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Interactive comment on “Storm pulses of particulate and dissolved organic carbon in a forested headwater stream and their environmental implications – importance of extreme rainfall events” by B.-J. Jung et al.

Anonymous Referee #1

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The manuscript of Byung-Joon Jung and colleagues addresses the question if exports of particulate organic carbon (POC) contribute substantially to total organic carbon exports in headwaters during stormflow events. This is a relevant topic, as compared to dissolved organic carbon (DOC), POC exports are not adequately considered in many carbon flux and budget calculations.

However, I have concerns with respect to the optical method used to measure the POC concentrations. POC is derived here from the difference between total organic carbon (TOC) and DOC. Both, DOC and TOC were measured in situ by light attenuation.

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[Discussion Paper](#)



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While DOC can be monitored fairly well by UV absorption (R₂ typically around 0.75, 0.84 in Jeong et al. 2012 as cited in the manuscript), optical TOC estimates include high uncertainties. First, there is large variation in the relationship between (VIS) light attenuation and particulate matter quantity depending on e.g. particle size or surface quality. Secondly, suspended particulate matter consists not only of organic carbon (POC) but also of mineral fractions. Changing concentrations of minerals between events seriously affect TOC estimates and therefore calculated POC values.

DOC and POC concentrations were calculated and corrected here on the basis of water samples analyzed in Jeong et al. 2012 (p. 6882 lines 22-26, Jeong et al. 2012, G03013 p. 4). However, the present study obviously includes a much higher number of events (6888 line 19 – p. 6889 line 2) exhibiting “large magnitudes and variations in POC” (p. 6889 line 3). Because of the uncertainties associated with optical measurements I am not confident if empirical validations of the method in Jeong et al. 2012 can be extrapolated to the larger dataset of this study. Different events potentially mobilize POC and DOC of different quality and composition from soil layers or aquatic sediments of a catchment. Heavy rainfall can increase soil erosion and can change the contribution of mineral soil particles to suspended particulate matter.

In conclusion, the uncertainties in POC values appear too high. A direct measurement of POC after filtration is strongly recommended.

Further comments

p. 6878 lines 2 and 3. It was not immediately clear to me how “erosion-related sinks of CO₂” and “biodegradation of recalcitrant organic materials” is related to the issue of this work (POC and DOC export). I suggest starting with the importance of extreme events or of extreme monsoon rainfalls for matter transport on a regional/global (?) scale.

p. 6878 lines 12 and 13. The Abstract does not contain the information that POC and DOC were not measured directly but derived from optical measurements.

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Interactive
Comment

p. 6878 lines 25 and 26. This sounds a bit like an exaggeration to set up the conclusions. It is now generally accepted that rivers are not passive conduits. Please see also p. 6881 lines 13-14.

p. 6879 line 14. Why “contrasts”? Both, dynamic transformation and high C sequestration can occur.

p. 6880 line 13. Please insert “in” situ.

p. 6882 line 6. This study included data “from 2008 through 2011”. In Jeong et al. 2012, data from May 2008 until January 2011 from the same catchment were analyzed. The authors should explain in the Methods which data were already published.

p. 6882 line 11. Although published in Jeong et al. 2012, I found the phrase “in-stream C analyzer” not applicable for a device measuring light absorption.

p. 6884 lines 6-10. Were filter blanks processed without suspended solids?

p. 6885 line 1. Please consider “The“ inoculum...

p. 6886 line 9 and Fig. 2. Except C export vs. rainfall, there seems to be no statistical relationships above the threshold value of 100 mm precipitation.

p. 6886 lines 17-19. “Above the threshold precipitation ... POC concentrations and fluxes increased drastically...“ Can you exclude that this important observation was based on nonlinear light attenuation relationships with increased turbidity (internal filter effects), instrument settings and corrections? Was it supported by conventional POC measurements?

p. 6887 line 16. Please consider Fig. 5 instead of Fig. 4?

p. 6887. I found parts of the manuscript difficult to read. Some sentences contained too much information (e.g. p. 6887 lines 22-25).

p. 6888 line 19. The start of the Discussion typically summarizes the most important

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Interactive Discussion

Discussion Paper



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findings. Here it starts with “The result ... expands our previous results obtained from a smaller number of storm events...“ I suggest rewriting the paragraph to indicate that this study represents a valuable contribution.

p. 6891 line 13-15. “...aged humic materials...“. Is the meaning of ‘aged’ old (i.e. analyzed by radiocarbon) or refractory and less available?

p. 6901 Table 1. This table can be omitted. R2 and P were already included into Fig. 2. The regressions itself appear questionable (please see above). I would prefer a table characterizing the rainfall events and other hydrological situations, which were sampled. This can include information, which data were already published in Jeong et al. 2012 (please see above).

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