

Interactive comment on “Response of dissolved and particulate organic carbon and nitrogen in runoff to monsoon storm events in two watersheds of different tree species composition” by Mi-Hee Lee et al.

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see also attached Supplement file

Anonymous Referee #1 Received and published: 26 June 2016 Lee et al. in this manuscript have tried to understand the effect of storm events on dissolved and particulate carbon and nitrogen in runoff from two different watersheds dominated with different species of vegetation. In general, study of this kind can provide an improved understanding of nutrients and material transfer from different terrestrial set up under monsoon condition. It is understandable that it requires a lot of effort to carry out study

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of this nature; it would have been better if there were more sampling events. Keeping aside the limitation in numbers of sampling events, the manuscript in present form is very poorly written with lots of mistakes in presentation of results and figures. I believe it is not suitable for publication in Biogeosciences. Below are some of my specific observations: Reply We appreciate your valuable comments and suggestions to improve our manuscript. As you indicated, logistical limitations did not allow us to take more storm samples. However, our approach combining elemental concentrations and isotope ratios of both DOM and POM provides rare data sets and insights, which would attract attention from the readership of Biogeosciences, we believe. We will thoroughly revise our manuscript incorporating your critical comments. Specifically, the abstract, introduction, and discussion sections will be rewritten in a more focused way to elaborate on motivations and major findings and their implications.

* Abstract does not clearly bring out the findings of the study. It merely describes the variability in results. I think they should modify it to include the processes involved for such observation. Reply The abstract will be revised to highlight major findings, including watershed-specific differential storm responses of DOC vs. POC (PON) and DON vs. DIN. We already suggested differences in hydrologic flowpaths as a major mechanism for the differential storm responses observed in the two watersheds. This proposed mechanism will be complemented with more detailed descriptions of the interplay between hydrology and species differences affecting litter and SOM chemistry. The abstract can shortly include processes and explanation for observation as from line 15 on:

‘During storm events, DOC concentrations in runoff increased with discharge, while DON concentrations were stable. DOC, DON and NO₃-N fluxes in runoff increased linearly with discharge pointing to changing flow paths from deeper to upper soil layers at high discharge, whereas nonlinear responses of POC and PON fluxes were observed likely due to the origin of particulate matter from the erosion of mineral soil along the stream benches. The cumulative C and N fluxes in runoff were in the order; DOC >

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POC probably caused by the relatively moderate precipitation less than 100 mm per event and $\text{NO}_3\text{-N} > \text{DON} > \text{PON}$. The cumulative DOC fluxes in runoff during the 2 months study period were much larger at the deciduous watershed (16 kg C ha^{-1}) than at the mixed watershed (7 kg C ha^{-1}) while the cumulative $\text{NO}_3\text{-N}$ fluxes were higher at the mixed watershed (5.2 kg N ha^{-1}) than at the deciduous watershed (2.9 kg N ha^{-1}), suggesting a larger N uptake by deciduous trees. Cumulative fluxes of POC and PON were similar at both watersheds. Quality parameters of organic matter in soils and runoff indicate that the contribution of near surface flow to runoff was larger at the deciduous than at the mixed watershed. Our results demonstrate different responses of dissolved C and N in runoff to storm events as a combined effect of tree species composition and watershed-specific flowpaths.

* Introduction is poorly written with no focus. It wanders from one topic to other other without gravitating towards the focus of the work. The first line of the introduction itself appears confusing to me. Reply The introduction was rather short in the 1. version. We will extend the introduction and cite more previous studies so that the focus of the paper becomes clearer. We will focus on three main topics: heavy rainfall effects, tree species effects and the relation among DOC, DON, DIN, POC, and PON.

* One common observation throughout the manuscripts is regarding the references. I think it should be chronologically arranged. Reply We followed manuscript preparation guidelines for authors in Biogeosciences webpage (source: http://www.biogeosciences.net/for_authors/manuscript_preparation.html), which regulate that 'In terms of in-text citations, the order can be based on relevance, as well as chronological or alphabetical listing, depending on the author's preference'. However, we can chronologically arrange the references in text, if editor wants us to cite references chronologically.

* Framing of the sentences from previous works is such that they appear as if they are from the present study (line 15-20). Reply Line 17 will be changed to 'Only few data were available on the partitioning of DON and PON fluxes in runoff from forested

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watersheds, like Inamdar et al., (2015)'.

* Introduction last sentence: What is measuring campaign? Reply technical comment: The term will be deleted. Also, the sentence will be simply written to 'The goal of this study was thus to investigate the influence of tree species and heavy storm events on the fluxes of dissolved and particulate forms of C and N from a mixed coniferous/deciduous and a deciduous forested watershed in South Korea during the 2013 monsoon season'.

* How can annual air temperature range from 10 - 15 oC with -6oC in January and 26 oC in August? Reply clarified as 'The average annual temperature of the Lake Soyang watershed in western Gangwon-province is 11oC with monthly average temperature ranging from -5oC in January to 24oC in August during from 1981 to 2010.

* Page 3: Line 20: '(deciduous watershed) (Figure 1)' should be replace with (deciduous watershed; Figure 1). Reply technical comment: It will be changed to '(deciduous watershed; Figure 1)'.

Page 4: The text suddenly jumps to Oi and Oe+Oa layers without providing any context to it. Reply The definitions of Oi, Oe and Oa will be added: 'The total stock of organic horizons (Oi: slightly decomposed recognizable litter, Oe: moderately decomposed fragmented litter, Oa: highly decomposed humus material) was collected at each plot in a $20 \times 20 \text{ cm}$ frame with 10 replicates'.

Page 4: What do you mean by partly below detection limit. Please provide the number of samples or occasions when it went below detection limit. Reply The detection limits were already stated in the text; page 4 line 24. Concentrations less than detection limit were observed in 5-8% of the measurements in runoff during the July events. This information will be given in the methods section

* The authors mention the statistical methods followed for analysis but it hardly comes during discussion. Reply Whenever we cite results that are significant, statistical sig-

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nificance will be mentioned throughout the text.

* Page 5: Line 25: Elaborate on the meaning of freeze drying the samples for mass spectrometric analysis or rephrase the sentence. Reply The sentence at the page 5: line 25 will be changed to 'After filtration (0.45 μm , Whatman), water samples were freeze-dried. Water samples were freeze dried to measure isotope abundance because freeze drying is widely used as pre-treatment of water samples for isotope analysis (Lee et al. 2013, Lambert et al. 2014). -J.-Y. Lee et al. (2013) Variation in carbon and nitrogen stable isotopes in POM and zooplankton in a deep reservoir and relationship to hydrological characteristics, *Journal of Freshwater Ecology*, 28(1):47–62. - Lambert T. et al. (2014) DOC sources and DOC transport pathways in a small headwater catchment as revealed by carbon isotope fluctuation during storm events. *Biogeosciences*, 11:3043-3056.

* Should not mineral N include nitrite? Reply Nitrite was not measured because it was negligible in soil solutions and runoff from test measurements.

* Authors state that 'the soil $\delta^{13}\text{C}$ and soil $\delta^{15}\text{N}$ values significantly increased with soil depth from -29 to -24‰ and from 0 to 8‰ respectively". However, it would be nice to see the vertical profiles of such data. Was the surface $\delta^{15}\text{N}$ always near 0 ‰ Reply New figure of soil $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ isotope will be added. The added data will be used as evidence of watershed-specific species effect on the quality of soil organic matter.

* I could not make the sense out of the sentence 'In the study period, the highest precipitation coincided with the maximum precipitation intensity, the highest precipitation intensity and the maximum discharge at the 10 mixed watershed and at the deciduous watershed on July 14th, 2013" Reply technical comment: This sentence will be deleted.

* While the difference in DOC concentrations with discharge between deciduous and mixed watershed appears to be convincing (Fig 2a), the POC and PON increase with discharge relies heavily on one data point from high discharge. I do not doubt the increase but I believe that to make unequivocal conclusion more points would have

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been an asset. Reply the discussion will be changed. The "threshold" interpretation will be weakened

* Please rephrase the sentence "The fluxes of DOC and $\text{NO}_3\text{-N}$ increased with a much steeper slope at the deciduous and at the mixed watershed, respectively". Reply The sentence will be rephrased as 'the DOC fluxes at the deciduous watershed increased with a much steeper slope in response to discharge than at the mixed watershed, while $\text{NO}_3\text{-N}$ fluxes at the mixed watershed steeply increased with increasing discharge than at the deciduous one.

* There is problem with the symbols and its representation in Figure 3. I think authors should be careful with these kinds of mistakes before submitting their manuscript for review. It is very tiring to review a manuscript with these kinds of mistakes. Reply sorry for the confusion: the mistakes will be corrected in the new figure.

* Result section discussing Chemical properties of DOM and POM in runoff should be modified with proper emphasis on isotopic data. At present the isotopic data has just been mentioned as passing comment. Reply We will provide more detailed descriptions on the isotopic signatures in the discussion section on Chemical properties of DOM and POM in runoff: 'Also the $\delta^{13}\text{C}$ data in runoff, being more negative at the deciduous watershed points to a larger proportion of forest floor leachates than at the coniferous watershed'.

* In the discussion, authors have admitted that the numbers of events are rather low in the study and observations made by them have already been observed before by Dhillon and Inamdar (2013). I am wondering what novel finding they are discussing which warrants publication in a journal like *Biogeosciences*. Reply Most of previous studies focused on the fluxes of organic matter at one watershed for one year or more. In our case, the novelty lies in comparing differential storm responses of DOC/DON and POC/PON with a particular reference to watershed properties and storm response patterns.

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* Discussion section needs to be re-written with proper emphasis on the major findings C3 from this work. The mechanisms and processes behind the differences in observation need to be discussed properly. The effect of altitude, nature of litter and specific nature of the two watersheds needs to be taken into account. Reply The discussion will be rewritten to provide more in-depth discussions of the three main points of the manuscript (species as a key watershed characteristic determining storm responses, differential responses of DOM vs. POM, and differential responses of DON vs. DIN) and also mechanistic interpretation of the findings. We will also address other watershed characteristics as you suggested (altitude, nature of litters and specific nature of the two watersheds) for example, 'The deciduous watershed is located at higher altitude suggesting more shallow soils than at the mixed watershed. This may explain the larger near surface flow paths at the deciduous watershed. Moreover, faster decomposition of the deciduous litter leaches relatively more DOM and both factors resulted in higher DOC export fluxes at the deciduous watershed than at the mixed watershed'.

*Fig 2: What are FPOC/FPON? Reply technical comment: can easily be clarified. Will be changed to POC/PON.

Fig 5: A succinct Fig 5 will be better. Reply The design of figure 5 and 6 can be changed. Please check below figures how it will be changed 1) the compartments at the y axis are rearranged downwards. 2) the x axis description is only once to the two graphs 3) PLF/FLF in figure 5 is removed.

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/bg-2016-92/bg-2016-92-AC4-supplement.pdf>

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-92, 2016.