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Discussions

Interactive comment on "Dynamics, chemical properties and bioavailability of DOC in an early successional catchment" *by* U. Risse-Buhl et al.

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The research by Risse-Buhl and colleagues describes the DOC changes, bioavalability and chemical properties along a hydrological flow path in an artificial catchment. I found the report extremely interesting and attractive. In my opinion the strength of this work is the DOC bioavalability experiments. However I had some difficulties to understand the experimental design and interpretation of results. On the other hand, the most weak part is that focus on carbon mass balance. Below I detailed all questions and doubts raised reading the manuscript

Study site: From literature I observed that chicken Creek is a "rectangular" catchment (fig. 1 in Hollander et al., HESS, 13: 2069-2094, 2009). It would be useful for a reader to generate a map of the catchment that indicates the exact position of the sampling

sites into the catchment. This might help the reader to have a visual perspective of the water hydrological flow path from the soil to the pond.

DOC bioavailability: In the Discussion, at the beginning of the section 5.2, authors reported that during incubations, "an initial period characterized by declines in DOC concentrations and relatively high respiration rates between days 0 and 14. . .[ ]. . ..(Fig. 5)." From Fig. 5 the initial DOC decline is clear for incubations with soil and stream sediment microbial communities. Conversely, it is ambiguous the DOC decline when microbial community from pond was used as inoculum. In addition, from Fig. 5 (panels a, b, and c) DOC concentration in pond water (gray diamonds) decreased clearly only in panel b. Therefore I interpret that BDOC for pond water was virtually null in two cases out of three. Similarly, for subsurface (gray squares), DOC decrease is evident in panel a but not really in the other two panels. In synthesis, I detected DOC a robust decline for "upwelling groundwater" only (soil solution is also clear but it was estimated only in one treatment, figure 5a).

I conclude that microbiota from soil and stream sediments are more (approx.) effective in DOC degradation than that from pond water and that pond water seem to me more recalcitrant that that of "upwelling groundwater". Nevertheless, authors stated that "DOC bioavailability was similar across all water types" and focused their explanation on changes on DOC aromaticity, molecular weight and carbohydrates. My questions are: How BDOC was estimated? How change SUVA, a250/a365 ratio and carbohydrates content in the four waters types during incubations?

Furthermore, authors stated "high respiration rates between days 0 and 14" (pag 1030, line 14). However, from figure 5, the temporal patter of the respiration rate (0<t<14 days) in soil inoculum (fig. 5 panel d: it gradually decrease) is opposite to that observed in stream sediment inoculum (Fig. 5 panel e: it gradually increase). This is an interesting result. Do you have some hypothesis that might understand these different dynamics in respiration? Does the respiration increase observed at the beginning of the panel e (especially in pond water!!!) a response of new high bioavailable DOM

release of microbial origin? This new DOC release might compensate the DOC consumption and determines a low/null net DOC changes (see panel b).

In the description of equation 4 it is necessary to add the units of the parameters. Furthermore, it is necessary to describe in more detail how data fit this model: are the fits statistically significant? How is estimated the parameter R (DOM recalcitrant fraction)?

DOC age: In the last paragraph of the introduction, authors "hypothesized that DOC in the catchment originates primarily from ancient organic matter of the Quaternary substrate, that DOC of ancient origin is the primary substrate for microbial activity" (pag. 1016, line 20). It is evident from results, that old organic matter is "a minor source of DOC" (pag 1028, line 14). However, the hypothesis that old DOC is a relevant substrate for microbiota is not discussed. I have just read that "preferential microbial degradation or sorption of 13C enriched compounds such as recently formed carbohydrates". It would extremely interesting to discuss in more detail why your initial hypothesis is not confirmed by results.

Water/DOC fluxes: Equation 3 is imprecise. Note that the left hand is a flux (Qgs), meanwhile the right hand is a mix of fluxes (Ppond, ETpond, Qpond) and volumes (ïĄd'Vpond). In my opinion the equation water mass should be rewritten in the following way: dVpond/dt=Qgs+Ppond-ETpond-Qpond

It remains confused to me the approach to estimate the DOC input. According the text pag. 1022, line25), DOC input is "calculated multiplying Qgs by mean annual DOC concentration measured at the weir and the H-flume". Are the discharge contribution of stream (Qs) and groundwater Qgw) identical (i.e. Qs ïĄ¿Qgs)? If Qs, Qgs and their DOC concentrations are known, DOC input is the sum of the two DOC fluxes? (i.e. DOCinput= Qs * DOCs+ Qgs * DOCgs). It is necessary to explain better how DOC inputs fluxes are estimated.

Finally, the DOC mass balance does not take into account the DOC release generated

into the pond (mainly by photoautotrophs). This is an important aspect. If this autochthonous DOC input cannot be quantified, in my opinion does not make any sense estimate an incomplete DOC mass balance in pond. Is the apparent decrease of the % removal (from 73 to 29%) the consequence of the increase of the contribution of DOC release from submerged macrophytes? In my opinion these results are the weakest part of the manuscript. If relevance of autochthons DOC can not be estimated and integrated in the balance, I would suggest removing this section. Removal of this section do not really change the main results of this study.

Minor questions:

In Material & methods section, authors identified four water types: 1) Soil; 2) Upwelling groundwater; 3) Subsurface water in the alluvial fan; 4) Pond. Therefore, what is the "perched flow" (line 11, page 1018, Figure 1b)?

Figure 5d, e, f: Respiration: units?

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