Point-by-point response to Interactive comment on "Sediment trap efficiency of paddy fields at the watershed scale in a mountainous catchment in Northwest Vietnam" by J. I. F. Slaets et al.

Original comments in italic
Responses in non-italic

Anonymous Referee #1

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General Comment
The manuscript deals with sediment fluxes and budgets of paddy rice areas at watershed scale which are not studied enough in the mountainous southeast Asia and published much in the literatures. And the paper has significant contribution on how to track the type sediment texture in the landscape. It is based on primary field data with appropriate analysis procedure to achieve the objective of the paper. The data in this paper are carefully collected, well described, analyzed and interpreted accordingly. The measurement points are also professionally selected and used to identify the influence of each part of the sub-watershed. It is also written in simple language to understand easily and I found it very good. Here under I put comments by each section that may improve the paper readability.
One of my general comment on the manuscript is the assumption of Hortonian overland flow from the contributing upland area to the paddy fields. On what bases are these assumption is made?

We thank Referee 1 for his expressed appreciation of the manuscript. The open-channel irrigation systems are adjacent to paddy fields on one bank, and upland area on the other bank. Slopes are steep and fast draining while rainfall intensities are high. The infiltration rate is frequently exceeded. Furthermore, the irrigation channels are not located in valley bottoms that are saturated, but rather at the footslope of the hills. Additionally, the groundwater level in the paddy fields is still significantly lower than the plough layer due to the topography (see picture) and soil profiles are not fully saturated, as paddy fields drain several metres above the bed of the river.

Specific comment:

Introduction
Page 20438 line 24: is it Bray, 1996 or 1994?
Thanks for catching this! The correct reference is "Bray F. 1986. The rice economies: technology and development in Asian societies. London, (UK): B. Blackwell" and the manuscript has been updated to reflect this.

Page 20438 line 26: Put Dobermann, 1998 in the reference list.
The reference "Dobermann, A., Cassman, K., Mamaril, C., Sheehy, J., 1998. Management of phosphorus, potassium, and sulfur in intensive, irrigated lowland rice. Field Crops Research, 56(1): 113-138." has been added to the reference list.

Page 20439 Line 19 and 20: There may be a disagreement between the sentences "paddy systems have located in the valleys" and "60% paddy cultivation is located in such hilly areas".
The manuscript has been updated to "In Northern Vietnam, 60% of paddy cultivation is located in valleys of such hilly areas, on terraces that form cascades (Rutten et al., 2014)."

Page 20439 Line 21: what does it mean traditional shifting cultivation system? you may need to define some of the terms in your manuscript for those readers outside of Southeast Asia.

The manuscript has been adjusted to clarify this point: "In shifting cultivation systems, forest plots are cleared and burned followed by cultivation of subsistence crops. Cultivation lasts for one to three seasons, after which the plots are left fallowed for a prolonged time (often a minimum of six times the cropping duration (Ziegler *et al.*, 2009))."

Page 20439 Line 28: The erosion in the study area is too much with 174 ton per ha. What is the texture of the soil on the agricultural fields?
These are field scale measurements in bounded plots, which explains the high estimates, and this has been clarified: "In our study area, maize and maize-cassava intercropping on steep slopes with clay topsoil texture resulted in plot-level erosion rates in bounded plots of up to 174 Mg ha^{-1} a^{-1} (Tuan et al., 2014)."

Materials and Method
The material and method section need to be clear about the number of samples collected for each analysis. In the result section, you reported the number of data without telling in this section those quantities.
Sample size for discharge and sediment concentration were shown in Table 1 for each monitoring location, which has been clarified in the Material and Methods: "Discharge and sediment concentration were monitored at five different locations in the catchment (Figure 1, Figure S1 and Table 1)."

Page 20442 Line 23- 27: During a manual water sampling, do you have a specific time interval you followed during the rainfall event? every 10, 20, 30 minutes?
The variation in sampling interval was clarified in the Material and Methods: "The sampling interval depended on the hydrograph. During rapid changes in turbidity of the stream, samples were taken more frequently (up to two minutes apart) than at the end of the falling limb (up to 15 minutes apart)."

why you want to take two 500ml bottles?
The second bottle was in the frame of a study looking at nutrient transport in the same system, and has now been removed from this manuscript.

Page 20444 Line 19: why the assumption of irrigated discharge to the paddy fields are the same before and after the rain? While there is rain, the amount of irrigated discharge from reservoir should be less?
Storms are often short-lived and unpredictable in this tropical mountainous catchment, and experience in the field showed that irrigation management was typically not adjusted during the short duration of rainfall events, leading to the assumption in the flow component separation that the reservoir discharge remained constant to the pre-event amount (Schmitter *et al.*, 2012). We have clarified that this specifically refers to reservoir outflow remaining constant within-event compared to pre-event, and does not refer to periods of rain versus dry spells: "Assuming that the irrigated discharge to the paddy fields prior to the onset of the a particular rainfall event remained constant during the duration of that specific rainfall event, Q_{of} can be calculated using Equation 2."

Page 20444: what is the computation time interval for equation 1 and 2? daily? or what time scale?
Thanks for bringing up this point, the flow component separation was done at the same temporal resolution as the discharge and sediment concentration time series, hence Equation 1 and 2 are at the two-minute time scale, which has been added to that section.

Page 20446: is equation 6 used to estimate the sediment load from overland flow? If this is the case, please say it within the section.
Yes, Equation 6 is indeed used to estimate the load from overland flow: "…with each load in the L_in, L_irr and L_out sediment balance in Equation 6 computed using Equation 5. The sediment load from direct runoff during rainfall is then estimated from Equation 6."

Page 20447: I am not clear about sources of sediment samples for the texture analysis mentioned in section 2.6? and how they are sampled?
Texture analysis was performed on the sediment obtained from a selected subset of the water samples collected for sediment concentration analysis. After gravimetrically determining sediment weight for the concentration, the sediment was then additionally analysed with mid-infrared spectroscopy. Samples in the subset were selected to cover the full range of seasons and flow regimes. "From the samples collected for sediment concentration analysis, the sediments of total of 152 samples were selected to cover analyzed for texture, covering the full range of locations, seasons and flow regimes, and analyzed for texture."

Page 20447: It is better to write the long forms of the acronyms QUANT2 and OPUS in addition to their short forms.
The terms refer to the name of the software (Opus) and the analytical package within the software used (Quant2), and are not abbreviations of long forms, therefore we have switched to the notation Opus and Quant2 to avoid confusion.

Results

Page 20448 line 10: why irrigation pattern difference if you assume the irrigation discharge is the same before and after rain? On page 20444 line 19, you assume the same discharge.
The assumption of reservoir outflow remaining constant (p20444, line 19) refers to individual rainfall events, during which the discharge is assumed not to be changed by the irrigation manager in the short duration of the event. The irrigation pattern difference is referring to seasonal changes in amounts irrigated, where less water is available during spring when the reservoir has not yet been replenished by rains, and differences between years, where a late onset of the rains in 2011 resulted in reduced water availability in the first half of the year. We have clarified the section to reflect this: "The lower amount of precipitation in the spring of 2011 resulted in a lower amount irrigated during that period se differences in rainfall pattern led to differences in irrigation patterns between the two years (Figure 2)."

Discussion Page 20 line 2: mention USDA, 2012 in the reference list.
Thank you for pointing this out, this reference has been corrected to "Schertz, D. L.: The basis for soil loss tolerances, Journal of Soil and Water Conservation, 38, 10-14, 1983."

Page 22 line 11: is it Keil et al., 2009 or 2008; different in citation and in reference.
Thank you for pointing this out, the correct reference was 2008.

Page 22 line 13: is it Dung et al., 2008 or 2009; different in citation and in reference.
Thank you for pointing this out, the following reference was added to the reference list: "Dung, N. V., Vien, T. D., Lam, N. T., Tuong, T. M., and Cadisch, G.: Analysis of the sustainability within the composite swidden agroecosystem in northern Vietnam. 1. Partial nutrient balances and recovery times of upland fields, Agriculture, Ecosystems and Environment, 128, 37-51, 2008."

Tables
Table 1: It would be better to show the eqns (for stage-discharge and suspended sediment concentration) than simply showing the n and R2 value
As a linear mixed model was used for the sediment concentration, which is explained in detail and parameter estimates for model coefficients are shown in Slaets *et al.* (2014), we prefer to not repeat them here as estimates for a mixed model involve an autocorrelation parameter and a residual error additional to the fixed effects, which we believe would drive away the focus of the reader in this applied paper. Instead, we refer the reader to the methodological paper: "Details on the linear mixed model development can be found in Slaets *et al.* (2014)."

Table 2: How did you determine the texture of sediment from overland flow?
Thank you for raising this point. As sediment concentrations during rainfall events were several orders of magnitude higher than those from irrigation water, the textural distribution of sediment during rainfall events was determined to be driven by the erosion fraction, and thus sediment texture from overland flow was equated to sediment texture from samples taken during storm events at the end of the channel.

Table 3 and 4: Balance are not ok for some columns because of may be digits
This is a good point. The reason some columns do not sum up exactly in Table 3, is because we use bootstrap medians rather than direct estimates of differences, in order to remove bias. This has been clarified in the table caption: "Loads are estimated as the median of the bootstrap estimates (Med) and therefore do not always sum up exactly within columns,, and 95% confidence intervals are shown (LL=lower limit, UL=upper limit) in Mg per year." Two rounding errors in Table 4 have been corrected.

Figures
Figure 2: the x-axis legend is missing.
The legend "Cropping season" has been added to the X-axis.

Figure 2 and Figure 5: the y-axis for flows should be in mm so that one can compare with the rainfall measurements. and what is the negative axis is telling?
The negative loads refer to water exported from the catchment via the irrigation channel, which has been added to the figure captions: "Total discharge from the reservoir irrigated to the 13 ha paddy area draining between Locations A and B in the river, and (negative on the Y-axis) total discharge exported from the sub-watershed via the irrigation channel at Location 3, per rice crop (spring, summer) per year, and amount of rainfall per rice crop per year."
To convert from cubic metres to millimetres, we would have to divide by an area, and the question is which area to choose. The surface of the reservoir, on which the rain falls? The area of the paddies, to which the irrigation water goes? In order to avoid this issue, we opt to leave the amounts in a pure volume measure, so interpretation is relevant for reservoir replenishment, rice irrigation and watershed losses.