

Interactive comment on “The mass distribution of coarse particulate organic matter exported from an alpine headwater stream” by J. M. Turowski et al.

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Reply Anonymous reviewer #2

We thank the reviewer for his/her comments. Below we give detailed replies and outline the changes made to the manuscript. See also the attached document.

P5I21: Please explain more precisely how the flow depth is used for extrapolation. I guess that different sizes of CPOM are transported in different manners, e.g. like bedload for larger particles, and like suspended load for the finer fractions. In this case, simply multiplying the cross sectional area of the trap with a factor to get the CPOM load for the cross sectional area of the stream would work for fines transported

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in suspension, but not necessarily for CPOM transported in a bedload-like manner. - The channel bed of the section where the two traps were positioned was essentially separated in two compartments, the low-flow channel on the orographic right and a gravel bank on the orographic left. We had a trap on each of these two sections, which were assumed to be representative. We divided the transported mass by trap width and multiplied by the width of the relevant section to obtain extrapolated masses. The trap opening covered the complete flow depth for most measurements. We checked the vertical distribution of CPOM by stacking a second trap on top of the first in a few cases when the flow overtopped the trap, and found that the material captured in the upper trap was negligible. In fact, according to our observations, most CPOM particles are transported as bedload. About 2/3 of the material by weight sinks. We have collected additional data on this point and will prepare a manuscript detailing our observations in the near future.

p6I17: Assuming that the volume of sediment (and CPOM) caught in a retention basin can quite large (also compared to log jams), probably in the order of tens of cubic meters or even more, how do you sample, and how do you estimate the total CPOM volume? Or is there a full sample of total CPOM volume? - We sampled only pieces with diameters >5cm from the retention basin, as is explained in the article (page 6, line 16, discussion version). From the analysis of the relative distributions, we believe that we representatively sample pieces with masses larger 3kg (page 8, line 21, discussion version). We have used the scaling relation to extrapolate the measured masses down to 0.1g (page 8, line 22, discussion version).

p6I22: While, for example, the minimal particle mass threshold is chosen (and well justified) on the basis of the empirical data (p8I7 ff), the choice of the 5000 l/s threshold for the initiation of LWD appears to be quite arbitrary, it should be backed by some theoretical or empirical justification. - The assumption was made based on long-term observations of the catchment. Flood events with peak discharges below 5m³/s export at most a few pieces of LWD (Fig. 1,2). Interestingly, in about 40 years of measure-

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ments we have not observed any flood events with peak discharge between about 5 and 9 m³/s, and only four exceptional events showed higher peaks (1984, 1995, 2007, 2010, see Turowski et al., 2009 and 2013). The results are not very sensitive to the assumption, i.e., the data points always plot close to the regression line. We have tried to clarify in the manuscript.

chapter 4: The authors report a power law scaling of the relative fraction of given CPOM particle masses, and a power law dependence of CPOM transport rate on discharge. The fitting of a linear function to log-transformed data to obtain a power law is common practice; however, mathematicians tell us that this leads to biased results, especially where we want to deduce a power-law behaviour. For the findings of this paper, I don't think that it is absolutely necessary to change the described procedure, but I'd like to refer the authors to another, mathematically probably more rigorous approach to powerlaw fitting (there is also an R procedure published by CR Shalizi that e.g. automatically detects the threshold above which the power law holds) published here: Clauset A, Shalizi CR, Newman MEJ. 2009. Power-law distributions and empirical data. *SIAM Review* 51: 661–03. - Thanks for making us aware of this. We have not changed the procedure used in this paper, but we will consider this method in future research.

p7116: Please give sample size n - We changed to 'the mean of 28 samples'.

p8121: Are the extreme events excluded from the regression fitting as a matter of principle? They do not seem to contradict the remaining results, and they do not seem to influence the regression coefficients too much (low leverage). Anyway, the correct prediction of events of that size by the regression is highly desirable. - The extreme events were excluded to show that the regression works well when extrapolated. The data are plotted log-log and since the extreme events lie far outside of the region where the other data sit, they would dominate the regression. In addition, the data from the extreme events are the least reliable because we extrapolated from measured masses >3kg to much smaller masses (see chapter 4). The good fit gives some support of the

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plausibility of the extrapolation.

p1113: For longer time scales, this should be termed an estimation rather than a calculation, and the underlying assumption of such a temporal extrapolation should be discussed (for example, steady state conditions (rate of CPOM input depending on type of forest, its temporal persistence and regrowth, rate of decay, etc..., see section 5.4 where this is discussed thoroughly for the transfer ("extrapolation") of results to other catchments) - We have changed to 'estimated CPOM export' and added discussion material.

p1114ff: "CPOM transport is dominated by large discharge events" - yes... but the August 2010 event is considered to happen once in 50 years, on average (p512). The question on which type (magnitude) of event dominates i.e. contributes the lion's share to the sediment transport, for example, is a classical question in geomorphology (Wolman and Miller, 1960) - No, page 5 line 2 was referring to the largest event observed so far, which occurred on the 20th June 2007. The return periods of the two events we have data for have been estimated at 20-25 years. The points of the reviewer stands nevertheless. We have added an additional figure (Fig 9 in the revised manuscript).

p12120: with "connectivity", you probably mean hydrological or runoff connectivity as CPOM is supposed to be transferred to the stream by overland flow - No, as we have outlined in section 5.1, the Erlenbach banks feature active creep landslides that advect trees into the channel. We have also mentioned other processes such as overland flow, wind throw, snow creep etc. We intended the word connectivity to be as general as it sounds. The sentence has been replaced in revision

- The technical points were corrected as suggested.

Please also note the supplement to this comment:

<http://www.earth-surf-dynam-discuss.net/1/C65/2013/esurfd-1-C65-2013-supplement.pdf>

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Fig. 1. Picture of the retention basin after the flood event from the 4th July 2009 (on the left, picture taken on the 4th July 2009) with a peak discharge of 4990 l/s (upper gauge, 1-min. data).

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Fig. 2. Picture of the retention basin after the flood event from the 20th June 2007 (on the right, picture taken on the 21st June 2007) with a peak discharge of 14560 l/s (lower gauge).