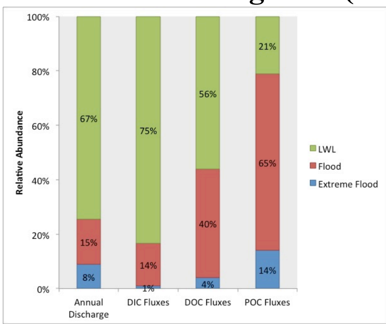
Anonymous Referee #3

<u>Author comment:</u> We would like to thank referee #3 for constructive comments to improve the overall quality of our manuscript. Our responses to the overall comments are given below.

There are two apparent significant errors in the paper. First, the proportion of flow in large storms is misrepresented. The authors distinguish floods as flows exceeded 10% of the year and extreme floods as flows exceeded 0.1% of the year. Figure 7, however represents these distinctions as applying to the percent of cumulative discharge, which is clearly in error: Far more than 10% of the cumulative discharge occurs during flows that are exceeded 10% of the time. The same error appears in the Conclusions (7140:12): "The floods and extreme floods, which represent 10% of the annual discharge. . ." Note that if 57% of the DIC transport occurs under low flow, and DIC is more concentrated at low flow than at high flow, then less than 57% of the water flux must occur at low flow.

<u>Author comment:</u> This comment was fully justified , we have recalcultated the new fluxes and given them in the new figure 7 (see below)



The new values do not change drastically except for the fluxes of DIC as foreseen by the referee. The interpretation for the POC and the DOC remains however the same. The new values are now in the discussion of the corrected version of the manuscript. In term of time, floods represent 9.9 % of the annual water discharge and extreme floods 0.1 %, therefore floods and extreme floods represent 10 % of the annual water discharge.

The other apparent error involves Figure 9. Comparing to Fig. 9b, I find the POC:PN mass ratios range from 1.04 (North America) to 7.35 (Asia), with one value at 14.8 (Capesterre). A POC:PN ratio of 1.04 is implausibly low. Seitzinger et al. 2005 (Global Biogeochemical Cycles) showed POC:PN ratios for all the continents (plus Oceania) in the range of 6.0 to 7.4. Fig. 9a shows a PN flux for North American large rivers of 3.17 Tg/y, which is about the same as Setiziner et al. reported for the North American continent, including small coastal rivers (3.0 Tg/y). However, the POC flux for North American rivers in Fig. 9b (3.3 Tg/y) is only 17% that reported by Seitzinger et al.

<u>Author comment:</u> This part will be modified in revised version with new calculations for continent exports based on model data. Therefore the export values reported in revised version will be the following fluxes (Seitzinger et al, 2005; fluxes are expressed in Tg yr^{-1}):

	POC	DOC	PN
S Am	40	59	6.3
N Am	20	23	3
Europe	7	8	1.1
Africa	24	24	3.6
Asia	47	32	6.6
Oceania	57	22	8.5
Australia	3	1	0.5

Moreover, the figure 9 will be removed in revised version because it seen a relevant most of the referees

The Globalization section (5.4 pp. 7138-7139) is weak on two counts (in addition to the problem with Fig. 9 noted above). First, it extrapolates to the whole world results that are taken from a single watershed with only four years of data. This is unreasonable. Second it is not clear what the point is. The question that should be addressed is whether tropical islands are unique in such a way that their exports are not properly accounted for in global carbon budgeting. This boils down to the relative contribution they make to the world's land surface, whether the carbon exports are disproportionately large, and whether a correction should be made to the budgets. None of these questions is clearly addressed in this section. While it may be of passing interest to know the contributions of these islands relative to large continental rivers, I think it simply confuses the issues to devote this much text and graphics to that question.

<u>Author comment:</u> It is a first order approach that will be refined when more studies including high resolution sampling of both the dissolved and particulate fractions are available. We don't believe it is unreasonable, it was done in the past by Louvat, P. and Allègre, C. J. Geochim. Cosmochim. Ac., 61, 3645-3669, doi:10.1016/S0016-7037(97)00180-4, 1997 for chemical weathering and the contribution of such type of island to the global C cycle. In addition previously published data of other similar islands showing the same range of DOC and POC concentration suggest that this first order calculation is valuable. In addition we have in the new version of the discussion showed that the quality of this organic matter is clearly different from large river organic matter inputs to the ocean making this calculation valuable and the contribution of all volcanic island unique compared to the large rivers. In addition the role of these islands could become more important with time as a diminishing fraction of the world's rivers remains unaffected by humans. Dams are a leading cause of disruption by leaving few major free-flowing river systems (Finer and Jenkins, 2012). They could induce significant modification downstream and upstream of the dam site for organic matter quality and total carbon flux to the ocean.

I could not follow the carbon mass balance section. It needs to be presented more clearly. What is the role of the 1100 t of NPP-less-litterfall? Where does it go? What is the meaning of the yield of litterfall? Is this the portion of litterfall that becomes incorporated into the soil? How can root respiration be considered an input rather than an output? What is the role of the 77 t of degassing from the stream? Is this seen as a potential fate for the 40 t total C that is exported? If so, where might the other 37 t come from? Or does it mean that far more than 40 t actually entered the stream?

<u>Author comment:</u> This part will be completely modified in revised version, .The incorporation of small rivers, streams carbon dynamic into carbon models is a complex multistep long-term goal. A first step to reach this goal is to document carbon stocks and fluxes at the scale of high order stream catchments and to calculate the time available for soil organic carbon aging ($Time_{SOC}$) which is an important parameter to a better understanding of setting ecosystem age and preventing retrogression. This is now the main topic of this section.

Given the emphasis in this paper on the importance of sampling high flows, and the emphasis on POC export, it is of some concern that the POC data came from only one of the three streams, and that no POC data were collected at the highest ("extreme") flows (Fig. 5).

<u>Author comment:</u> We agree but sampling during the very extreme events is very dangerous and sometime event the remote sampling device do not resist to the flow. We therefore believe that our data probably represents the minimum range for the fluxes especially for the carbon fractions like DOC and POC that are strongly influenced by these events.

I recommend presenting results in past tense. The paper should be edited with an eye towards standard English. I did not find cases in which the English was so weak as to be ambiguous. However, I did find many instances of grammatical error and poor construction. The following are examples from the first two pages:

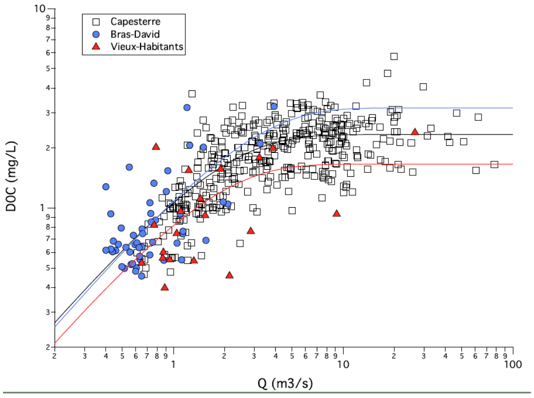
<u>Author comment:</u> The article has been reviewed by a native English speaker.

Abstract 9: Two independent clauses joined by a comma.

<u>Author comment:</u> These two independent clauses will be separated in revised version in two distinct

sentences.
Abstract 15-17: "is linked to the intensity of meteorological events than the frequency". This needs the words "more than to" in place of "than".
__Author comment:__ **This sentence will be corrected in revised version with: "rather than"**
Abstract 17: "Looking at the " is a dangling prepositional phrase.
__Author comment:__ **This prepositional phrase will be removed in revised version.**
7119: "resist to the degradation" should read "resist the degradation".
__Author comment:__ **The "to" will be removed in revised version.**
7120: "enriched surface horizons in organic matter" should read "surface horizons enriched in organic matter"
__Author comment:__ **As suggested by the referee the sentence will be reformulated in revised version.**
Detailed comments:
7119:15 clarify what is meant by "the global continental carbon flux"
__Author comment:__ **Global continental carbon flux represents all carbon flux from continents to oceans: DOC, POC, DIC, PIC.**
7122:10 C/N ratio should specify whether mass or molar
__Author comment:__ **All C/N are mass ratios, and this precision will be added in revised version.**
7126-7127 The method for correcting alkalinity should be presented in the methods section.
__Author comment:__ **We prefer to have these parts in results, because these calculations are linked to results values.**

7127:17-20 This should be presented in the methods.
__Author comment:__ **We prefer to have these parts in results, because these calculations are linked to results values.**
To produce an unbiased estimate of flow-weighted average concentration, the sampling probability per unit time must be equal. Noting that the samples were taken at uniform sampling intervals would be sufficient.
7129:10-12 and Fig 5 – this should be in the results section.
7129:13-7130:10 All or most of this section should be in methods.
__Author comment:__ **This section will be moved in revised version in results section.**
7129: 12 Fig. 5 The DOC trend seems to have an asymptote. Is the power law the best fit?
__Author comment:__ **We agree the power law is one of the best fit to represent the fit between DOC concentrations and discharge. A exponential law given in the following log log diagram could also give reasonable results. Bu with such a low the high stream discharge data is underestimated and leads to values which are either similar to the power law for the Bras David and Vieux Habitant watersheds (blue and red lines) or to values smaller by a factor to for the Capesterre watershed (grey line) the real value is probably in between. A mixed law combining the power law and the exponential is probably the best approximation but it needs a larger number of fitted parameters that are difficult to justify and explain compare to those obtained with the power law for instance that relates to a minimum concentration for the DOC for instance. The power law data was kept in the text and the discussion since high discharge events are missing probably in our sampling and the power law is a way of including them in our annual fluxes calculations.**



7130:8 A sentence is needed clarifying whether and how this measure of uncertainty was used to compute the error intervals shown in Table A3. Otherwise this formula appears interesting but superfluous.

<u>Author comment:</u> The error intervals shown in Table A3 and A4 are standard errors. This will be added in revised version for each Table.

7136:23. What is meant by dissolution of soil?

<u>Author comment:</u> It is not dissolution of soil but dissolution of soil CO_2.

7138:6. The calculated residence times vary from year to year. Obviously the true residence time (say the average age of carbon in the soil, or the ratio of the long- term average outputs-to-soil stock), cannot vary significantly from year to year. The discrepancy arises from the assumption that the soil is in steady state; it is clear that, for any given year, the soil is not in steady state. The problem can be corrected by specifying that the reported residence times are calculated estimates that vary to the extent that the steady state assumption is violated.

<u>Author comment:</u> This part will be modified in revised version to discuss about the time available for soil organic carbon aging imposed by the export functions.

7139:7-8 Clarify that the 2.36 Tg came from the mean of the 4 years in Table 1, and only from Capesterre. (The previous sentences draw from all three streams, so it is difficult to see where the average came from).

<u>Author comment:</u> This flux will be modified in revised version by the real average for the three watersheds (1.40 TgC yr^{-1}).

7140: 12: The floods are actually much more than 10% of that annual discharge, as noted above.

<u>Author comment:</u> If we consider the water discharge, floods and extreme floods represent 10 % of the annual water discharge.

7153: Table 2. Define Y in the table caption. A line representing the 4-year averages would be helpful.

<u>Author comment:</u> As suggested by the referee, in revised version, the Y will be defined in table caption (yield) and a line will be added for the 4-year averages.

Supplemental Table A3. Specify what the error ranges represent; i.e., standard errors or 95% confidence limits. The value for beta of 1.00 with an error of zero for each of three variables seems unlikely, especially in light of the scatter apparent in Fig. 5. Verify that these are correct. If so the error interval should be reported to an additional decimal place.

<u>Author comment:</u> For Table A3 and A4, the error ranges will be specified in revised version like standard errors. And the mistake for the error of zero for beta value will be corrected.