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Biogeosciences Discussions

Interactive comment on "Nitrogen assimilation and short term retention in a nutrient-rich tidal freshwater marsh – a whole ecosystem ^{15}N enrichment study" *by* B. Gribsholt et al.

B. Gribsholt et al.

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We thank both referees for their constructive feedback and their many useful suggestions. Most of these have been incorporated in the revised version, including addition of 'missed' reference.

The whole ecosystem deliberate tracer addition approach is a relatively new technique that has its strength and weaknesses. Among the weaknesses are the very large logistic demands, the costs of the tracers, the very large number of isotope analysis required and the lack of accurate quantification of compartment process rates because of heterogeneity in label distribution and heterogeneity of ecosystems. Marshes are in particular difficult to study because of their dynamic, open nature (most of the tracer added

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is exported during the first tide implying significant loss of financial resources) and spatial heterogeneity. However, there are also some advantages and unique features that can not be studied with other approaches, in particular the unbiased assessment of the relative importance of various compartments within an ecosystem (pelagic vs. benthic, relative importance of various primary producers, nitrogen retention by bacteria, plants and animals, etc). This unique information of the whole ecosystem labeling approach is clearly shown in our studies (benthic nitrification more important than pelagic nitrification, nitrification more important than assimilation, less conspicuous compartment such as litter and ruderals more important than dominant reed meadows). No doubt that if our objective would have been to accurately derive process rates for a single compartment that we would have adopted another approach, but this was not our intention. We rather have semi-quantitative knowledge of the important ecosystem-processes and compartments than very accurate knowledge on processes and compartment of minor quantitative importance. In the revised version we have modified the text to better communicate the strengths and weaknesses.

Both reviewers mentioned that we might have underestimated the role of rooted macrophytes in marsh N-retention. We largely agree and we had already mentioned this in the manuscript, but evidently not clear enough. We have revised the text to communicate more clear that (1) our study focuses on retention of 15N-ammonium from creek water and not assimilation of (total) nitrogen from all sources. Because of the short-term nature of our study, we have not or only partly labeled nitrogen resources for deeper rooted plants and therefore these macrophytes do not capture 15N as they would have if label distribution would be homogeneously distributed. (2) Litter, ruderal vegetation and reed roots/rhizomes assimilate nitrogen from different pools, more or less stratified vertically and that litter/sediment surface organisms capture for that reason more than reeds. Once again, our prime objective was to study the short-term fate of creek-water 15N-ammonium and not total nitrogen assimilation. Our study therefore elucidates the direct assimilation and dependence on creek-water nitrogen of marsh ecosystem compartments, and not the indirect, eventual nitrogen resources. More

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specific, some compartments may ultimately depend on creek-water nitrogen but only after micro-organisms first have captured it. The nitrogen assimilated by these micro-organisms is then mineralized later in the season or at depth and it is then captured by macrophytes. The text has been modified accordingly.

Interactive comment on Biogeosciences Discuss., 3, 1081, 2006.