

Interactive comment on “Are small mountainous tropical watersheds of oceanic islands important for carbon export?” by E. Lloret et al.

Anonymous Referee #1

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Lloret et al. present an extensive dataset on suspended sediment, POC, DOC and DIC measurements made in three small tropical watersheds in the French West Indies, over a period of 4 years. These are combined with discharge data to estimate annual fluxes and yields, and to evaluate the importance of peak events in the delivery of suspended sediment and different C species.

In principle, data from such small tropical watersheds, characterised by very steep slopes and high precipitation are valuable since this type of systems is known to represent a disproportionately high contribution to the flux of sediments and POC to the ocean.

Unfortunately, apart from reporting these flux estimates, the manuscript is really poorly written and the discussion and interpretation of the data is far from solid. I have a

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very long list of reservations based on which I can only discourage publication of this manuscript unless the authors restart from almost scratch.

The general writing style and English is far below standard. It is essential to have this thoroughly proofread and corrected by a native speaker. I'm giving only a few examples at the end of this review

Detailed comments Abstract: spell out all abbreviations on first use (FWI, DOC, POC, DIC)

Abstract, Line 10-11: this sentence is somewhat redundant, it follows from the statements above

Abstract: remove reference to estimates of soil residence time and global extrapolations based only on this dataset.

P7119 L10: “less than one-third of terrestrial organic carbon”: be specific. Do you mean terrestrial carbon transported to the coastal ocean by rivers?

Section 2 (Site characteristics) should go under Materials and Methods.

P7122L11, L16 and elsewhere: C/N ratios: are these molar ratios, or expressed as weight:weight ?

P7124 L22: nominal pore size should be 0.7 μm , not 0.7 $\mu\text{mol l}^{-1}$.

P7125 L2: temperature, pH, conductivity: these data are not presented in the manuscript, only used to calculate DIC. It might be good to at least give a range of values or describe overall trends.

P7125 L8: a CHNS-ThermoFisher analyser: I assume this should be Thermo + specify the model.

P7125 L9: concentrated H₃PO₄ acid vapour. Hmm – I guess this should be HCl, not H₃PO₄ ?

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P7125-7126, section 4.1. Two issues here: first, comparison with literature data does not fit in a Results section and should be moved to the Discussion. Secondly, the authors refer to two or three other studies to compare their data to (mountainous rivers in Taiwan, Puerto Rico, New Zealand) but these seem somewhat randomly chosen. There is a huge amount of literature data on riverine fluxes of sediment and POC from a wide range of systems, including many more from mountainous areas than the ones referred to here – I do not see any point in randomly picking out 3 to compare the range of concentrations with. Just a few examples: Coynel et al. (2005) Contribution of small mountainous rivers to particulate organic carbon input in the Bay of Biscay. *Biogeochemistry* 74:151–171 Alvarez-Cobelas et al. (2010) A worldwide view of organic carbon export from catchments. *Biogeochemistry*. Kao et al. (2005) Calculating Highly Fluctuated Suspended Sediment Fluxes from Mountainous Rivers in Taiwan. *Terrestrial, Atmospheric and Oceanic Sciences*, 16: 653-675

P7126 L14 and further: I'm not too keen on the alkalinity "corrections" used here – there is very little good evidence to support the idea that this correction procedure will give you more reliable DIC data.

Section 4.2: Personally I do not see much merit in these monthly averages

Section 5.1. The approach used to calculate fluxes needs some critical discussion, and reference to the available literature on different methodologies. A useful source of relevant references (although the more recent ones are missing) and an overview of limitations of the approach taken by the authors can be found in Letcher et al. (1999) Technical report: review of techniques to estimate catchment exports. Available from <http://www.npi.gov.au/publications/pubs/nswreport.pdf> I strongly suggest the authors to try alternative approaches and compare different methodologies + include a critical discussion.

P7130 L11-13: if data gaps are up to 30%, then why would the influence on the annual fluxes be weak?

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P7134 : the absence of a clear trend between TSM and %POC is an important finding in this study, as it contrasts strongly with other systems. Unfortunately, no hypothesis is presented to explain this.

Section 5.3. This section is very messy. The authors should update their terminology, the following paper is a good start to get this right: Chapin et al. (2006) Reconciling Carbon-cycle Concepts, Terminology, and Methods. *Ecosystems* 9: 1041-1050. For example, what is meant with "Carbon mass balance" (=carbon inputs – carbon outputs) ? The authors then continue to assemble literature data on a range of different components – often only vaguely described and from totally different places whereas the natural variability in each of these components is known to be very high – I honestly do not see any point in this exercise. For example: -an average value for tropical forest biomass, based on a global estimate -average value for NPP for tropical forests -soil organic carbon stock data from soils in Martinique -organic carbon yield from litterfall (what do you mean with this) from the study region -root production and root respiration from a rainforest site in Brazil -river degassing from the authors' work, but with no details provided, only reference to a PhD study which is not accessible for most readers. This results in a "summary of the carbon mass balance" (Figure 8) which does not show a closed budget at all. What is the point of this ?

Ditto for the estimates of the residence time of OC in soils – there is little point in this when taking data on soil stocks from a different place. There is also some confusion here as the authors suggest the residence time to be linked to the absence of floodplains (P7138) – but based on the formula they used the presence of floodplains downstream of their sampling sites would have no effect on the estimated residence time of soil organic carbon. Also, presenting the soil OC residence times as being different for 2010 and 2007 is not very meaningful – this residence time is only relevant on longer time frames.

Figure 9 and 10 are also somewhat problematic. What do the authors mean (legend of Figure 9) with "the mean fluxes of each continent have been calculated to sum litera-

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ture values of mainly large rivers" ? So they are not estimates for the entire continent, only for some of the major rivers ? Or were these extrapolated ? Either way, this is not appropriate. There is a wealth of data and modeling studies on global export of sediment, POC, PN, and DOC at the global scale. See e.g. work by Mayorga, Beusen, Seitzinger, Meybeck etc, some examples below. Beusen et al. (2005) Estimation of global river transport of sediments and associated particulate C, N, and P. GLOBAL BIOGEOCHEMICAL CYCLES, VOL. 19, GB4S05, doi:10.1029/2005GB002453, 2005 Mayorga et al. (2010) Global Nutrient Export from WaterSheds 2 (NEWS 2): Model development and implementation. Environmental Modelling & Software 25 (2010) 837–853. Milliman & Farnsworth (2011) River Discharge to the Coastal Ocean: A Global Synthesis. Cambridge University Press.

Dito for Figure 10 – where do these data come from ? I doubt these to be resulting from a comprehensive dataset, and they look strongly biased.

Examples of textual corrections needed : P7118 L2: "In the tropic": in the tropics, or : in the tropical zone P7118 L2: "the small watersheds": delete "the" P7118 L6: ranged between P7118 L10-11: awkward, rephrase P7118 L118-19: is estimated at 2.0 – 8.9 Tg C y⁻¹ P7118 L26: lixiviated: not frequently used. Leached ? P7118 L26: "transferred in aquatic ecosystem": rephrase P7121 L8: "The aims of this paper are, on the light of POC, DOC, and DIC . . . concentrations": ?? P7121 L10: "global carbon export": do you really mean global (worldwide), or just annual (for your study sites) ? P7122 L21: "a wet rainy season": I guess most wet seasons are rainy and vice versa.. P7123 L14-15: "flood events. . . were in greater numbers": occurred more frequently Throughout the ms: "rainfalls", "precipitations": do not use plural. Throughout the ms: "meteorological events": be more specific, this can be anything.

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