: Concentrations of what? P 4137 L14 and 21: The hypothesis in these lines almost reads the same. Please remove duplication. P4141 L9: delete 'through the tube' P4142 L5: It not true that 98% of the N2 and N2O would be in the headspace. Given the headspace and water volumes in the vials a substantial amount of gas would remain in the water. I guess that what is meant here is that 98% of the equilibrium concentration was reached. Please rephrase. Also, were data corrected for water-gas partitioning? P4144 L7: Do these masses present production rates or just concentrations of N2O and N2? Please clarify. P4148 L10 and further: How can an increase in NO3 concentration from 3.84 to 34.7 microM due to 15N-NO3 label addition lead to only an 22at% labeling in the NO3 pool. Should be something like 90at%. Please explain (exchange with sediment?). P4154 L3: Please specify what is meant by decoupling between the water column and the anoxic sediment P4154 L3: How can NO3 assimilation by algae lead to the release of NH4. There is probably some leakage from the algal cell from NH4 produced during assimilatory nitrate reduction, but this is not assimilation and other processes like DNRA seem more likely explanations? P4155 L11: mention that assimilation is here by algae P4155 L11:

This explanation for the higher denitrification rates in the restored system seems very vague to me. How about differences in organic matter content and carbon mineralization rates between the two sediment that were selected for this study. The NO3 addition experiment didn't detect any difference in denitrification rates even though both amount and frequency of the NO3 additions were varied. P4157 L26: DEA?

Table 1: Please add the %Corg and LOI data. Seems important sediment characteristics that were measured (see methods).

Interactive comment on Biogeosciences Discuss., 9, 4133, 2012.