

Interactive comment on “The impact of wildfire on biogeochemical fluxes and water quality on boreal catchments” by Gustaf Granath et al.

Anonymous Referee #2

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The impact of wildfire on biogeochemical fluxes and water quality on boreal catchments (Granath et al., 2020, Biogeosciences Discussions) This study reports on the impacts on wildfire on C dynamics and water quality from a boreal forest catchment in Southern Sweden, using paired (before-after) measurements on fire areas. To be honest, I was hoping quite a lot from the paper, as the topic seems really interesting and promising (as both pre fire situation and post-fire conditions were supposed to be included. It would be quite unique possibility to describe quite exactly the C dynamics related with fires (pre fire conditions, combustion, and post-fire conditions), and all this in relatively large scale. Unfortunately, at this stage the paper misses many explanations, and actually entire research is missing some of the needed measurements. Thus, at this stage the authors were not able to convince me that some of their statements are actually

C1

valid. At this stage I have the impression, that by leaving the pyrogenic material measurements (charred material, charcoal, ash) out from the research, the authors are overestimating the C losses through combustion. Also, as the water measurements started weeks after fire (and one week after first rain), the authors are underestimating the fluvial C movements. As the authors have not been explaining how they have been using eddy data (they are presenting net ecosystem exchange (NEE) results, that also includes the photosynthesis (carbon uptake), but they haven't been explaining the proportions of the photosynthesis and respiration, the authors have not been convincing me that their numbers behind different C fluxes are correct. The authors are also completely ignoring the fact (would expect it at least in discussion) that (at least some of) the areas were logged after fires.

Below are my detailed comments: P2 L11: What about Scandinavia? Emissions are bigger or smaller compared to North America, as the fires are completely different in these two regions. P2 L12-13: Compared to what areas? North American areas? Upland soils vs. peatlands? P2 L23-24: New study by Rodríguez-Cardona et al 2020 (Scientific Reports volume 10, Article number: 8722) shows clear post-fire decrease (although they are using longer chronosequences there). P2 L24: What is POC export? P4 L1: It should be stated somewhere here that (at least some) the areas were logged after fire! P4 L1: In intro there is a lot of talk about drained peatlands and/or peatlands. Is this the case also here, are the areas mainly forests on drained peatlands? I think some kind of description of the area would be good to include here. P4 L9: Any expectations/hypothesis? P4 L16-17: Would expect more of the area description. How old was the forest? Was it similar through the area or there was many different stands with different age and tree species? P5 L5-8: Can it be that due to late start you have been actually missing some of the C movement (it is washed through different soil horizons with days after rain)? P5 L28: Is this the same as the "ash layer" mentioned earlier? P5 L30: It can be also up to 60% or even higher (Wiechmann et al 2015. PloS one, 10 (8), e0135014-e0135014). P5 L 30-31: how were the charred logs/snags/stumps treated? If you haven't been measuring the pyrogenic carbon (charcoal, ash) separately, you

C2

are probably overestimating a lot. P6 L9-10: Based on Figure1, these transects and sample plot locations are not similar to the burned area. Please specify how these reference transects were located (how far from each other, etc.). P6 L14: “. . .three to five soil cores. . .”. Per transect? Per plot? P6 L19-21: If stated like this, then my question is what about Europe and Scandinavia? P7 L4: With eddy, I assume you are measuring net ecosystem exchange (NEE) (including C uptake by photosynthesis and release by respiration). If we assume that everything was killed during fire (but you were saying that at the beginning the fire was not stand replacing) then you would measure the respiration (decomposition, etc.), but the vegetation comes back quite quickly after fire, so I would still say that you are measuring NEE. How you are able to talk about the C emissions? As you are not explaining how you were separate the respiration (C emissions) from the photosynthesis. How big and to what direction is the footprint area of the eddy systems. I would assume that the winds from the west are dominant in these areas, but this way the southern eddy is not measuring fire area (at least most of the time)? Also, the eddys are placed so that you are not able to combine the C loss measurements and eddy data (as they are most probably not overlapping). Any specific reason why the eddys were placed as they were? P7 L18-20: This is really big assumption! Taking also into account that you actually haven't been taking the formed pyrogenic carbon (charcoal, charred material, etc.) into account (not analyzed it separately), your C loss calculations might be overestimated. P9 L13-15: So you are saying that 95% of the C emitted during the fire was coming from O-horizon? You had high severity, stand replacing fires on areas (high intensity), all the trees killed, vegetation removed, and then more than 95% comes from O-horizon? On table 2 there is only one value for emissions during the fire, and no separation by vegetation and/or soil. P9 L23-25: I still think that you were actually missing the biggest fluvial losses (the pyrogenic material that is washed away with first rain event). P10 L1-2: Base on the figures you have been measuring NEE with eddy. Unfortunately, there is no data available about vegetation recovery (biomass, coverage), but I have the impression that 3 years after fire, there is already some new vegetation also in areas with high severity. So one

C3

can't talk anymore about C loss when interpreting the NEE values. P10 L4-5: Now the talk is about C uptake (my previous comment). But the vegetation regrowth data is not presented, and it is still not explained how you separated the respiration and uptake data from each other. P11 L11-12: Sorry, but based on your results and talk, I'm not convinced! By not taking into account (analyzing separately) the amount of charred material and charcoal, you are overestimating the direct emissions from the fires. P11 L16-18: Sorry, but you missed the first rain event (if the first samples were taken week after first post-fire rain), and with that probably also DOC that was washed away (or washed to deeper soil horizons) from the areas. So, I assume you are underestimating the fluvial C loss. P14 L23: Discussion is completely missing the fact that the areas (at least some of them) were logged after fire. How the mixing of soil (pyrogenic material and soil) by machinery would affect the emissions and water quality? How the logging (removing the material that would start to decompose on areas) could affect the C fluxes?

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C4