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Biogeosciences Discussions

Interactive comment on "The impact of four decades of annual nitrogen addition on dissolved organic matter in a boreal forest soil" *by* M. O. Rappe-George et al.

Anonymous Referee #3

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The authors found an accumulation of DOC in B but not O horizon soils, no responses to changes in pH or ANC from the long term N addition, and an increase in SUVA in B horizons of fertilized plots which they suggest is due to a mobilization of old SOM. Their best correlation of DOC was with tree biomass, which increased strongly when fertilized with N.The authors also found an increase in the DOC:DON ratio after fertilization ended, suggesting the N in SOM was getting consumed or leached.

However, several of us read it and do not think these are valid explanations. You could have an increase in aromaticity from the partially decomposed lignin components that are leaching into the soil from excess tree biomass (i.e. presumably if they are making

more biomass they would be making more litter which they refer to in the discussion ref. Saarsalmi et al. 2007). Especially since the authors make the case in the Introduction that the DOC input to the mineral soil can be large (refs Zech and Guggenberger 1996, Kleja 2008) and that DOM is a significant source of C in B horizons (Buggenberger et al. 1994). They say in the discussion that "As there were no treatment effects in O horizon leachates, the increased DOC in mineral soil requires an explanation other than increased leaching of DOC from the overlying O horizon." We disagree. The O horizon solution may already be C saturated, overall C stock is increasing in O horizon.

I think it is fine to suggest that root exudation in the mineral horizon may be stimulating priming which could be the source of the DOC increase, but I think the authors cannot rule out just straight leaching from the increased tree biomass/litter.

Another argument the aithors make about this is that (line 15 p. 9) is that 'in mineral B horizon leachates, the terminated N treatment, N2, had the highest DOC, not the ongoing N1 treatment, which demonstrated that ongoing N addition did not fuel DOC but that DOC was more related to the accumulated amount of added N.' BUT, once you have the higher tree biomass (which was still increasing in 2009, Fig 3), you have higher litter input and higher leaching from that increased amount of litter that could be the source of DOC increases in the B horizon.

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